An Analysis of Organisational Adaptation to Climate Change: The Case of the Bardiya National Park.

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Abstract

This research is concerned with understanding how the management authority of the Bardiya National Park (the BNPMA) is able to adapt to the pressures of increasing climate variability and change. To that end, this study employs a mixed-methods case study approach to elucidate the key drivers of change facing the BNPMA, the processes through which the organisation adapts to these challenges, and the factors that enable and constrain action. In doing so it intends to provide a more comprehensive understanding of the potential future effectiveness of adaptation interventions.

Analysis of local weather data, in conjunction with data obtained from village level surveys, highlights a number of climatic trends which, along with related environmental changes are shown to have an important role in driving change within the BNPMA. A range of anthropogenic drivers are also shown to be relevant. The factors enabling and constraining the BNPMA's ability to respond to these identified drivers of change are subsequently examined through the analysis of data obtained from Likert questionnaires, semi-structured interviews, focus groups, and field observations. Organisational systems, culture, internal resources and the process of knowledge generation and sharing are all found to play a pivotal role in determining the capacity of the BNPMA to respond to its drivers of change. The final analytical section of this thesis uses three examples to evaluate the learning processes through which the BNPMA operationalises its adaptive capacity and mobilises it as adaptive management interventions. Drawing on the results of semi-structured interviews, focus group discussions, official park documents, and fieldwork observations, three distinct types of learning are identified within the organisation.

In conclusion, this study argues that learning plays a key role in adaptive management approaches to conservation and in operationalising organisational adaptive capacity, enabling the BNPMA to effectively respond to new challenges. However, further research is needed to assess the wider applicability of the drivers of change highlighted in this study, within Nepal and beyond, as well as the interplay of components of adaptive capacity in conservation organisations and the learning processes through which this capacity is mobilised.

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Acronyms

AAM	Active Adaptive Management
BCP	Bardia Conservation Program
BNP	Bardiya National Park
BNPMA	Bardiya National Park Management Authority
BZCF	Buffer Zone Community Forests
BZMC	Buffer Zone Management Committee
BZUC	Buffer Zone Users Committee
BZUG	Buffer Zone User Group
CBAPCU	Community Based Anti-Poaching Control Unit
CBD	Convention on Biological Diversity
CCC	Climate Change Council
CFUC	Community Forest User Committee
CFUG	Community Forest User Group
CITES	Convention on International Trade in Endangered Species
DNPWC	Department of National Parks and Wildlife Conservation
DoF	Department of Forests
DoHM	Department of Hydrology and Meteorology
GoN	Government of Nepal
ICIMOD	The International Centre for Integrated Mountain Development
IUCN	International Union for Conservation of Nature
KMTNC	King Mahendra Trust for Nature Conservation
MK Test	Mann-Kendall Test
MoFSC	Ministry of Forests and Soil Conservation
MoSTE	Ministry of Science, Technology and the Environment
NAPA	National Adaptation Programme of Action
NC	Nepali Congress Party
NRM	Natural Resource Management
NTFP	Non Timber Forest Products
NTNC	National Trust for Nature Conservation
NWD	Number of Wet Days
PAM	Passive Adaptive Management
PES	Payments for Ecosystem Services
REDD	Reducing Emissions from Deforestation and Degradation

REDD+	REDD plus the conservation, sustainable management of forests and enhancement of forest carbon stocks.
RNA	Royal Nepali Army
RPS	Nepali Rupees
SCBD	Secretariat of the Convention on Biological Diversity
Seasonal MK Test	Seasonal Mann-Kendall Test
SES	Social-ecological Systems
SLR	Simple Linear Regression
SNA	Social Network Analysis
TAL	Terai Arc Landscape
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VDC	Village Development Committee

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Chapter 1 - Introduction

1.1 The Challenge of Climate Change

According to the IPCC we can now say with near certainty that human induced climate change is taking place, and this claim is backed by a large number of studies which purport to demonstrate the impacts of these changes (IPCC 2007). Indeed, in their most recent report the IPCC (2014a) highlight the unparalleled rate of greenhouse gas emissions and the unambiguous role of humans in driving this increasing climate variability and change. Evidence of climate impacts is strongest for natural systems and whilst isolating climate impacts on human systems is more problematic due to difficulties surrounding attribution (ibid.), they are likely to be borne soonest and most severely by the poorest and most vulnerable in society (Adger et al. 2003). Improving our understanding of climate change adaptation therefore has key role to play in reducing the extent and asperity of these burgeoning climate impacts.

Whilst the last 20 years have seen a proliferation of literature focused on the impacts of increasing climate variability and change, research on adaptation lags almost a decade behind (Wilby and Vaughan 2010). Since we are already experiencing the impacts of human-induced climate change, adaptation must become a policy priority and there is an urgent need for policy oriented research in order to accomplish this (Moser et al. 2008, Dovers and Hezri 2010). This chapter presents a brief overview of the key research areas addressed in this thesis and their associated research gaps. Subsequently the study site is introduced, its relevance to this body of literature outlined, and its selection as the focus of this study justified. The chapter concludes with a more detailed consideration of the specific research objectives of this study, and a presentation of the thesis structure.

1.2 Adaptation and Organisations

Arnell (2010) highlights the surge in interest in adaptation since the turn of the millennium, and whilst a growing body of adaptation knowledge exists, a number of specific research gaps remain. Further work is needed, for example, to improve our knowledge of the drivers of and barriers to adaptation and our understanding of the processes through which adaptation occurs (Moser et al. 2008, Arnell 2010); research in this area will have associated benefits for those tasked with mainstreaming climate change adaptation in their organisations (Tompkins et al. 2010). Dovers and Hezri (2010 p219) argue that the growing consensus that anthropogenic climate change is occurring, combined with the increasing

focus on adaptation in the climate change community, have created a window of opportunity for the study of, "the mechanisms of policy and institutional change...[as well as the]... structures and processes within public policy and administrative systems at national and sub-national (state, provincial, local) jurisdictional scales." Furthermore Arnell (2010 p.109) notes that there are very few examples of studies which examine, "how adaptation is actually being delivered or on the barriers... which will influence how adaptation will take place."

Adaptation is primarily a local issue since climatic changes, and their impacts, are not experienced equally between locations (Pandey et al. 2011). At the local scale organisations fulfil a unique role, providing the context within which individual adaptation occurs whilst representing an important component of wider societal adaptation (Berkhout 2012). Given this singular and influential role of organisations in adaptation, the paucity of studies examining how organisations adapt to climate change, particularly in the developing world, is a critical research gap to attend. More specifically, there is a need for studies which examine the processes through which adaptation may occur in organisations, and the factors that enable and constrain action (Conway 2011). Some authors (e.g. Berkhout et al. 2004, Storbjörk 2010) have highlighted the importance of learning to the process of organisational adaptation, and this represents an additional valuable focus for further research. As Adger et al. (2003) observe, developing our knowledge of how organisations adapt to climate change can be considered a prerequisite to improved understandings of the likely effectiveness of adaptive actions employed in response to actual or anticipated climate variability and change.

1.3 The Conservation Imperative

Conservation has never been of greater importance than it is today, with current extinction rates estimated to be in the region of 100 - 1,000 times pre-human levels (Pimm et al. 1995). Effective conservation is key for both human survival and the maintenance of ecosystem processes including climate regulation and soil and watershed protection, issues which in turn have the potential to impact upon the livelihoods of local natural resource dependent communities (Rands et al. 2010, SCBD 2014). These dual dimensions of conservation illustrate the need for approaches to conservation which balance local rights with global environmental aims; long-term conservation can only be achieved with the

cooperation and support of local people and will only be possible where conservation provides socio-economic benefits for local populations (Naughton-Treves et al. 2005).

Protected areas have long been a cornerstone of international conservation policy and are widely viewed as being a robust and effective mechanism for conserving the multi-faceted value of biodiversity. Protected areas are rooted in the concept of permanence but in a changing climate there is a real risk that they may no longer provide suitable habitats for the very species which they were created to conserve (SCBD 2014). Climate change is already having significant impacts on wildlife populations and ecosystems (Mawdsley 2011, IPCC 2014b, SCBD 2014) however there has been an apparent air of lethargy in relation to local level action on climate change and biodiversity conservation. This lassitude can, in part, be attributed to the inherent uncertainty associated with climate change projections. Adaptive management approaches to conservation are one potential means through which this inertia might be overcome (Allen and Gunderson 2011), however more research is needed to clarify the concepts and practical utility of such approaches (Fabricus and Cundill 2014).

In spite of the growing consideration of climate change in the latest report of the Convention Biological Diversity (SCBD 2014), particularly in relation to increasing the interconnectivity and representativeness of protected areas, there remains a distinct lack of local level action on issues of climate change and conservation. This situation is mirrored in the inaction of donors, management agencies and conservation organisations and is likely due, at least in part, to the unparalleled enormity of the challenge; this is the worst possible management response. Furthermore, there has been a distinct absence of academic studies that consider the social and political dimensions of adaptation in conservation (Heller and Zavaleta 2009). The majority of recent research in this area has focused on the ecological dimensions of conservation in a changing climate, marginalising consideration of the importance of human behaviour in determining conservation outcomes (e.g. Mawdsley 2011, Morecroft 2012).

1.4 Conservation and Climate Change in Nepal

The research themes and gaps outlined above are examined in this thesis in the context of Nepal, a country where issues of climate change and conservation are particularly pertinent. In 2010 Nepal was ranked fourth in a global analysis of countries most at risk

from climate change (Maplecroft 2010) and a growing number of studies (for example Gurung and Bhandari 2008, Singh et al. 2010, Manandhar 2011) have demonstrated that Nepal's climate is changing faster than the global average, with changes in temperature, rainfall, and monsoon patterns observed. Moreover, Nepal is host to biodiversity of global significance playing host to 9.3% of the world's bird species and 4.5% of mammal species within just 0.1% of the Earth's landmass (WWF Nepal 2012). Currently 18% of Nepal has protected area status and 39% of the country is classified as forested (Springate-Baginski et al. 2007).

In the context of increasing climate variability and change, Nepal's biodiversity has a vital role to play for both mitigation and adaptation strategies. Nepal's population is heavily dependent on natural resources with over 80% of the population rural and dependent on agriculture and livestock production for their subsistence (Malla 2000, World Bank 2014). Forests represent 75% of Nepal's energy resources and provide 40% of the fodder needs of rural populations (Chaudhary 2000). These natural resources are therefore likely to form the cornerstone of any adaptation strategies employed by a large proportion of the country's population. In terms of mitigation, Nepal's forest resources represent a potentially significant source of mitigation, and therefore income, under the UNFCCC's REDD+ initiative and schemes which offer payments for ecosystem services (PES). Ensuring the effective and sustainable conservation of these resources whilst facilitating sustainable economic development is therefore an issue of great urgency in Nepal. Given this background the conservation sector in Nepal can be viewed as a priority area for the study of organisational adaptation to climate change.

Within this country context this thesis is focused on the specific case of the Bardiya National Park (BNP) in Nepal's remote Mid-Western Region. Officially gazetted in 1988, this IUCN Category II protected area[1] plays host to a high number of endangered bird and mammal species, and is situated in an area which has been identified as being highly vulnerable to increasing climate variability and change (Ministry of Environment/GoN 2010). Local populations are heavily dependent upon natural resources for their subsistence but are prohibited from exploiting the natural resources available within the park. This abundance of endangered and endemic species, in concert with the relatively

[1] According to the IUCN's definition, Category II Protected Areas are large, strictly protected areas, whose purpose is to protect large-scale ecological processes with characteristic species and ecosystems, whilst promoting education, tourism and recreation (Dudley 2008 p.16).

high density of natural resource dependent people who inhabit the region, make this an apposite focal point for studies of conservation and climate change adaptation.

1.5 Research Objectives

This thesis aims to address the broad research gaps outlined above and is, therefore, primarily concerned with understanding how the conservation organisation tasked with managing the BNP, the Bardiya National Park Management Authority (BNPMA), adapts to increasing climate variability and change. To that end, this study is structured around three key research objectives. The first of these relates to the current deficiencies in understanding of the factors driving adaptation, the objective being to identify the key drivers of organisational change to which the BNPMA is having to respond. The second key objective is to assess the main factors that facilitate and constrain the adaptive capacity of the BNPMA, and in doing so address our limited knowledge of the barriers to adaptation. Finally this research aims, through a focus on the organisation's learning and decision-making procedures, to improve wider understandings of the processes through which adaptation occurs within organisations.

Whilst based on a single case study it is envisioned that the findings of this research will be more widely applicable, with the objective being not merely to add to the existing body of literature, but to explore the hitherto under-examined nexus of conservation, climate change adaptation and organisational learning. Broadly this research aims to result in outputs that are relevant to general questions of how adaptation to climate change is taking place, and the factors that enable and constrain action. It is also intended to contribute to wider theoretical understandings of organisational change and learning, adaptation, and adaptive management approaches to conservation. In terms of substantive policy implications, the research aims to result in improved understandings of the current impacts of, and responses to, increasing climate variability and change, providing a solid platform from which to launch future adaptation responses in Bardiya. This may, in turn, have implications for conservation and adaptation work more widely.

1.6 Thesis Structure

In this thesis I begin by outlining my conceptual framework, drawing on a diverse body of literature to examine the rationale and theoretical basis which underpins it, and the key research questions addressed by this study. Subsequently I outline the methodology

developed to engage with these questions, detailing the overall approach adopted and the methods of data collection employed. The thesis then introduces the context of the study in more detail, examining the environmental, social, economic, political and organisational contexts within which the national park management authority operates. In doing so it provides the foundation upon which the three subsequent analytical chapters build.

Chapter Five presents an analysis of the key environmental and anthropogenic factors driving change within the BNPMA, and examines the means through which the organisation identifies these drivers, perceiving them as important challenges to which they must respond. In Chapter Six attention turns to the identification of the key factors that enable and constrain the BNPMA's ability to effectively respond to these new challenges. Chapter Seven uses a selection of relevant examples to elucidate the process of learning through which this capacity is translated into adaptive actions. The final section of this thesis presents a summary of the study findings and details the key conclusions of this research, their theoretical and conceptual contribution to the knowledge base, and their wider policy relevance.

Chapter 2 – Literature Review

2.1 Introduction

Having briefly introduced the key themes and research problems situated at the heart of this study, this chapter presents a critical analysis of the relevant literature, concepts, and theories, pertaining to this field of research. In doing so this chapter expounds the rationale for this study, the academic foundations upon which it builds, and the research gaps that it aims to address. To situate this study in the context of the existing body of research in this area, the development of conservation approaches is first examined. The growing emphasis on adaptive management approaches to conservation and the promise and potential pitfalls of such strategies are then analysed, specifically in the context of increasing climate variability and change. The issue of climate change itself is then considered in more detail, and the growing importance and prevalence of adaption initiatives outlined. Key concepts relating to adaptation are subsequently examined and the selection of adaptive capacity as a focus of this study justified.

Attention is then drawn to the dearth of studies examining adaptation in organisations, an important research field given the potentially vital role that organisations have to play in societal adaptation. The often ill-defined distinction between organisations and institutions is then examined and the implications of framing this study through the lens of a bureaucratic organisation outlined. Key issues and areas of contention in organisational change and learning are then considered and the conceptualisations of organisations, organisational change and organisational learning underpinning this research justified. The final section of this chapter builds upon this theoretical and conceptual background, elucidating the key research objectives introduced in the previous chapter and presenting a conceptual framework that provides the basic structure through which the theories and concepts outlined may be operationalized, to address the specific questions at the heart of this study.

2.2 Conservation

Conservation, which can be defined as the preservation of the natural environment for future use and human benefit (Adams 2009 p107), is inherently concerned with the relationship between people and nature, and with the balance between short-term (predominantly economic) benefits, and longer-term environmental sustainability (McManus 2000). Contrasting motivations for biodiversity conservation are underpinned by

fundamentally different value systems which, as Hunter et al. (2014) explicate, tend to fall along a spectrum with anthropocentric conservationists focused on the welfare of humanity representing one extreme, and biocentric conservationists attributing equal value to all species, representing the other. Authors identifying with the biocentric position tend to frame arguments regarding the importance of conservation around ecological justifications, including the need to protect current species and habitats for their own sake (Bruner et al. 2001) and the necessity of maintaining vital global ecosystem services (Adams and Hutton 2007). Authors representing the anthropocentric viewpoint, in contrast, frequently emphasise the importance of conservation arising from its value to humans, including the importance of natural resources as a driver of pro-poor growth (Bass and Steele 2009) and as an issue of social justice (Redford and Sanderson 2000). In reality, the majority of conservationists lie somewhere along this spectrum, closer to each other than to the extremes (Hunter et al. 2014). What all conservationists agree on, however, regardless of their position along this continuum, is the importance of conservation; the question then becomes how this end may best be achieved.

Regardless of underlying motivations, the importance of conservation and the threats to the success of conservation initiatives, have never been greater than they are today (Pimm et al. 1995). Human demands on the biosphere accelerated at an unprecedented rate through the 20th century and continue unabated to this day (Adams 2004). Key components of these demands include the world's burgeoning population and associated increases in human resource requirements, stemming from the ceaseless drive for increased economic growth and prosperity (Margules and Pressey 2000, Jianhua et al. 2010) exacerbated by political instability (Naughton-Treves et al. 2005) and the commercial exploitation of natural resources such as timber (Tint et al. 2011). Today human impacts on ecological systems have transcended these direct influences of resource extraction and land use change, as evidenced by inescapable global changes including anthropogenic climate change (Adams 2004). Of particular relevance to Nepal, where 80% of the population are rural and depend upon natural resources for their subsistence, are issues of deforestation, resource extraction to meet basic livelihood needs, political instability, and wider environmental and climatic changes (Malla 2000, Bass and Steele 2006, World Bank 2014).

2.2.1 A Brief History of Conservation Approaches

From the establishment of the first national parks in the USA in the late 1800s, for almost a century, conservation approaches to address the impacts of human demands on the natural world were founded upon the broad assumption that effective conservation could only be achieved through the absolute and permanent separation of man from nature (Adams 2004). Such 'fortress' approaches to conservation involve the creation and demarcation of park boundaries through the construction of physical barriers or regulations, and both residence and consumptive use of park resources are strictly prohibited. Through the separation of elements of biodiversity from humans and the over exploitative practices which threaten their continued existence in the wild, fortress conservation approaches aim to preserve ecosystems and species into the future and can therefore be seen as broadly ecocentric in value.

Fortress approaches to conservation remain the key conservation tool to this day with 12% of the earth's land currently protected (Persha et al. 2010). Numerous authors have documented the effectiveness of protected areas in conserving the ecosystems and biodiversity within their borders, even in light of growing land-use pressures and significant financial constraints (e.g. Bruner et al. 2001, Persha et al. 2010). Other scholars, however, have been overwhelmingly critical of such approaches, casting doubt upon the ability of isolated protected areas to maintain viable populations of rare and far ranging species, or to maintain important ecosystem services such as natural fire regimes (e.g. Myers et al. 2000, Salafsky and Wollenburg 2000, Naughton-Treves 2005). Researchers more closely aligned with an anthropocentric view of conservation focus on a collection of different limitations, including increased incidents of poverty amongst local populations resulting from the unequal distribution of costs and benefits over space and time (e.g. Chen et al. 2007, Persha et al. 2010), and the social and livelihood impacts of forced evictions on local populations (e.g. Brockington et al. 2004, Colchester 2004, Schmidt-Soltau 2005).

In light of these well documented ecological and social failings of such strategies, community based conservation approaches rose to prominence towards the end of the 1980s, founded upon the belief that conservation initiatives could only achieve their conservation aims where they concurrently addressed human concerns (e.g. Naughton-Treves et al. 2005). Community conservation approaches argue that long-term conservation can only be achieved with the cooperation and support of local populations,

and that this is only possible where conservation provides socio-economic benefits for local populations. The 1990s saw a burgeoning of such approaches which have proliferated in recent years and are now considered by many to be mainstream conservation practice, representing the best alternative to the fences and fines approach of fortress conservation (Malleson 2002). Others, however, remain sceptical arguing that such approaches are fundamentally flawed as the livelihood aspirations of local populations are incompatible with the sustainable use of local resources (Holmes 2003) and that under such approaches communities often continue to exploit natural resources as financial incentives are rarely great enough to encourage locals to monitor threats to conservation or to take preventative action (e.g. Salafsky and Wollenberg 2000). Further limitations of such approaches discussed in the literature include the potential for the elite capture of benefits and the coercive nature of community conservation which on the one hand returns rights over traditional and indigenous lands to local people, whilst on the other dictating how such land may be used, usually to the benefit of international elites (Chen et al. 2007).

Such dissatisfaction with community based approaches to conservation has led to a resurgence of interest in approaches to conservation founded upon protected areas, as well as the consideration of novel market-based approaches to conservation involving direct incentives for biodiversity conservation through mechanisms such as REDD+ and PES. The unresolved nature of this wider debate is, I would argue, largely a product of the lack of empirical studies examining the conservation and livelihood outcomes of these various approaches. Whilst a growing number of authors have begun to evaluate the biodiversity (e.g. Alix-Garcia et al. 2012, Arrigada et al. 2012, Yang 2013) or socio-economic (Gubbie et al. 2009, Kwaw et al. 2012) outcomes of conservation approaches, there remains a lack of empirical evidence of the social and environmental outcomes of different conservation management regimes. Difficulties associated with evaluating the effectiveness of each approach to conservation are frequently compounded by the lack of high quality data on prior economic and social conditions, and how they have changed over time, and by the competing understandings of how success should be measured, stemming from competing conservation values and interests.

What this brief analysis of the wider literature demonstrates is that no single conservation strategy will be universally effective. The best strategy is therefore to choose the right approach or combination of approaches in any particular case. Whatever approach is

employed, it must emphasise the importance of local knowledge, cultures, and socio-economic circumstances, and it must be cognisant of the current and historical relationships between local people and natural resources and any associated traditional sustainable management techniques (Adams and Mulligan 2003). Protected areas are likely to remain a vital component of current and future conservation strategies, and such approaches do have the potential to impact positively on biodiversity outcomes. There is, however, an urgent need to ensure that they are designed and managed in ways which ensure local communities receive adequate and sustainable livelihoods benefits. If this balance between conservation and development aims is not achieved then conservation initiatives will fail on both counts.

In addition, there is a need for conservation research that goes beyond examining protected areas in isolation and considers the relationships between ecological processes and socio-economic forces at the local and landscape levels. Any study of conservation issues must include a consideration of the wider cross scale influences that work to shape conservation outcomes; it must be acknowledged that conservation is about more than just local communities and local level issues. Whichever conservation approach is deemed most appropriate in any given case, being flexible and remaining open to changing approaches over time, is key to ensure successful conservation outcomes.

2.2.2 Adaptive Management Approaches to Conservation

Whatever an individual's motivations are for conservation and regardless of the broad framework selected to realise their aims, there is growing consensus that in a world characterised by escalating uncertainty, adaptive management is the most effective means of ensuring conservation aims are successfully achieved. Initially conceptualised by Holling (1978) as an approach to investigate the dynamics and resilience of systems, adaptive management is now broadly understood to be an approach to NRM that reduces uncertainty whilst building knowledge through a process of learning (Allen and Gunderson 2011) in order to facilitate action in the face of uncertainty. However as Keith et al. (2011) observe, authors frequently use adaptive management as an umbrella term to cover a range of different types of management intervention, all of which involve change over time.

In its simplest form adaptive management is often equated to a 'trial and error' or an unstructured 'learning by doing approach' in which a single action is implemented in response to a new driver of change; if this action fails to adequately address the new challenge an alternative response is implemented (Williams 2011a, Rist et al. 2012, Westgate et al. 2013). Other authors (e.g. Conroy et al. 2011) equate adaptive management with a more complex 'structured decision-making' approach. Unlike simple trial and error, structured decision-making involves the development of a range of feasible actions to achieve a defined objective and the selection of the preferred option having considered potential outcomes (Conroy et al. 2011). Allen et al. (2011) distinguish between adaptive management and structured decision-making defining the latter as a problem solving approach used to identify and evaluate NRM options, whilst emphasising the central importance or learning in the former.

Recently a number of authors have made a further distinction between passive adaptive management (PAM) and active adaptive management (AAM) (e.g. Williams 2011b, Rist et al. 2012, Westgate et al. 2013) which are conceptualised as two distinct approaches both involving the use of management interventions to improve the state of a system. PAM is often linked to normal or best practice management, in which a single preferred course of action is implemented to improve a system, which is then modified based on experience (Rist et al. 2012). In PAM approaches the focus is firmly on the attainment of resource objectives and any learning that occurs is seen as an unanticipated by-product of decision-making as usual (Williams 2011b). As such I argue that PAM simply represents an alternative conceptualisation of the trial and error and structured decision-making approaches discussed above, and that the learning that occurs within this context is analogous with the process of single-loop learning (discussed in more detail in Section 2.4.3). AAM, on the other hand, has experimentation and the hypothesis testing of management options at its core, and is characterised by the specific aim of using formalised learning to reduce uncertainty in underlying conceptual models (Rist et al. 2012, Westgate et al. 2013). AAM is therefore, I would argue, more closely aligned with the process of double-loop learning (see Section 2.4.3).

There are a number of key characteristics common to all conceptualisations of adaptive management. The central tenets of an adaptive management approach are adaptation and responsiveness to facilitate decision-making in an uncertain world. The specific structure of

adaptive management approaches (see Figure 2.1) distinguish it from trial and error approaches, as does the emphasis that all forms of adaptive management place upon learning (Armitage et al. 2008, Allen et al. 2011, Fabricus and Cundill 2014). Learning within the organisation is viewed as being important, as is the wider social learning that may occur. Wider stakeholder involvement, both in learning and in decision-making, is seen as a key component of an adaptive management approach to conservation. Similarly, the influence of wider socio-economic and political systems on the ability of an organisation to manage adaptively is emphasised (Armitage 2008, Allen and Gunderson 2011).

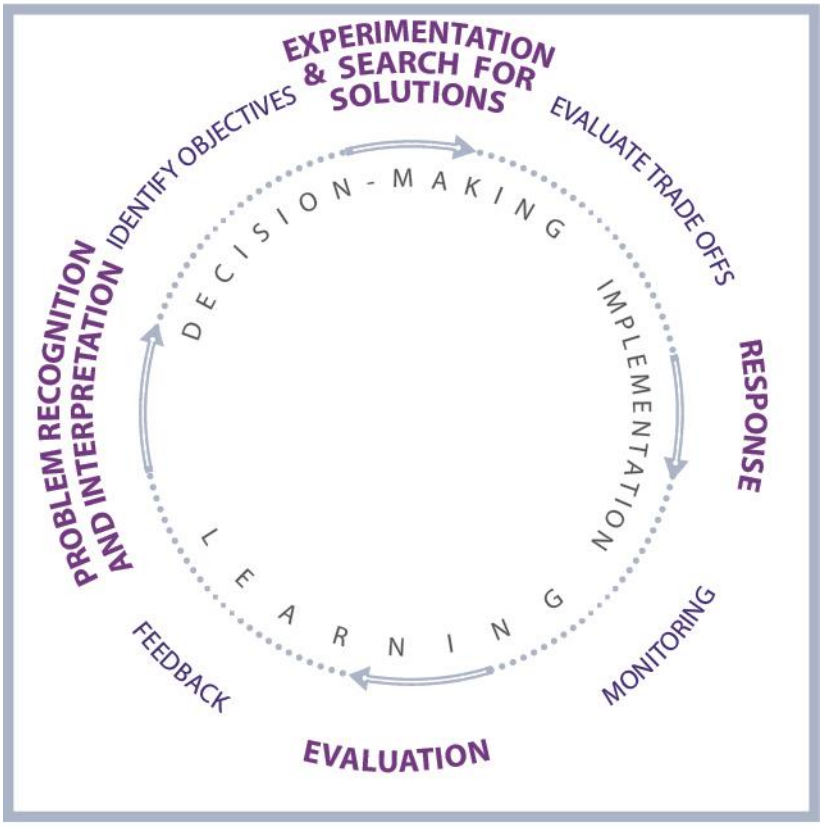

Figure 2.0.1 An interpretation of the stages in an adaptive management approach (developed from Allen et al. 2011 p1340). This illustration represents the first building block of my conceptual framework and is adapted, in Figure 2.6, to emphasise the importance of organisational learning processes in adaptation.

Given that an adaptive management approach enables action to be taken in the face of uncertainty, it is an approach best employed where a clearly defined natural resource system in need of managing exists, and where it is difficult to reliably predict changes in environmental conditions but where management actions can impact upon the state of the system (Wiliams 2011a, Allen and Gunderson 2011). Where adequate financial and human resources exist an adaptive management approach can therefore be a useful means of integrating conservation with the sustainable livelihoods of rural populations to achieve a

balance between strict protection and the needs of communities (Chazdon et al. 2009). Conversely, in situations where the natural resource system is not clearly defined, where there is high organisational resistance, the institutional environment is unsupportive or inflexible, and where stakeholder groups are unwilling to engage or compromise, an adaptive management approach to conservation is unlikely to be successful (Rist et al. 2012, Fabricus and Cundill 2014).

Furthermore, numerous authors have argued that an adaptive management approach has inherent problems including the lack of a clearly defined approach, the human and financial resources required, the failure of natural resource managers to acknowledge uncertainty, and difficulties in effectively engaging stakeholders, amongst others (Allen et al. 2011, Allen and Gunderson 2011, Westgate et al. 2013). I argue, following Rist et al. (2012) and Fabricus and Cundill (2014), that these limitations stem from the lack of agreement as to exactly what constitutes adaptive management and how to define it, combined with the fact that actual examples of real world applications of a pure adaptive management approach are rare, and examples of success in using adaptive management rarer still. An additional consequence of this absence is a lack of understanding of the structure and form of the learning component of adaptive management (Fabricus and Cundill 2014). Not only would more targeted studies of adaptive management in action help to clarify the concept and application of adaptive management, they could also shed light on the learning component that sits at the heart of all adaptive management approaches.

There is also a need for greater attention to be paid to the potential of adaptive management approaches to moderate the negative impacts of increasing climate variability and change whilst exploiting any potential benefits associated with it. Some authors (e.g. Allen and Gunderson 2011) have speculated that such an approach is unlikely to be of use in the context of climate change due to the complexity of the issue, the high levels of external influence involved, and the low confidence intervals associated with current climate projections. In contrast, I argue that an adaptive management approach to conservation in a changing climate is preferable to inaction as it not only enables natural resource managers to make decisions in spite of the uncertainty and severity of the challenges posed by climate change, but also because it will facilitate further learning around these important issues. Conservation is a complex discipline characterised by uncertainties and the influence of change in the wider social and ecological system, which

are beyond the control of natural resource managers and decision-makers. Whilst there is also uncertainty surrounding climate projections, particularly at the local level, meteorological records and improving understandings of climate processes may help to shed some light on the likely direction of change in key climate parameters, to limit the potential for uncertainty to become an excuse for inactivity.

2.2.3 Conservation and Climate Change

Although conservation research is only just beginning to seriously engage with climate change issues, there is widespread agreement that many terrestrial, freshwater, and marine ecosystems are already being directly and indirectly affected by increasing climate variability and change, and that the scope and severity of these impacts is likely to increase (Sutherland et al. 2009, Pettorelli 2012, SCBD 2014). Current bioclimatic models are characterised by high levels of uncertainty, in part resulting from the questionable accuracy of scaled down GCMs (Jones and Boyd 2011), however a number of authors have begun to examine the potential impacts of climate change on conservation strategies and on global biodiversity more generally. In their seminal paper, Parmesan and Yohe (2003) undertook a statistical analysis of the influence of climatic changes on natural systems. The authors found that whilst land use change was likely to have been the most important driver of biological change in the 20th century, climate change also had an important role driving change in natural systems (ibid.). Reid and Swiderska (2008) estimate that global average temperature rises of 2-3°C would result in 20-30% of all species being at a greater risk of extinction. Furthermore, they argue, habitats will change as climate change impacts upon ecosystem boundaries resulting in the expansion of some ecosystems and the reduction of others, with extinctions a likely result (ibid).

Mawdsley (2011) considers observed changes in natural systems resulting from climate change, citing a range of outcomes including changes in species distribution, changes in phenology, increased spread of diseases, and the proliferation of invasive species. Other authors have documented similar findings stressing the impacts of climate change on the distribution of suitable habitats, species and microclimates, noting that in addition to the new threats arising from such changes, where species are already threatened as a result of human activity, these pressures will be exacerbated (Chazdon et al. 2009, Morecroft 2012). As a consequence, climate change is likely to intensify existing conflicts and compromises between conservation and livelihoods objectives (Heller and Zavaleta 2009). Indeed in their

2009 paper, Sutherland et al. cite the means through which biodiversity policy and management practices can be modified and implemented to account for climate change, as one of the 100 most important questions facing conservationists in their pursuit of effective biodiversity conservation.

Moreover, arresting biodiversity loss will be beneficial for mitigation efforts, through the creation and maintenance of carbon sinks, whilst simultaneously reducing the vulnerability of natural and human systems to increasing climate variability and change (Rockström et al. 2009). Action must therefore be taken to counter the threats to successful conservation posed by increasing climate variability and change, however as Mawdsley (2011) notes, the general response of donors, conservation organisations and management agencies to date, has been characterised by inaction. The depth of uncertainty surrounding this topic combined with the overwhelming breadth of the task, likely lie at the root of this apparent indolence, however this is the worst possible management response. Current conservation strategies, and in particular protected areas, are rooted in the concept of permanence, based on a notion of what Baron et al. (2009 p1034) term dynamic equilibrium and stationarity, underpinned by a stable climate. Climate change is likely to impact upon the effectiveness of biodiversity protection strategies, particularly protected areas which may lose species representation within their boundaries, whilst the unparalleled pace of climate change means that *in situ* genetic adaptation of species is unlikely and that migration may also not be a viable option (Heller and Zavaleta 2009).

In a changing climate there is a real risk that traditional conservation strategies will no longer conserve suitable habitats for the very species that they were created to protect. More alarmingly, most conservation policies and management plans lack explicit consideration of climate change and there is a clear need to ensure that climate change considerations are mainstreamed into all conservation planning and actions (Heller and Zavaleta 2009). Despite this policy vacuum a growing number of authors have begun to consider the range of broad adaptations which have the potential to maintain conservation effectiveness in a changing climate. Typically such adaptation strategies involve a focus on the importance of the landscape level and a consideration of how species might move across such a space (Morecroft 2012, SCBD 2014). More specifically it is argued that such an aim could be achieved through increasing the number and size of protected areas (Reid and Swiderska 2008, Mawdsley 2011, SCBD 2014), reducing non-climate pressures on

biodiversity (Mawdsley 2011, Morecroft et al. 2012), improving connectivity between conservation sites (Reid and Swiderska 2008, Morecroft et al. 2012), and reviewing legislation and regulations to ensure it facilitates such actions (Mawdsley 2011). Despite such recommendations there are few examples of such approaches being tried in practice (Morecroft 2012) so many uncertainties remain as to their practical application. As Heller and Zavaleta observe (2009) there has also been a distinct absence of academic studies that consider the social and political dimensions of conservation in a changing climate, a major omission given the importance of human behaviour in determining conservation outcomes.

Further work is therefore needed on adaptation and conservation approaches, and a number of authors have begun to consider the defining characteristics of adaptive conservation approaches at the local level. A key theme throughout the literature is that of partnerships and stakeholder engagement, with numerous authors (e.g. Pettorelli 2012) calling for improved dialogue between academics, policy makers, and conservation managers, to overcome the discord between conservation research and practice. Others, for example Baron et al. (2009), focus on the importance of partnerships with other conservation organisations and the need for more inclusive local level participation (Chazdon et al. 2009). The importance of local stakeholder involvement is, in my opinion, key, not only because the local level is the primary site at which adaptation occurs, but also since the attainment of sustainable livelihoods benefits requires local stakeholders to be involved in planning and decision-making processes. Furthermore, local stakeholders are likely to have valuable knowledge, not only of current natural resource management practices, but also of past responses to environmental and demographic shocks as well as, potentially, information on recovery rates.

In addition to such benefits of collaboration, other authors have emphasised the need for interdisciplinary approaches with a greater emphasis on applied science in order to address the research gap that exists at present (Parmesan and Yohe 2003). More broadly, there is a need to integrate learning with management actions and to focus on approaches that foster learning and participation (Baron et al. 2009, Heller and Zavaleta 2009). Clearly defined goals, increased flexibility of management procedures and guidelines, and thorough monitoring and evaluation processes are also cited as important traits to enable adaptation of conservation approaches at the local level. It could be argued that each of

these traits, discussed in the wider literature, is a component of the adaptive management approach illustrated in Figure 2.1. Given this, and the fact that there has been a lack of research to date evaluating the success of adaptive management approaches to conservation, or how conservation can be achieved in the context of increasing climate variability and change, adaptive management with its focus on learning and action in the face of uncertainty would appear to be of great potential in ensuring the success of conservation interventions in our increasingly uncertain world.

2.3 Climate Change

The UNFCCC define climate change as, "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods," (UNFCCC 1992 p3). In their 2013 report, the IPCC (p4) emphasise the extent of the climate change challenge observing that, "warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia." Atmospheric CO_2 concentrations are now over 40% higher than preindustrial levels and atmospheric levels of all greenhouse gases are at levels unseen for at least 800,000 years (IPCC 2013). The evidence for the human influence in this warming trend is greater than ever, with the IPCC claiming that, "it is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century," (ibid. p.16, original emphasis).

In order to limit future climatic changes and their potentially devastating consequences, there is an urgent need to significantly reduce greenhouse gas emissions and to sustain this reduction. Based on current levels of action and attainment in relation to mitigation efforts, a 4°C world looks increasingly likely, and under this scenario global climate impacts will be severe, with even higher levels of change likely at the local scale (Stafford-Smith et al. 2011, Sherwood et al. 2014). Indeed even if greenhouse gas emissions are significantly reduced, most aspects of climate change will continue to be felt over the coming centuries (IPCC 2007, IPCC 2013) and climate impacts will fall disproportionately on the poorest most marginalised members of society who are least equipped to deal with them (Adger et al. 2003). Whilst such communities have often demonstrated adaptability in the face of past changes, climate change is likely to further exacerbate poverty levels in developing

countries whilst confounding poverty reduction efforts and intensifying pressures on biodiversity.

The socio-economic and ecological impacts resulting from climate change have been observed and experienced over the last several decades across all corners of the globe (IPCC 2014b). In Asia, for example, the 5th Assessment Report of the IPCC documents observed impacts on terrestrial ecosystems including changes in plant phenology and growth, and distributional shifts of species to higher altitudes and latitudes (IPCC 2014b p31). The extent and severity of such impacts is likely to be exacerbated by increasing climate variability and change. The IPCC state with high confidence that unique and threatened ecosystems and cultures are already at risk from climate change and that the breadth and gravity of these risks will significantly increase with additional warming of just 2°C (IPCC 2014b). Projected levels of climate change are also likely to result in an increased risk of extinction through the 21st century and beyond as many species are unable to migrate to suitable climates or to adapt to climatic changes at the required speed (ibid.). Under medium and high emissions scenarios there is also a severe risk of irreversible damage being caused to the composition, structure and function of terrestrial ecosystems (ibid.).

Given the abject failure, to date, of mitigation approaches and interventions to stabilise, let alone reduce, greenhouse gas emissions, in concert with the undiminished and rapacious human appetite for fossil fuels, future climatic changes have become an inevitability. In light of this absence of substantive effective interventions to mitigate the causes of current and projected climate change, action must be taken to increase the ability of individuals, organisations, governments and society as a whole to minimise these threats whilst exploiting any potentially beneficial opportunities that may arise; adaptation has become an imperative.

2.3.1 Climate Change Adaptation and Adaptive Capacity

The concept of adaptation has a long history in academia. Janssen et al. (2006) document the use of the term in the 1900s, in anthropological research, whilst others record its first appearance in the social sciences in the 1940s where it was used to refer to structural changes in a system in response to external circumstances (Young et al. 2006). Contemporary understandings of adaptation as a concept came to the fore in the 1990s

and have less in common with the anthropological perspective than with the latter, whilst incorporating a specific focus on global change in general, and climatic changes more specifically. Whilst no universally agreed and accepted definition of climate change adaptation exists there are a number of key traits that are common to most definitions of the term. Firstly adaptation refers to adjustments in either natural or human systems that may occur either as a result of human action or independently of it (IPCC 2014b). A second key component of the concept of adaptation is the recognition that climate change is likely to pose threats to natural and human systems but that it may also present positive opportunities that can be exploited (Janssen et al. 2006, Berkhout 2012). Moreover, definitions of adaptation commonly frame action as being in response to actual or anticipated climatic stimuli (Janssen et al. 2006). This facet of the definition is important since it incorporates the idea that climate change is a discipline characterised by high levels of uncertainty and as such, adaptation can occur in spite of our limited certainty of the exact strength and direction of future climatic changes (Dovers and Hezri 2010). Finally, implicit in most definitions of the concept is an understanding that adaptation is, by its very nature, place and context specific as a result of the specificity of climate impacts over time and space (Berkhout 2012). As Pandey et al. (2011) note, adaptation is essentially a local issue, and this can be considered to be the key site of adaptation since factors driving change in one location may not be relevant in another.

For the purposes of this study a systems definition of adaptation, that delineates adaptation in terms of learning, will be applied, building upon the IPCC's (2007 p6) definition of adaptation as, "adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." Defining adaptation in this way enables a focus on the management of risks and the exploitation of opportunities resulting from increased climate variability and change, within the BNPMA. In this study understandings of adaptation also draw on the work of Kuruppu and Liverman (2011 p65) who explicitly acknowledge the learning dimensions of adaptation, which are of central importance to this study, characterising it as, "a continuous process of learning and reflection." Building on the work of both of these and other authors, adaptation is defined here as, the continuous process of reflection, learning, and associated adjustment in natural and human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

Recent work on adaptation has begun to develop a number of self-explanatory, yet nevertheless important, dichotomous typologies of the concept. These distinct typologies of adaptation relate primarily to the timing of adaptation responses and to the fountainhead of adaptation actions. Anticipatory versus reactive adaptation (e.g. Adger et al. 2003, Smit and Wandel 2006, Jones and Boyd 2011, Kuruppu and Liverman 2011, Runhaar et al. 2012) (occasionally termed proactive vs. reactive, e.g. Grothmann and Patt 2005) is the terminology used to highlight the distinction between adaptation actions taken in response to anticipated climate impacts and those taken in response to experienced stimuli. Whilst reactive adaptation may be a feature of both human and natural systems, anticipatory adaptation is limited to human systems (Gallopin 2006). Similarly, adaptation may be planned or autonomous (Adger et al. 2003, Smit and Wandel 2006, Jones and Boyd 2011, Kuruppu and Liverman 2011, Runhaar et al. 2012) (occasionally characterised as private vs. public adaptation e.g. Grothmann and Patt 2005, Tompkins et al. 2010), that is it may be initiated in a top down manner or instigated independently by local actors. Whilst autonomous adaptation may take place in natural or human systems, planned adaptation remains exclusively the preserve of latter.

In terms of climate change research, adaptation is a relative latecomer to the party. Concerns around climate change began in earnest in the 1980s with the majority of academic research initially focusing on potential impacts and subsequently on mitigation (Grothmann and Patt 2005). More recently the focus has turned toward adaptation, and this shift in focus from impacts to adaptation is ongoing (Conway 2011). Arnell (2010) and the IPCC (2014a) highlight the rapid increase in adaptation related studies since the year 2000, however research in this area still lags almost a decade behind that in other areas of climate change (Wilby and Vaughan 2010). To date, that research which has been done on adaptation and human responses to environmental change has variously focused on the concepts of adaptive capacity, vulnerability, and resilience. These key concepts are used by scholars from a wide range of backgrounds however the exact definitions of these terms, the relationships between them and the emphasis and import placed upon them remains somewhat elusive.

The first key concept that represents a hub of adaptation research is adaptive capacity. Adaptation is necessary where drivers of change affect a system, and is only possible where

capacity to respond to these drivers exists. Adaptive capacity can therefore be defined as, "the adaptation space within which decision-makers in any system... might find feasible [response] options," (Moser et al. 2008 p646). The capacity of an organisation to adapt to change is dependent upon the interplay of a number of factors, internal and external to the organisation and should therefore be seen as a dynamic property of organisations rather than as a static attribute (signified by the double ended arrows in Figure 2.2). As Tompkins et al. (2010) note, the presence of adaptive capacity within an organisation does not guarantee that adaptation will occur since adaptation requires that capacity to adapt is transformed into action. This transformation is dependent upon the process of organisational learning outlined later in this chapter.

The 2001 IPCC assessment report on impacts, adaptation and vulnerability, was amongst the first to examine the range of factors determining adaptive capacity. This report highlighted the extremely limited extend of research in this area and, drawing on wider research on hazards, resource management and sustainable development, assembled a list of key factors influencing the adaptive capacity of communities or regions. In the wake of this report there have been a growing number of studies examining the determinants of adaptive capacity, which have corroborated, developed and amplified this range of determinants, summarised in Table 2.1 and illustrated in Figure 2.2 below. Research on this subject has been focused around areas as diverse as urban planning (Runhaar et al. 2012), water resource management (Yohe and Tol 2002, Kuruppu and Liverman 2011) and institutions (Gupta et al. 2010), and over diverse scales from the societal level (Adger et al. 2003, Tompkins et al. 2010) to the community level (Jones and Boyd 2011, Chhetri 2012). Significantly less attention has been paid to the determinants of adaptive capacity in organisations although Dovers and Hezri (2010) and Berkhout (2012) have taken the first steps towards this. Since the determinants of adaptive capacity are system, sector and location specific (Yohe and Tol 2002), the lack of consideration in the wider literature of the factors governing adaptive capacity in organisations generally, and conservation organisations more specifically, is an important research gap to address. I argue that since adaptive capacity is conceptualised in this study as being a systemic property, those determinants shown to apply to other systems should, with judicious modification in consideration of scale and sector, be equally applicable in the case of organisations.

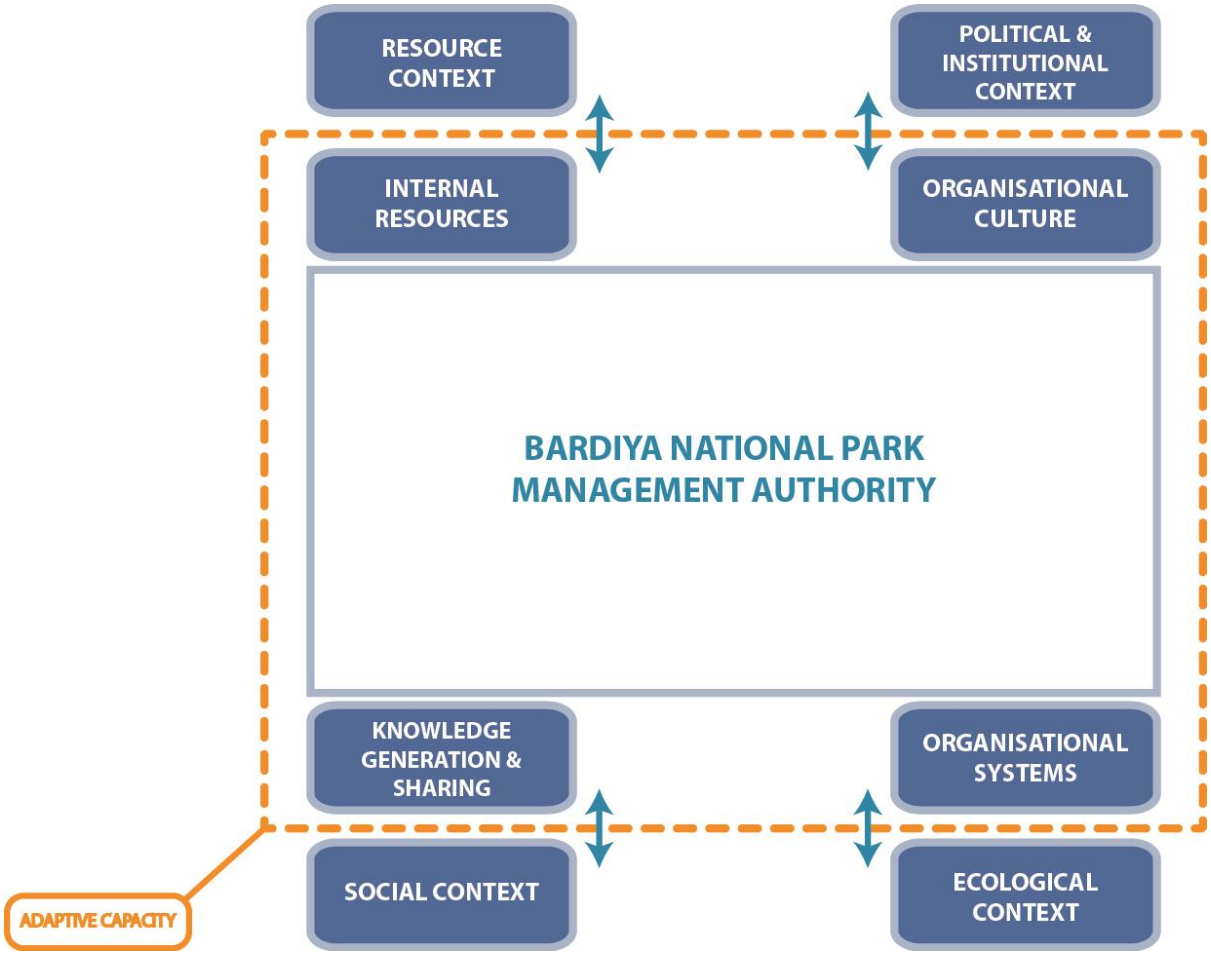

Figure 2.0.2 Internal and external determinants of adaptive capacity, building upon Berkhout et al. 2004 p14 and the range of authors cited in Table 2.1. This diagram represents the second building block of the Conceptual Framework of this study, presented in full in Section 2.5.1.

Table 2.1 documents the widely cited determinants of adaptive capacity anticipated to be of relevance in the case of organisations. These have been categorised, in this thesis, as being either internal or external determinants, that is, as dimensions thought to exist within the system or beyond its boundaries. This distinction is illustrated in Figure 2.2, which builds upon the work of Berkhout et al. 2004 (p14) and provides a key foundation upon which my conceptual framework is constructed.

Internal Factors Governing Adaptive Capacity	Cited in
Knowledge Generation and Sharing	IPCC 2001, Yohe and Tol 2002, Adger, Brown et al. 2003, Gupta et al. 2010, Jianhua et al. 2010, Tompkins et al. 2010, Wilby and Vaughan 2010, Ford et al. 2011, Jones and Boyd 2011, Pandey et al. 2011, Stafford-Smith et al. 2011, Chhetri et al. 2012, Runhaar et al. 2012
Internal Resources	IPCC 2001, Yohe and Tol 2002, Adger et al. 2003, Smit and Wandel 2006, Dovers and Hezri 2010, Gupta et al. 2010, Jianhua et al. 2010, Kuruppu and Liverman 2011, Pandey et al. 2011, Chhetri et al. 2012, Runhaar et al. 2012
Organisational Systems	Gupta et al. 2010, Tompkins et al. 2010, Wilby and Vaughan 2010, Berkhout 2012
Organisational Culture	IPCC 2001, Grothmann and Patt 2005, Baron et al. 2009, Wilby and Vaughan 2010, Ford et al. 2011, Jones and Boyd 2011, Kuruppu and Liverman 2011, Stafford-Smith et al. 2011, Berkhout 2012, Runhaar et al. 2012
External Factors Governing Adaptive Capacity	
Social Context	Yohe and Tol 2002, Dovers and Hezri 2010, Pandey et al. 2011, Runhaar et al. 2012
Resource Context	IPCC 2001, Yohe and Tol 2002, Moser et al. 2008, Dovers and Hezri 2010, Jianhua et al. 2010, Ford et al. 2011, Kuruppu and Liverman 2011, Pandey et al. 2011, Berkhout 2012, Chhetri et al. 2012, Runhaar et al. 2012
Ecological Context	IPCC 2001, Adger, Brown et al. 2003, Agrawal et al. 2008, Moser et al. 2008, Kuruppu and Liverman 2011, Runhaar et al. 2012
Institutional Context	IPCC 2001, Yohe and Tol 2002, Adger et al. 2003, Adger, Brown et al. 2003, Vincent 2007, Agrawal 2008, Moser et al. 2008, Dovers and Hezri 2010, Gupta et al. 2010, Jianhua et al. 2010, Ford et al. 2011, Jones and Boyd 2011, Kuruppu and Liverman 2011, Pandey et al. 2011, Stafford-Smith et al. 2011, Berkhout 2012, Chhetri et al. 2012, Runhaar et al. 2012
Political Context	Smit and Wandel 2006, Vincent 2007, Gupta et al. 2010, Ford et al. 2011, Winn et al. 2011,Runhaar et al. 2012

Table 2.0-1 Commonly cited determinants of adaptive capacity, believed to be of relevance in the case of organisations.

The influence of knowledge generation and sharing upon adaptive capacity revolves around ideas of access to information, training, knowledge exchange and advocacy. Where knowledge around climate change is limited and levels of uncertainty are high, a lack of awareness concerning the implications of climate change or possible response options may limit the capacity of an organisation to respond (Runhaar et al. 2012) or may result in a reluctance to act in light of prevailing levels of uncertainty (Tompkins et al. 2010, Jones and Boyd 2011, Stafford-Smith et al. 2011). As discussed in Section 2.2.2, the failure of individuals and organisations to effectively deal with the issue of uncertainty frequently retards decision-making and leads to inaction. Conversely, where the information and skills exist to enable a recognition of the need to adapt, the range of available adaptation options are understood, the ability exists to identify and select the most appropriate, and the channels needed to enable this information to flow throughout the organisation are present, then this will have a positive impact on decision-making and therefore on adaptive capacity (IPCC 2001, Chhetri et al. 2012). Similarly Jianhua et al. (2010) argue that to maximise the capacity of an organisation to adapt it is vital to ensure not only that staff have an appropriate level of knowledge, education and training but also that they are placed in roles that best fit these skills and experiences.

Internal resources are also commonly cited as being a key component of adaptive capacity. In the case of organisations internal resources comprise the range of human, financial, technological and infrastructure resources available to the organisation to address new challenges. Where a conservation organisation has limited funding from central government, for example, it is less likely to have access to the range of technological innovations such as camera traps or drones that could enable more effective adaptation; where it has a human resource deficit staff may be required to work in roles for which they are not suitably trained; where it lacks the appropriate infrastructure such as climate stations it may be unable to track and identify the need to respond to climatic changes. In such cases insufficient internal resources will work to limit the organisation's adaptive capacity.

The more circumscribed range of references, documented in Table 2.1, citing organisational systems as an internal determinant of adaptive capacity, is a symptom of the limited body of literature which has explored the specific situation of organisations to date. That work which has been done suggests that relevant organisational systems include those

pertaining to planning, monitoring and evaluation, and internal policy formulation (Tompkins et al. 2010, Wilby and Vaughan 2010, Berkhout 2012). Where organisations have clear and structured work plans and staff have clarity regarding their contribution to the organisation's overall goal, where there is clarity regarding individual responsibilities and the outcomes of activities are regularly monitored and evaluated, the organisation is likely to have a greater capacity to adapt than in instances where this is not the case.

A greater range of literature considers the role of culture in determining the adaptive capacity of institutions, households and individuals (Gupta et al. 2010, Kuruppu and Liverman 2011, Grothmann and Patt 2005 respectively). To extrapolate, organisational culture is likely to contribute positively to adaptive capacity where an organisation has clear goals, a shared vision, is flexible and willing to change practices regardless of how long they have been in place, and where the organisation's leadership is visionary and entrepreneurial yet collaborative (Plowman 2000, Wilby and Vaughan 2010). Organisational culture also incorporates the idea of perceived adaptive capacity which some authors (e.g. Grothmann and Patt 2005, Stafford-Smith et al. 2011) regard as being a key determinant of adaptation. This focus on the psychological dimensions of adaptive capacity argues that an individual will only adapt if they accept the need, and believe that they have the necessary tools, to do so. Such cognitive barriers to adaptation are considered in literature discussing adaptation at both the individual (Kuruppu and Liverman 2011) and institutional levels (Gupta et al. 2010); I argue that such factors may be equally relevant in determining organisational adaptive capacity.

In terms of external components of adaptive capacity a number of key determinants, closely aligned with the internal components discussed above, are cited as relevant to overall adaptive capacity. Yohe and Tol (2002) argue that whilst the role of what they term social capital in adaptive capacity is still not well defined, it is linked to ideas of knowledge sharing, mutual trust, and conflict solving (see also Pretty and Ward 2001). Building on this and the work of others (including Dovers and Hezri 2010, Pandey et al. 2011, Runhaar et al. 2012) I argue that the social context of the BNPMA will contribute positively to organisational adaptive capacity where the organisation has strong links to relevant partner organisations, and extensive information and knowledge sharing channels exist between them. A strong social context is likely to be of even greater significance in this case given the study's focus on a conservation organisation. As outlined above it is now widely

acknowledged that conservation initiatives cannot succeed without the cooperation of local people. Where public perceptions of the organisation in question are positive and local stakeholders demonstrate a willingness to cooperate with and engage in conservation activities that may be potentially detrimental to their livelihoods, organisational adaptive capacity is likely to be higher than where this is not the case.

The external resource context of an organisation is also likely to exert a significant influence upon its adaptive capacity. As with the internal dimension of this component, access to finance, technology and human resources in the organisation's external environment will have a bearing on the ability of the organisation to adapt to new challenges. Where an organisation can draw on financial resources that exist in its wider environment, for example from partner NGOs, and where there is a pool of people willing and able to get involved in conservation efforts, and where technological innovations such as the introduction of drought resistant crops reduce pressure on conservation areas or enable them to tackle challenges in new and innovative ways, the organisation's external resource context is likely to impact positively on organisational adaptive capacity (Armenakis and Bedeian 1999, Dovers and Hezri 2010, Moser et al. 2008, Chhetri et al. 2012).

A number of authors (e.g. IPCC 2001, Adger, Brown et al. 2003, Agrawal et al. 2008, Moser et al. 2008, Kuruppu and Liverman 2011, Runhaar et al. 2012) have highlighted the role of ecological context in determining adaptive capacity. This external component of adaptive capacity refers to the state of the ecological system in terms of proximity to tipping points, its stability, and its ability to resist wider environmental and climatic changes, the knowledge that managers have of their ecological context and how to manage it, and the level of dependence on natural resources. As the aims of conservation organisations are inherently entwined with the natural environment, and given that rural populations in developing countries are often heavily dependent upon natural resources for their subsistence, it seems probable that the ecological context of the BNPMA will exert an importance influence on the adaptive capacity of the organisation.

A further external determinant of adaptive capacity of likely relevance to organisations, particularly government organisations, is the formal and informal institutional context. Formal institutions include legislation and work guidelines which are visible and overtly formulated through official government and organisational processes (Pelling et al. 2008).

Informal institutions on the other hand refer to intangibles such as cultural norms and values and accepted behaviours (ibid.). Where key institutions are flexible and innovative in both form and function they are likely to contribute positively to organisational adaptive capacity (Yohe and Tol 2002, Adger et al. 2003). Conversely in situations where relevant legislation is lacking and institutions are inflexible, fragmented, and inclined to suffer from institutional inertia, structural relationships between national, regional and local level institutions can work to inhibit autonomous choice within local level organisations, constraining adaptive capacity (Ford et al. 2011, Runhaar et al. 2012). This is particularly true in relation to conservation where all too often a lack of appropriate legislation enforcing protection leads to protected areas being little more than 'paper parks,' (Jianhua et al. 2010).

Closely linked to the influence of institutional context on adaptive capacity is the role of external political context. Governance systems lacking legitimacy and public support, the prevalence of inequitable, unresponsive, and unaccountable processes and rules are all likely symptoms of the existence of constraints on adaptive capacity (e.g. Vincent 2007, Gupta et al. 2010, Runhaar et al. 2012). Similarly where there is a lack of political will in relation to climate change and conservation issues and the political arena is characterised by corruption, cronyism and political short-termism, the capacity of organisations to adapt to change is likely to suffer (Ford et al. 2011). Where the opposite is true, the political context of an organisation can contribute positively to adaptive capacity.

2.3.2 Adaptation, Vulnerability, and Resilience

Closely linked to the notion of adaptive capacity and representing a second key hub of adaptation research is the concept of vulnerability, a strand of adaptation research that has developed out of work on risk and vulnerability to natural hazards (Grothmann and Patt 2005, Smit and Wandel 2006, Young et al. 2006, Eakin and Patt 2011). Through the 1990s understandings of the term came, increasingly, to focus on the susceptibility of systems to harm resulting from the impacts of environmental change (Janssen et al. 2006). In its current use there remains a lack of consensus as to the exact meaning of the term, however a number of common themes can be identified. In a paper reviewing the linkages between the concepts of adaptive capacity, vulnerability and resilience, Gallopin (2006) highlights three widely accepted traits common to the assortment of vulnerability definitions employed in the wider literature: that vulnerability is considered in relation to

specific disturbances beyond the range of normal variability; that disturbances occur at different scales and affect systems at different scales; and that most systems are facing multiple interacting sources of stress. The IPCC incorporate all of these traits into their definition of vulnerability as, "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes," (IPCC 2007 p200).

The concept of vulnerability encompasses a range of elements of which it is a function, including the exposure and sensitivity of a system to a given stressor, and its ability to adapt (Adger 2006). As with the term vulnerability itself there is no widely agreed upon definition of sensitivity although in relation to climate change it tends to refer to the degree to which a system is affected by climatic changes (Gallopin et al. 2006). Despite the inconsistencies in how it is defined the concept of vulnerability has strong links to the wider body of work on adaptation. Indeed in recent years there has been mounting interest in concept of vulnerability and its associated terminology as a result of the growing focus on studies of anthropogenically driven climatic change, the resultant dynamic vulnerability of the system in question, and the necessity to adapt (Janssen 2006). Studies of adaptation and vulnerability have examined the circumstances that enable adaptation, and have tended to emphasise the similarities between the objectives of sustainable development and building adaptive capacity (Grothmann and Patt 2005, Eakin and Patt 2011). Janssen at al. (2006) in their systematic research of climate change papers found that adaptation and vulnerability were the two most commonly linked concepts in published work on climate change adaptation, further reinforcing the links between the two concepts in the wider climate change literature.

In this thesis I argue that although the concept has undoubted merit, there are a number of weaknesses associated with the term which reduce its utility and practical application to this study. A key aspect of the growing interest in vulnerability is the perceived utility of vulnerability assessment techniques at the policy level to rank priorities for intervention (e.g. Yohe and Tol 2002). This appeal stems from the apparent potential of the concept in bridging the gap between academic research and the policy arena (Adger 2006). However as Hinkel (2011) argues, vulnerability remains a relatively ill-defined concept with imprecise associated terminology, little clarity on how these combine to create a measure of vulnerability, and with a burgeoning number of poorly defined methodologies used to

assess it. Although a growing body of work is beginning to address this issue, framing practical and robust research around the concept of vulnerability remains problematic not least due to the failure of such approaches to consider differences in the perceptions and experiences of vulnerability of actors within a system.

Furthermore, Hinkel (2011) argues, this catchall concept also reflects the past focus of climate change work on mitigation and impacts, antecedents which are not hugely helpful in relation to work on adaptation. In addition, I argue that vulnerability is, by its very essence, a concept replete with negative connotations and its use has the potential to result in the framing of issues in a pessimistic way. Studies of adaptive capacity, in contrast, tend to have a more positive focus on the strengths of components of a system and the empowerment of actors within in. Whilst some authors (e.g. Gallopin 2006) contend that vulnerability can also be a positive trait involving beneficial transformations, I argue that such claims ignore the inherent contradictions implied by such understandings of the term. Consequently, where the term vulnerability is used in this thesis it is used in its simplest, clearest, and arguably most useful form, that is purely 'susceptibility to harm'.

Over the last decade a third broad strand of adaptation research has grown up, linked to the emergent interest in the concepts of social-ecological systems (SES) and resilience. This strand of research frames adaptation as a systemic process and argues that successful adaptation requires flexible institutions coordinated across scales that focus on longer term processes driving systemic change and that facilitate social learning (Eakin and Patt 2011). The concept of resilience was first introduced by C.S. Holling (1973) in the field of population ecology and as such it focused squarely on applied mathematics, modelling and applied resource ecology (Folke 2006). Holling's original work on resilience concerned the existence of multi-stable states in ecological systems however as with vulnerability, the emergent interest in the concept in recent years in tandem with the escalating interest in studies of climate change, has seen understandings of the term develop, although the key concepts of basins of attraction, panarchy, and cross scale dynamics endure (Gallopin 2006, Young et al. 2006).

The IPCC define resilience as, "the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure, whilst also maintaining the

capacity for adaptation, learning and transformation," (IPCC 2014b p5). Whilst transformation is defined as, "a change in the fundamental attributes of natural and human systems," (IPCC 2014b p5). Additional concepts including adaptability and transformability are also frequently cited in resilience work.

Advocates of the resilience approach extol its virtues as a practical tool for understanding complex social-ecological systems highlighting its ability to shed light upon the crucial relationships between the social and ecological aspects of a system (Folke 2006). As such it has been argued that it is a useful means of examining the factors influencing the conservation outcomes of protected areas (Thapa et al. 2010). Adopting a resilience approach allows the researcher to analyse changes in the SES of interest, examine its ability to recover from disturbances, and to view the system at multiple levels of interaction (Folke 2006). It can therefore be of use in informing our understandings of adaptive capacity and adaptation (Thapa et al. 2010).

Whilst the term resilience is increasingly used in relation to climate change in both the academic and policy arenas, Eakin and Patt (2011 p148) argue in their study of adaptation research, policy and practice, that there is limited evidence of this concept being operationalised. Where vulnerability is a seductive concept in terms of its potential to prioritise areas for the receipt of scarce development funds, resilience as a concept appears further removed from adaptation work in practice (Béné 2013). Furthermore a number of authors (e.g. Folke 2006, Linnenluecke et al. 2012) use the concept in a way that is all but indistinguishable from adaptive capacity, regardless of how they have defined it. For the sake of clarity, then, in this study there appears to be little to be gained from focusing on conceptualisations of resilience at the expense of the more clearly and consistently defined and readily operationalised concept of adaptive capacity.

A further limitation of the concept and its components relates to their development in relation to the analysis of purely ecological systems (Smit and Wandel 2006). Accordingly whilst resilience approaches may be effective in explaining changes in ecological systems they commonly fail to consider or provide explanations of human behaviour, a factor of fundamental importance to effective conservation. Allied to this limitation are the shortcomings of resilience framings in effectively addressing issues of power, politics, conflict and culture (Béné et al. 2014). Given these potential limitations in the context of

this study, the concept of resilience does not form a key focus of this research. Where the term is used, it is defined simply as, 'the ability of a system to return to its original form following a disturbance'.

A fundamental purpose of this research is to examine the adaptive capacity and the adaptive needs of the BNPMA, an ambition that necessarily builds upon evidence of the organisation's past responses to environmental change in order to identify the means through which adaptation initiatives may best be implemented and adaptive capacity enhanced. This specific focus builds upon and fits within the first body of adaptation research outlined above, focusing specifically on adaptive capacity. I argue that adaptive capacity is a fundamental component of each of the distinct bodies of adaptation research discernible in the wider literature, whether termed adaptability, resilience or coping capacity, and that it is therefore an important area of study, particularly in relation to the first strand of adaptation research described, with its focus on the practical steps that the organisation can take to enhance its capacity to adapt. Smit and Wandel (2006) highlight this stream of research as an important research gap to address, and whilst a growing body of work has been done on this since their paper was published (e.g. Tompkins et al. 2010, Wilby and Vaughan 2010, Berkhout 2012) investigations relating to the specific situations of organisations, and particularly conservation organisations, are still lacking.

Another research gap addressed by this framing is the absence of work that exists on the psychological dimensions of adaptation, that is the role of people's beliefs and understandings of risk in driving adaptation (Grothmann and Patt 2005) and their motivations for adaptation (Tompkins et al. 2010). Moser et al. (2008) argue that more work is needed in this area to develop our understandings of the social determinants and processes of adaptation and as outlined above this is an area that a resilience approach is perhaps ill-equipped to address. Jones and Boyd (2011) reiterate these sentiments, arguing that more work is needed to examine how social and cultural factors shape adaptation actions.

Other authors (e.g. Conway 2011) stress the need for a greater emphasis on the links between adaptation research, policy, and decision-making, a sentiment echoed by Moser et al. (2008). As Smit and Wandel (2006) note, research focusing on practical adaptation initiatives framed through an adaptation and adaptive capacity lens emphasises the means

through which an actor, in this case the BNPMA, is able to address changing conditions in their external environment and the decision-making processes through which these actions take shape. Other authors back this call, arguing for more policy oriented adaptation research, and a greater examination of mechanisms of policy and institutional change and how institutional or organisational structures should change to better facilitate adaptation (Arnell 2010, Dovers and Hezri 2010) as well as the need for more research into adaptation in practice (Tompkins et al. 2010).

A related lacuna in the wider adaptation literature relates to a specific subset of studies that examine how adaptation is actually being delivered within and by organisations, and the barriers that influence how this adaptation takes place (Arnell 2010). Linnenluecke et al. (2012), for example, highlight the current dearth of studies examining the factors that enable organisations to respond to increasing climate variability and change whilst Tompkins et al. (2010) concur, arguing that more work is needed to understand the drivers of adaptation, in order to facilitate the mainstreaming of adaptation considerations in organisations. Whilst, as the following section of this chapter demonstrates, a significant body of research exists examining the means through which organisations identify, respond to and learn from external stimuli in pursuit of their goals, very little work has specifically examined adaptation in organisations.

2.4 Organisations

2.4.1 Organisations, Institutions and Bureaucracies

In the context of this study, organisations are defined as, "collectives of actors whose activities are coordinated within definable social units to achieve certain common goals," (Berkhout 2012 p91). As highlighted in the previous section, the local scale is of key importance for adaptation responses to the challenge of climate change (Storbjörk 2010, Agrawal et al. 2008) and local organisations can therefore be seen as key actors for adaption. Indeed, a better understanding of the capacity constraints facing local organisations can be considered an essential first step to ensure the optimal design and implementation of future adaptation initiatives (Conway 2011). Individual adaptation to climate variability and change takes place in the context of organisations and whilst societal adaptation does occur, this can be seen as an aggregation of organisational responses (Berkhout, 2012). Improving our knowledge of how organisations cope with the effects of increasing climate variability and change is therefore a fundamental first step in

understanding the future potential of adaptation options as effective responses to climate change (Adger et al. 2003). To date, there is a dearth of studies examining how adaptation is occurring in organisations and, more specifically, on the factors influencing how adaptation to climate change occurs. Those that exist are almost exclusively focused on private sector organisations and/or developed countries (e.g. Berkhout et al. 2004, Baron et al. 2009, Storbjörk 2010, Tompkins et al. 2010, Arnell 2010, and Harries and Penning-Rowsell 2011).

The choice of a public sector bureaucratic organisation as the focus of this study aims to address these gaps however it has a number of implications. Firstly, as can be inferred from a number of authors (e.g. Berkhout et al. 2004), public sector organisations are less able to operate autonomously than private sector organisations and certain determinants of adaptive capacity such as the wider institutional and political context are therefore likely to assume greater importance than would be the case in private sector organisations. Conversely, the adaptive capacity of public sector organisations is perhaps less likely to be influenced by the wider economic and market context. The selection of a bureaucratic organisation as the focus of this study is also likely to have a number of implications. In his original conceptualisation of bureaucracies, Weber (1947) argued that their emphasis on specialised expertise, legal authority and strict hierarchical control bred certainty, continuity and unity, making bureaucracies, in their pure form, the most proficient form of organisation. Bureaucracies, Weber argued, result in the diminution of social difference whilst the prominence of rules renders personal status and relationships extraneous to success, with staff appointments based on the free and fair selection of the most competent candidates (Rockman 2014).

In practice, particularly in developing countries, the administrative apparatus of the state has rarely come close to realising a form of bureaucracy analogous to Weber's ideal (Rockman 2014). Recent work (e.g. Khan 2001) has highlighted a number of key 'bureaupathologies' which result in dysfunctional and ineffective bureaucracies, which I argue may be of relevance in determining the adaptive capacity of the BNPMA. Kahn (2001) highlights the role of clientelism, incrementalism, arbitrariness, imperialism and parochialism in limiting the effectiveness of bureaucracies. A number of other studies have discovered similar limitations to the success of bureaucracies specifically in South Asia and Nepal. Pant et al. (1996 p54) examined the failure of development interventions in Nepal,

characterising the country's public sector organisations as being dominated by, "an administrative and management culture founded on archaic feudal traditions and characterised by slow decision-making, risk avoidance, 'red tapism' and high power and status orientation." In a more recent study Zafarullah and Huque (2007) highlight the inflexibility and elitism which typify Nepali public bureaucracies whilst Jamil and Dangal (2009) go further, highlighting the high power distance, the prevalence of ascription, the lack of trust in political leaders, the clientelism and general disregard for merit that exist, traits which are embodied by, and are symptomatic of, dysfunctional bureaucracies. Nepali public sector organisations then, are characterised as unrepresentative, clientalistic, process and rule oriented organisations dominated by elites, where success depends less on performance than on personal connections.

In relation to the components of adaptive capacity outlined in Section 2.3.1, the possible implications of this for the BNPMA may include constrained adaptive capacity resulting from limited knowledge sharing within the organisation, staff lacking the necessary education and training to fulfil their tasks effectively, the prevalence of extra-legal incentives, the culture of inflexibility, non-collaboration and Chakari and Chaplusi,[2] and correspondingly inflexible institutions. The clear plans, policies and procedures which characterise bureaucracies in their pure form may, on the other hand, work to enhance the adaptive capacity of the BNPMA, as may the organisation's social context, since studies have also shown that Nepali bureaucrats overwhelmingly see themselves as servants of the people (Jamil and Dangal 2009).

In Weber's conceptualisation of bureaucracies (1947) institutions and rules also feature prominently and, as discussed, these may prevent organisations from adapting to new challenges. Indeed the distinction between organisations (bureaucratic or otherwise) and institutions is an important one, but one that is often blurred in the wider literature with the two concepts frequently conflated, exemplified, to varying degrees, by various scholars (including Yohe and Tol 2002, Dacin et al. 2002, Agrawal et al. 2008, Gupta et al. 2010, Boyd 2012). As Dovers and Hezri (2010 p221) observe, the term institution is often used to refer to a specific organisation, a policy instrument or policy programme. Amongst authors from a range of disciplinary backgrounds there is little consensus on how to conceptualise

[2] Chakari and Chaplusi is the system by which success in the workplace is dependent upon personal relationships and the need to flatter and please your immediate superior, rather than upon achievement and performance (discussed in Jamil and Dangal 2009).

institutions, an issue which is particularly keenly felt in the field of climate change research (Kingston and Caballero 2006).

For the sake of clarity, institutions are defined in this study following North (1990 p3) as, "the rules of the game in a society or, more formally, … the humanly devised constraints that shape human interaction." To extend this definition, organisations are, then, the teams that play the game; that is, in the most general terms, political, economic or educational bodies (North 1990). Institutions may be formal (laws and regulations) or informal (conventions, codes of conduct and routines embedded within an organisation) and they may be created or evolve over time (Low et al. 2005, Kingston and Caballero 2006). Whilst institutions help to shape social practices and interactions, they are themselves shaped by them (North 1990, Gupta et al. 2010). Consequently institutions tend to be characterised by stability, predictability and resistance to change, whilst organisations are thought to change more often (Dovers and Hezri 2010, Munck af Rosenschöld 2014) a trait which renders them amenable to study in relation to climate change adaptation. In the following section of this chapter the focus turns to the processes through which organisations operate and are thought to change, beginning with a consideration of the range of factors driving change within organisations.

2.4.2 Organisational Change

Organisational change involves the modification of an organisation's activities, routines and objectives in response to new situations for which they have no existing appropriate procedures in place (Berkhout et al. 2004, Van de Ven and Poole 2005). Such changes may be precipitated by interpretations of organisational experience which are deemed likely to have a significant impact upon the operation of an organisation and its ability to achieve its goals. Specific literature on adaptation in organisations is much scarcer than that on organisational change more generally, but that which there is recognises that organisational adaptation occurs are in response to more than just climatic changes (Berkhout et al. 2004). My conceptual framework characterises the perception of these new experiences or situations as 'drivers of change,' see Figure 2.3.

Figure 2.0.3 Drivers of organisational change and the process of problem recognition and interpretation (building upon Berkhout et al. 2004 p14, Daft and Weik 1984, and others e.g. Tompkins et al. 2010). This diagram represents the third sequential component of the conceptual framework for this study and is closely linked to Figures 2.1 and 2.4 which provide further detail on the processes occurring within the BNPMA.

Drivers of change are dependent upon context and are likely to include perceived or actual environmental changes, including climate change (Berkhout et al. 2004, Tompkins et al. 2010), direct and indirect policy and legislation (Tompkins et al. 2010), and anthropogenic drivers including population pressures, increasing resource consumption and other human activities (Naughton-Treves et al. 2005, Jianhua et al. 2010, and Tompkins et al. 2010). Somewhat counterintuitively and despite my focus on a public sector organisation, anthropogenic drivers commonly associated with private sector organisations including market forces (Armenakis and Bedeian 1999, Berkhout et al. 2004) may also have a potentially important role to play. The influence of mitigation mechanisms, for example, including REDD+ and PES schemes, as well as other factors such as tourism and demand for illegally extracted timber on international markets may be of relevance in this area. In addition, despite the lack of work that has been carried out to date on adaptation in conservation organisations, I argue that in the case of protected areas, additional drivers threatening the success of conservation outcomes such as human-wildlife and park-people conflict will also be of relevance, particularly given the reliance of conservation outcomes on human actions and behaviour. In the context of the BNPMA, additional drivers may also include the international climate change and conservation agendas which influence national and local level policy, particularly through the availability of multilateral and bilateral funding for climate change and conservation programmes.

The process through which organisations identify their drivers of change and recognise the need to respond, is not well understood (Berkhout 2012). Numerous different conceptual models of how this process occurs exist in the wider literature, stemming from the

different ontological and epistemological understandings of the nature of organisations, and the diverse disciplinary backgrounds in which studies are founded (Van de Ven and Poole 2005). Understandings of organisational change do not, for example, fit well with classical management theories of stability and routine (Hatch 1997). Much of the research in this area builds on Lewin's (1947) model of change as occurring in successive phases of unfreezing, change and refreezing, resulting from an imbalance between the forces for and against change, however this model has been criticised for being overly simplistic, linear and static (Hatch 1997, Adams and McNicholas 2007).

In response to such criticisms numerous authors (e.g. Judson 1991, Kotter 1995) have developed understandings of organisational change based on what Van de Ven and Poole (2005) term a process epistemology which characterises organisations as being processes, and focuses on how change develops and unfolds over time. This is distinct from the more traditional variance epistemology which characterises change simply as an observed difference between two points in time. The relevance of a process conceptualisation is that it builds upon the idea that organisational change is a fluid process of adaptation rather than a simplistic static one; key components of such understandings are that organisational change is an ongoing process involving multiple steps. Despite this shift, change is still frequently understood as being planned, a result of the actions of a change agent within the organisation in question, as opposed to being emergent, driven by changes in the wider environment which demand adaptation as the price of survival, and compel organisations to adapt or die (Hatch 1997).

Recent scholarship in this area has endeavoured to address this limitation, building upon the work of Daft and Weik (1984) who argue that previous conceptualisations of organisations have a tendency to treat organisations as static frameworks or mechanical systems with change driven from within, whilst failing to address their systemic complexity. Daft and Weik (ibid.) develop a model which, consistent with Berkhout's (2012) conceptualisation of organisations as social systems that process information they receive from their uncertain environment, argues that organisational change is driven by changes in its external environment and that understanding perceptions of change is therefore key to understanding the adaptation responses of organisations. Indeed the authors argue that almost all of an organisation's activities are based upon the interpretation of their perceptions of their external environment (ibid. p.286).

Figure 2.0.4 An illustration of the relationship between organisational scanning interpretation and learning (Daft and Weik 1984 p286).

As illustrated in Figure 2.4, how drivers of change are perceived by the organisation in terms of their exposure and severity, that is, how they are signalled to it and interpreted, therefore becomes a strong determinant of organisational response (Grothmann and Patt 2005). An organisation's perceptions of its environment, that is how it understands its drivers of change, is dependent upon how far it intrudes into its external environment through the process of scanning. Table 2.2 documents the four modes through which this scanning process may occur, as outlined by Daft and Weik (1984). Sources of data regarding the organisation's external environment may be external, collected through direct contact between staff from the organisation and those operating in its external environment, or internal, gathered from others within the organisation (ibid.). Similarly data may be obtained by personal means, that is direct contact with other stakeholders, or through impersonal means, that is through documents such as newspapers and technical reports (ibid).

		Organisational Intrusiveness	
Organisational assumptions regarding their environment		**Passive**	**Active**
	Unanalysable	Undirected viewing – Scanning is not routine, data is collected informally and is often based on hunch, rumour, or chance.	Enacting – Data is gathered through experimentation and testing.
	Analysable	Conditioned viewing – The organisation interprets its external environment within traditional boundaries and its usual routines.	Discovering – Involves active detection comprising formal searching, questioning, surveys, and data gathering by the organisation.

Table 0-2.2 A model of organisational interpretation modes (Daft and Weik 1984 p228).

I argue that the strength and relevance of such a conceptualisation of organisations as interpretation systems, despite its original formulation for private sector organisations, lies in the emphasis and importance that it lends to the relationships between an organisation and its environment. The influence of the environment on the organisation and its structures and processes, is contingent upon how the organisation interprets and makes sense of its external environment and responds accordingly. This conceptualisation is consistent with understandings of organisations as social systems which respond to their

perceived drivers of change which exist in their external environment, rather than as fixed entities which exist in isolation from these external forces.

This study builds upon Daft and Weik's conceptualisation and incorporates the more recent emphasis of authors such as Grothmann and Patt (2005) and Runhaar et al. (2012) on the importance of perceptions in driving organisational change. However far an organisation intrudes into its external environment in the process of scanning, action is ultimately taken (or not) on the basis of perceived risk. I argue that organisations build interpretations of their external environment through a process characterised as comprising four fundamental stages: scanning for data; data signalling; the collection and interpretation of data; and learning, where action taken and new data fed back for interpretation (Risbey et al. 1999, Grothmann and Patt 2005, Runhaar et al. 2012) see Figure 2.5.

Figure 2.0.5 An amended illustration of the process of organisational sense-making building on Daft and Weik (1984 p286).

I argue that it is through this process that organisations, whether private sector companies or public sector bureaucracies, develop responses to their perceived drivers of change. The capacity of the organisation to respond to these drivers will depend upon the interplay and relative strengths of the internal and external components of adaptive capacity in conservation organisations, presented in Table 2.1. The organisation interprets these drivers through the process of sense making outlined above, how it translates its adaptive capacity into action depends upon the process of organisational learning, explored below.

2.4.3 Productive Organisational Learning

Learning at the organisation level of aggregation can be defined as a deliberate process that may be rationally planned, and/or a result of continuous experimentation and re-evaluation (Storbjörk 2010). As discussed above, organisations can be characterised as learning organisations as they scan their external environment and interpret and understand their experience of drivers of change to derive meaning from them. Organisations learn as they acquire information and are successful where productive organisational learning takes place, that is, valid learning that leads to actions with positive outcomes. As illustrated in Figure 2.6 organisational learning can be understood as a

cyclical process, throughout which additional evidence from experience will feed in to validate new routines (Berkhout et al. 2004).

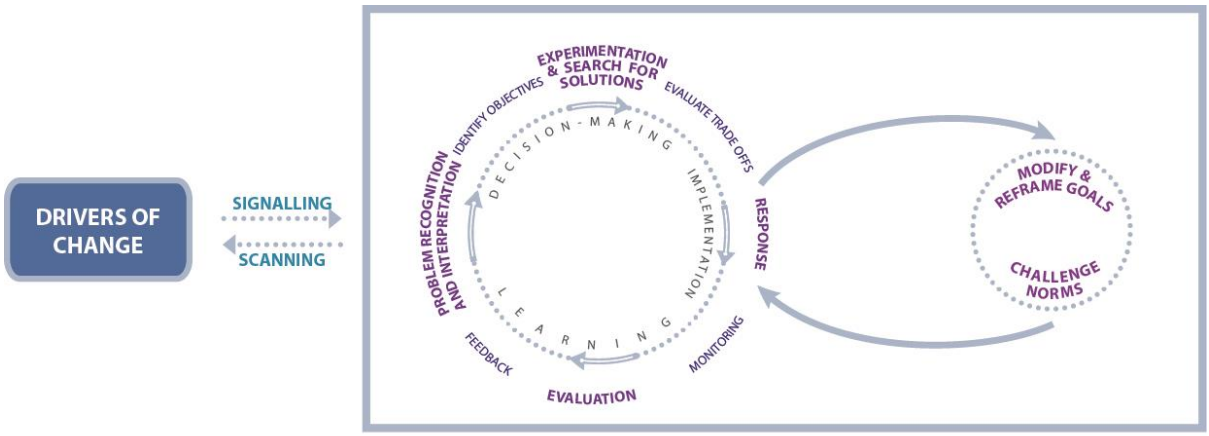

Figure 2.0.6 The process of organisational interpretation and learning, integrating the adaptive management approach outlined in Figure 2.1 and building upon Berkhout et al. 2004 p14 and Pahl-Wostl 2009 p9 to emphasise the importance of learning processes. This diagram represents the final component of the sequential diagrams which are brought together in Figure 2.7 to represent the conceptual framework underpinning this research.

A key concern when examining learning in organisations is the unit or level of analysis, that is who, or what, is learning. As organisations are collectives of individuals it has been argued that learning takes place at the individual level since as individuals learn, so too will the organisation (Argyris and Shön 1996, Easterby-Smith et al. 2000, Fabricus and Cundill 2014). However, this is often not the case as individual knowledge does not always diffuse throughout the organisation, resulting in the organisation having more circumscribed knowledge than the sum of its parts. This issue can be exacerbated where turnover of staff is high and those leaving the organisation take their knowledge with them. Conversely, in some situations organisations have greater knowledge than the sum of their members through the latent knowledge residing in the structures, procedures and memories that it has built up over time (Argyris and Shön 1996, Senge 2006). In such situations it can be asserted that it is the organisations themselves that are learning.

This crucial issue remains an important area for debate in the organisational learning literature. Consequently in examining organisational learning it is vital to identify the most appropriate level of aggregation or layer of learning at which to focus, that is to say the individual, group, or societal level (Argyris and Schön 1996, Löf 2010, Shultz and Lundholm 2010). Systems Theory is focused on context and relationships and argues that you cannot understand any one part or outcome of an organisation without studying the whole (Senge 2006, Aragón and Macedo 2010). Such a framing facilitates an approach to organisational

change that allows the wide range of internal and external factors influencing change to be addressed, and focus to be trained on underlying problems rather than merely symptoms. Adopting an understanding of organisations building upon Systems Theory involves the conceptualising organisations as systems embedded within systems (Hatch 1997). To avoid confusion regarding the level of analysis addressed in this study it is therefore necessary to maintain a clear distinction between the system that is the central focus of the study (in this case the BNPMA), the supersystem (the wider arena within which the BNPMA is situated), and the subsystem (the internal characteristics of the organisation and its members). In doing so I focus on the organisation level of aggregation (the BNPMA) whilst examining how the system at this level interacts with higher level processes, and concurrently drilling down to the lower level of aggregation to examine the importance of interpersonal enquiry in organisational learning. This should enable the elucidation of a fuller understanding of the polycentric and networked learning that is occurring within the organisation across multiple layers.

The foundations for contemporary understandings of organisational learning were laid by management science and organisational behaviour scholars Argyris and Schön in their 1978 book entitled Organizational Learning: A Theory of Action Perspective. This work built upon the authors' earlier research into the relationship between individuals and organisations (cited in Argyris and Schön 1978) that identified two theories of action which, since action preceded learning, are seen as prerequisites for organisational learning. The first of these, termed espoused theory, refers to the theory of action used to explain or justify a given pattern of activity; we are doing x because of y. the second, the organisation's theory-in-use, refers to the underlying reasons an action is taken, and in the context of organisations this includes organisational norms, strategies, values and assumptions that govern action (ibid.).

In this publication the authors developed this theory further, laying out their conceptualisation of organisational learning, identifying two key forms (ibid.). The first of these, termed by the authors 'single-loop-learning,' can be defined as, "instrumental learning that changes strategies of action or assumptions underlying strategies, in a way that leave the values of a theory of action unchanged," the organisation detects and correctsan unexpected or negative outcome by making simple modifications to an existing strategy (Argyris and Schön 1996 p20). In simple terms, then, single-loop-learning is

learning that leads to incremental improvements in organisational practice whilst leaving the organisation's existing framework of values and norms unchanged. Under this scenario learning occurs through the feedback gained from the monitoring and evaluation of action, however whilst this type of learning addresses the outcomes of a problem it fails to consider the underlying causes (Argyris and Schön 1996, Hatch 1997, Fabricus and Cundill 2014).

The second form of learning identified by Argyris and Schön, termed 'double-loop-learning,' is defined as, "learning that results in a change in the values of theory-in-use, as well as in its strategies and assumptions," (1996 p21). Where double-loop-learning occurs, it therefore involves the modification of an organisations existing framework of strategies, norms and values, in order to address new challenges. As Hatch (1997) expands, double-loop learning involves the modification and reframing of the organisation's goals, and includes a process of challenging core values and norms. In doing so, therefore, double-loop learning corrects behaviour and addresses the underlying causes of identified problems.

Argyris and Schön also identified a third type of learning, developed from the work of Bateson (1972) termed deutero-learning. This second order form of learning referred in its original conception to a profound reorganisation of an individual's character or beliefs (Bateson 1972) and was developed by Argyris and Schön to refer to the process through which organisations learn how to learn. In other words deutero-learning is a process focused on learning about learning and is concerned with enhancing the capacity of an organisation to learn effectively through either single- or double-loop-learning (Armitage et al. 2008, Fabricus and Cundill 2014). It entails the modification of an organisation's systems of learning, that is the structures that facilitate or inhibit organisational enquiry and is, therefore, distinct from both single- and double-loop learning in that it is exclusively process focused.

Recent interest in single-and double-loop learning in the adaptation and adaptive (co)management literature (e.g. Armitage et al. 2008, Boyd and Osbahr 2010, Cundill et al. 2011, Leys and Vanclay 2011, Fabricus and Cundill 2014, Lundmark et al. 2014) has resulted in a degree of blurring of the theoretical distinction between these forms of learning as they were originally conceptualised. Commonly such studies have implied the primacy of

double- over single-loop learning, positing the former as comprising more systemic changes which, they argue, 'go beyond' the latter (Shultz and Lundholm 2010). Some argue that double-loop leaning involves the reframing of rules and routines (Lundmark et al. 2014) whilst others argue that it involves challenging existing worldviews and core values (Storjbork 2010). Some even imply that double-loop learning is a prerequisite for adaptation (Shultz and Lundholm 2010). I argue that a simple conceptualisation of the distinction between single- and double- loop learning, following the work of Argyris and Schön, in which single- and double-loop learning are viewed as complimentary as opposed to those which give one conceptualisation primacy over the other, is beneficial and serves to overcome the growing lack of clarity surrounding these concepts.

A second outcome of the recent increase in interest in learning has been the growing attention on a third learning loop, commonly termed 'triple-loop learning', which has increasingly been conceptualised in the adaptation literature. As Tosey et al. (2011) document in detail, this more recent concept is not strongly established in the literature and is frequently conceptualised in diverse ways either as superior to double-loop learning, as analogous to deutero-learning, or as similar to Bateson's (1972) Learning III (learning which represents a profound reorganisation of character). Most frequently such studies in the adaptation and natural resource management literature attribute this triple-loop learning to Argyris and Schön (Armitage et al. 2008, Löf 2010, Storjbork 2010) conceptualising it as inherently superior to both single- and double-loop learning; indeed some authors argue that this transformational learning loop is a prerequisite for the transition of the whole system to a higher level of adaptive capacity (e.g. Pahl-Wostl 2009). I argue that such conceptualisations of a third, higher, level of learning is unhelpful as it feeds back into misunderstandings concerning the relationship between single- and double-loop learning. A more useful concept for examining organisational adaptation is that of deutero-learning with its focus on learning how to learn, which I argue is more closely and clearly linked to the idea of increasing adaptive capacity, than any muddled conceptualisations of triple-loop learning.

The lack of understanding and clarity in the wider literature as to what exactly constitutes learning and the distinction and relationship between the three distinct forms of learning is, in part, a consequence of the lack of real world examples which have examined organisational learning in practice (Tosey et al. 2011, Fabricus and Cundill 2014). Whilst

recent studies may have muddied the water around the distinction between single- double- and deutero-learning, what they have done is to shed light on the inherent links that exist between organisational learning and adaptive management, reflected in Figure 2.6. In this thesis I argue that the concept of organisational learning provides a useful frame through which to examine the components of adaptive capacity outlined in section 2.3.1 of this chapter, and the means through which these are mobilised into adaptive action. I argue that improving understandings of learning cycles within an organisation will shed light upon the process of organisational behaviour change, and therefore on the factors that facilitate and constrain the ability of organisations to adapt to change. As Hatch (1997) observes, organisational learning - be it directly through trial and error, or indirectly through contact with other organisations - enhances adaptive capacity and furthermore drives adaptive action. Shultz and Lundholm (2010) go further, elucidating the links between adaptive capacity, conservation, and learning, inferring that national parks provide a potentially fruitful focus for empirical studies of organisational learning in relation to sustainable development and adaptation to climate change, as they provide an arena to examine the degree to which national and international policy frameworks, and the capacity of organisations to adapt, are translating into local management actions on the ground.

2.5 Examining the Relationship between Climate Change and Organisational Learning

As this chapter has shown, organisational adaptation to climate change is an important but currently under-researched area; as yet our understandings of organisational perceptions of, and responses to, climate change are limited. Likewise empirical studies of organisational learning in the wider literature are scarce. These research gaps are of particular relevance in the case of conservation organisations in developing countries, where adaptive management appears to offer a promising approach to conservation in a changing climate, but where more work is needed to assess the value of such approaches in practice, and to clarify the links between adaptive management and learning.

This study builds upon this diverse body of literature, documented above, and is concerned with understanding how the BNPMA in Nepal is able to adapt to pressures in its external environment, including increasing climate variability and change. More specifically this research aims to address the identified research gaps and result in an improved understanding of the drivers of adaptation in the BNPMA, the processes through which the

organisation adapts to climate change, and the factors that enable and constrain action. In doing so it aims to create a more comprehensive understanding of the potential future effectiveness of adaptation interventions in and around the BNP.

In order to achieve these aims this research addresses three key questions developed through a number of important sub-questions.

1. **What are the BNPMA's key drivers of change?**

This question examines the diverse drivers of change in the context of the BNPMA, that is, the external factors at the local, national and international scales to which it is having to respond, and which influence and impact the organisation's aims and activities. This question is underpinned by the driver of change section of Figure 2.7 and is addressed in detail in Chapter Five. Relevant sub-questions include:

→ *How do perceptions of environmental change influence the operations of the BNPMA?*

→ *What anthropogenic factors are driving change within the organisation?*

→ *How does the BNPMA scan its environment and gather data on its diverse drivers of change?*

→ *To what extent is it possible to assess the relative importance of, and links between, the BNPMA's drivers of change?*

2. **What are the main factors that facilitate and constrain the adaptive capacity of the BNPMA?**

This question is centrally concerned with the factors that facilitate and constrain organisational adaptive capacity. Addressing this question necessitates the appraisal of internal factors as well as those situated in the wider organisational environment, in order to assess the degree to which those factors commonly cited in the climate change literature are relevant and applicable in this case. This question is examined in detail in Chapter Six, building upon the adaptive capacity sections of framework presented below. Sub-questions include:

→ *What is the role of internal factors such as organisational culture in determining the adaptive capacity of the BNPMA?*

→ *What is the role of external factors such as institutional context in determining the adaptive capacity of the BNPMA?*

3. **To what degree does the organisational learning schema fit with the observed activities, routines and procedures of the BNPMA?**

The focus of the seventh chapter of this thesis is the final key question of this research which examines how learning takes place within the BNPMA. This question addresses the internal section of Figure 2.7 which represents the BNPMA's internal decision-making and learning processes. Key sub-questions to elucidate these issues include:

→ *How, if at all, does learning take place within the BNPMA?*

→ *To what extent can the BNPMA be considered a learning organisation?*

→ *What is the relationship between learning, adaptive capacity and adaptive management in the BNPMA?*

2.5.1 Conceptual Framework

In order to guide the development of research design, to help prioritise the key ideas and themes discussed above, and above all to provide a basis through which to collect and analyse research data, it is important to construct a conceptual framework. To that end Figure 2.7 provides a means of ordering the diverse concepts and processes involved in organisational adaptation to climate change. Building upon the literature discussed throughout this chapter Figure 2.7 integrates: conceptualisations of adaptive management approaches to conservation, components of adaptive capacity, drivers of organisational change, organisational sense-making, and organisational learning (Figures 2.1-2.6 respectively). Whilst this process has necessarily involved a degree of simplification to enable an appropriate level of generalisation to be attained, and whilst this study is aiming to produce specific rather than universal findings, the conceptual foundations upon which it is based mean that this framework could be relevant to similar contexts, or amended and developed for use in other distinct settings.

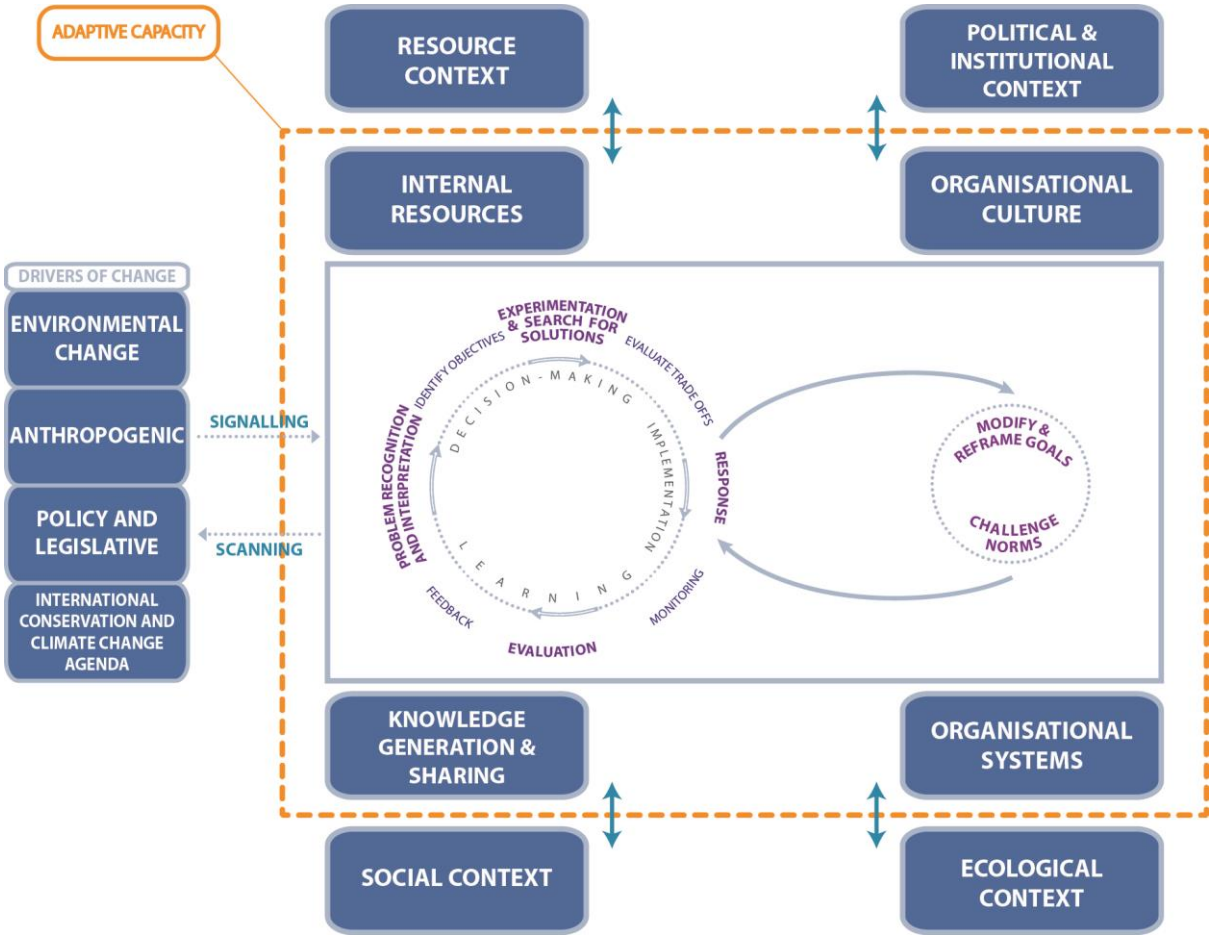

Figure 2.0.7 Final conceptual framework for analysing organisational adaptation to climate change, developed primarily from Berkhout et al. 2004 p14, and Pahl-Wostl 2009 p9, and integrating Figures 2.1-2.6.

This chapter has introduced the rationale underpinning this study, the diverse body of literature upon which it builds, and the conceptual framework and questions through which it aims to address identified research gaps. The following chapter outlines the methodology through which these questions are addressed.

Chapter 3 – Methodology

3.1 Introduction

In simple terms a methodology is the broad approach taken to the collection and analysis of data. More specifically a research methodology incorporates the tools, techniques and procedures used to collect and analyse data and generate knowledge, as well as the underlying reasons for employing these actions to test or generate theory (Schensul 2008). As such a methodology can be seen as the lynchpin between the theory and concepts underpinning a research project and the data obtained, enabling researchers to operationalise their chosen theories and connect them to their data. The importance of methodological choice therefore rests on the fact that the selection of a particular methodology has implications for the methods and form of the research that is undertaken, the theory upon which it is founded and the results obtained, as well as associated claims to generalisability.

In this chapter I present the research methodology of this study beginning with a discussion of the research philosophy underpinning this work and the implications of this for study design. The rationale for adopting a mixed-methods case study approach is then presented and the consequences of doing so for the wider applicability of results considered. The research methods used to gather data are then discussed, the links between these diverse data sources outlined and the means of data analysis introduced. Potential limitations to this research are then highlighted and important ethical considerations pertaining to this research discussed. The chapter concludes with a reflection on the overall research methodology, arguing that despite the limitations associated with each individual research method employed, the adoption of a methodologically pluralist approach has ensured that data gathered to address the key research questions of this study is defendable and of high quality.

3.2 Research Philosophy

When conducting academic research it is important to be explicit and open about the way that one views social reality and the historical, cultural and philosophical backgrounds which inform that view; to be consistent about how one believes the world is and the means through which one can come to know the world. Studies of organisational change are characterised by two fundamentally different ontological perspectives, distinguished by their distinct beliefs in the essential nature of organisations. A modernist ontological

perspective acknowledges the importance of processes within organisations whilst characterising them as 'things' that can be described as variables (Van De Ven and Poole 2005). The contrary ontological view is what Hatch (1997) terms the 'Symbolic Interpretive' perspective. This ontological position considers organisations to be entirely composed of organisational processes and is closely allied to a constructivist ontology which asserts that the world cannot be viewed objectively, rather that it is socially constructed.

This research adopts a modernist ontological perspective which is useful when studying drivers of organisational change since it enables a focus on the attributes of the organisation in question, in this case the BNPMA, and aims to result in explanations of causality (Van De Ven and Poole 2005). Such approaches have become dominant in studies of organisational change as they allow change to be studied at multiple levels of analysis and enable a consideration of the influence of change in the wider context, on the organisation in question. The modernist perspective understands the organisational environment as lying outwith the organisation's boundaries, influencing "organisational outcomes by imposing constraints and demanding adaptation as the price of survival." (Hatch 1997 p63). This research is implicitly concerned with cause-and-effect relationships, with the mechanisms that drive and constrain organisational learning and adaptation to change, and the role of external context in influencing organisational behaviour. It is, therefore, intrinsically entwined with a modernist ontological perspective.

This distinct understanding of how the world is, is closely aligned with a specific epistemology; that is, how one can know the world and what constitutes 'legitimate' knowledge (Ramazanoglu and Holland 2002). Founded as it is upon a modernist ontological perspective with a focus on responses to environmental change, this research lends itself to a critical realist epistemology, also termed a process epistemology in this context (Van De Ven and Poole 2005). A pragmatic critical realist or process approach is appropriate in studies concerned with environmental change and the management of ecological resources since climatic and environmental change can be considered a real phenomenon which cannot be understood or addressed in isolation from of our own preconceived values, interpretations and biases.

In this study an interpretivist approach to organisational learning is adopted, consistent with this wider epistemological and ontological perspective. As discussed in Chapter 2 an

interpretivist conceptualisation of organisational change characterises organisations as social systems that process information received from their external environment to derive meaning from it (Daft and Weik 1984). Strategies are formalised and decisions made based upon these perceptions.

Whilst a proceduralist approach to organisational change focuses on changes in the routines and procedures that are operating within an organisation (Berkhout 2004), an interpretivist approach embraces the system's complexity, examining the role of external factors in driving organisational change.

The adoption of an interpretivist approach, therefore, necessarily influences the research methods selected and how they are employed. Methods that focus on elucidating the perceptions of key actors both within the BNPMA itself, and without, are therefore central to the methodology of the study, as are methods that examine the processes through which these perceptions are translated into actions. The following sections of this thesis discuss the research strategy and key research methods employed in this study, in more detail.

3.3 Research Strategy

Having established the ontological and epistemological perspectives upon which this study is founded, the following section of this paper briefly considers the relevance, advantages, and application of a mixed-methods case study approach. Subsequently I introduce the methods employed to gather the data needed to address my key research questions, as well as the procedures through which these data were analysed.

The selection of either a qualitative, quantitative or mixed-methods approach to address a research problem has clear implications for the types of methods employed, as well as significant epistemological implications. A quantitative approach tends to be associated with positivism, whilst a qualitative approach is commonly linked with an interpretist epistemological viewpoint (Bryman 2004). Coming from a critical realist process perspective, this chapter argues that a mixed-methods interdisciplinary approach, drawing on the well-documented strengths of qualitative and quantitative methodological approaches is appropriate in this case. Such an approach recognises the overriding

importance of ensuring the selection of the most appropriate research methods in order to gather the data required to effectively answer the research problem. Indeed as Van De Ven and Poole (2005) document, studies of organisational change adopting process epistemologies frequently employ mixed-methods case study approaches, as they are effective in facilitating the examination of the process of organisational change over time.

In order to address the key research questions of this study, a mixed-methods approach employing the most pertinent quantitative and qualitative methods is therefore employed. As Young (2011) observes, there is a pressing need to undertake research of environmental issues which combines both quantitative and qualitative approaches in order to ensure that measures of association are found and further, to reveal the causal mechanisms underlying these relationships. In the context of conservation, numerous authors (for example Heller and Zavaleta 2009), have similarly argued that the current bias of studies towards solely ecological science is failing to account for the obvious importance of social factors in determining conservation outcomes.

Within this broad strategy, this research adopts a case study approach as this is a powerful tool, well suited to providing an in-depth understanding of complex social and environmental interactions and causal links (Yin 2009). A case study approach makes use of both qualitative and quantitative methods, and data from a range of sources can be used to triangulate findings, leading to a more holistic understanding of the issues under investigation (Tellis 1997). The Bardia National Park, situated in the Western Lowlands of Nepal, is the focus of this case study; more specifically the BNPMA which is the key local organisation charged with managing the park. Officially gazetted in 1988 this IUCN Category II Protected Area plays host to a high number of endangered bird and mammal species, and is situated in an area which has been identified as being highly vulnerable to increasing climate variability and change (Ministry of Environment/GoN 2010). Local populations are heavily dependent upon natural resources for their subsistence but are prohibited from exploiting the natural resources available within the park (World Bank 2014). In addition to the BNPMA a number of conservation and development NGOs (such as WWF-Nepal) operate around the National Park (Allendorf et al. 2007). Whilst the focus study site for this research is the BNPMA, to adequately address the key research questions, as the next section of this chapter illustrates, it was necessary to examine

factors at a variety of scales. This entailed further research at the national level, as well as a consideration of international climate change and conservation treaties and agendas.

3.4 Methods of Data Collection

Within this frame of a mixed-methods case study approach, the overarching research question was addressed through an exploration of three key sub questions, each of which required its own specific yet overlapping and complimentary combination of research methods. In the following section of this chapter the distinct methods of data collection employed in this research are introduced and their various merits and relevance for this research considered. The means through which the associated data is analysed is also documented and the ethical dimensions and methodological limitations of this research presented.

3.4.1 Focus Groups

Focus group discussions are, in essence, semi-structured group interviews centred around a particular topic or issue. As such they are an effective research tool as they are centrally concerned with the views of stakeholders, enabling respondents to highlight the issues that *they* deem to be of greatest importance (Bryman 2004). Shortly after arriving in Bardiya an initial focus group was held, attended by two Senior Game Scouts and five Game Scouts, focused on the drivers of change facing the BNPMA and the factors that enable and constrain action. A second focus group was held at the conclusion of fieldwork, with five senior staff members of a Kathmandu-based NGO specialising in forest conservation issues in Nepal, to examine the wider applicability of the preliminary findings of this study.

For the park level, focus group respondents were selected both purposefully and opportunistically, with participants selected from those Game Scouts willing to remain behind following a two hour meeting. Since the majority of the BNPMA's Game Scouts are posted to remote stations within the core area of the park, this was judged to be the best opportunity and most efficient method of providing a forum in which to educe their opinions on new challenges facing the BNPMA and the factors enabling and constraining effective responses. This focus group lasted approximately one hour and was held in the grounds of the BNPMA's headquarters so as to attain a balance between familiarity and privacy and to create a safe and accepting environment to encourage participants to share and develop their opinions. The focus group session was introduced using a script outlining

the purpose of the session, the rules of conduct during the session and confidentiality and privacy guarantees (see Appendix 3.1). The session was led, in Nepali, by the researcher's assistant, with the researcher acting as observer, recording the unspoken interactions between participants such as impressions of body language, gestures and group dynamics. The focus group was recorded by the researcher and written up by the research assistant who then produced a translated transcript.

The second focus group was, for practical reasons, held in the offices of the NGO from which the respondents were drawn. The session was run following the same procedures and protocol as the earlier focus group, with the exception of the fact that this session was conducted in English. All of the participants were fluent in English, and as the session was recorded this enabled the researcher to record additional observations and interactions which were later added to a full transcript of the session.

The purpose of employing a focus group discussion at the start of this research project was to allow the park's Game Scouts to highlight, in their own words, the challenges facing their organisation and the aspects of their organisation which they believe help and hinder them in addressing these new challenges. Information gained from this focus group was used to inform semi-structured interview questions and the Likert questionnaire for park staff. In this way, all of the subsequent qualitative research tools employed in this research were guided by and conducted in consideration of the topics and issues deemed to be of greatest importance by the organisation's staff themselves.

The purpose of conducting a focus group at the end of the fieldwork component of this project was primarily to afford the researcher an opportunity to present his initial findings to a range of experts with a thorough knowledge of the situation in other national parks and conservation areas in Nepal. In doing so this stimulated a discussion which helped to shed light on the wider applicability of the drivers of change, components of adaptive capacity and learning processes found in the case of Bardiya.

Data from both focus groups was analysed using similar procedures. Audio recordings of each session were fully transcribed into QRS International's NVivo software and the researcher's observations added. In each case key concepts and thematic areas were identified and the transcripts of the focus group discussions coded accordingly,

transforming the dataset into a more manageable size. The coded data was then group into themes relating to aspects of each of the three key research questions of this study, to enable ideas and generalisations to be formed about these themes, and to highlight connections between these diverse concepts and ideas.

3.4.2 Likert Questionnaires

The second key research method employed in this research was a Likert questionnaire, a useful tool with which to capture information on the opinions and intensity of feeling that park staff have towards a range of aspects of their organisation, and to identify areas of (dis)agreement within this. Likert questionnaires are a valuable and effective tool in organisational research since they provide a straightforward and speedy means of eliciting information pertaining to staff attitudes, opinions and beliefs about various aspects of their organisation (Bryman 2005). Results attained through this method are deemed to be of sufficiently high validity and reliability as the use of homogeneous scales increases the likelihood that attitudes are being effectively measured (Burns 2000). In addition, responses are easily analysable by the researcher.

A Likert questionnaire was developed by the researcher drawing heavily on scholarship concerned with components of adaptive capacity (see Chapter Two for example IPCC 2001, Gupta et al. 2010, Tompkins et al. 2010, Wilby and Vaughan 2010) and a number of evaluation tools for organisations (Watkins and Marsick 1999, Botcheva et al. 2002, Strichman 2005, Preskill and Torres 2009). A five point Likert scale ranging from 1 (strongly disagree), to 5 (strongly agree) was developed, with respondents asked to select the option that they felt best fit the preceding statement. The questionnaire was divided into 13 sections by theme and a total of 65 questions in order to draw out information on all of the components of adaptive capacity identified from the wider literature (see Appendix 3.2).

The questionnaire was drafted in English and subsequently translated into Nepali by a translator based at a Nepali forestry focused think tank in Kathmandu. On reaching Bardiya the researcher engaged a local research assistant to undertake a back translation of the document in order to obtain an understanding of the quality of the translation despite the researcher's limited grasp of Nepali. This process highlighted a number of deficiencies in the original translation which the research assistant was able to correct, in discussion with

the researcher, based on his more comprehensive understanding of the research project and local context.

Post-translation the questionnaire was piloted on two members of park staff and it quickly became apparent that, particularly for those staff with limited levels of education, the questionnaire was not as self-explanatory as had been anticipated. Consequently the research assistant was tasked with administering these questionnaires on a one-on-one basis. Although this modified approach necessarily resulted in fewer questionnaires being completed, the quality of the data obtained was much higher than would otherwise have been the case. In total 25 questionnaires were completed by opportunistically selected staff holding diverse positions throughout the organisation ranging from the Chief Warden to elephant driver.

The responses received from these questionnaires provided information pertaining to all aspects of the organisation, ranging from opinions on the quality of the BNPMA's leadership, to the financial and human resource constraints being faced. In doing so it provided simply quantifiable information regarding the diverse components, both internal and external, of the organisation's adaptive capacity. Responses were analysed following the procedures outlined by Boone and Boone (2012). As a first step, individual Likert responses for each of the 65 questions were plotted as bar charts in Microsoft Excel. Responses were coded from 1-5 where 1 = strongly disagree and 5 = strongly agree. Negative questions, that is those that did not pose questions concerned with positive attributes of the BNPMA, were reverse coded. Descriptive statistics including median, mode, and the percentage of respondents who agree/disagree were calculated; for these individual Likert items the mean is not a valid test as the data is ordinal in nature (Bertram 2007).

Multiple questionnaire responses were then summed together, by category, to result in four broad categories and 14 subcategories of internal adaptive capacity and four categories of external adaptive capacity. The mode of the sum of all component responses for each of these categories and subcategories was then calculated to derive an overall response for each category ranging from strongly disagree (1) to strongly agree (5).

3.4.3 Social Network Analysis Questionnaire

In parallel to the Likert questionnaires discussed above, a social network questionnaire was administered to a number of park staff. As Prell et al. (2011) observe, in order to ensure that those who are affected by environmental decision-making processes have the ability to affect the management of these processes, it is first necessary to identify and locate the relevant stakeholders. Social network analysis is a useful method to achieve this within a defined system, in this case the BNPMA, as this tool enables the researcher to identify, measure and map interactions and knowledge sharing within an organisation and between that organisation and those within its external environment (Reed et al. 2009).

In order to obtain information regarding the BNPMA's key internal and external stakeholders, a questionnaire comprising three parts and eight questions was circulated to park staff (see Appendix 3.3). In addition to their name and job title, the questionnaire asked respondents to list: up to ten organisations with whom they have contact in their role at work as well as the frequency of contact, up to ten key individuals with whom they interact within their organisation and the frequency of contact, and up to ten key individuals with whom they discuss technical work related issues outside of their working day and the frequency of contact. A total of 23 complete responses were received.

This questionnaire aimed to identify the key actors operating within the management authority of the BNP as well as their influence and interactions with other individuals within their working and social spheres. Furthermore, it intended to illuminate the key organisations from the local to the national scale with which the BNPMA interacts in pursuit of its goals. The findings from this questionnaire enabled the researcher to identify the key stakeholders, both individuals and organisations, involved in or affected by conservation efforts in Bardiya, which were then followed up in more details through targeted semi-structured interviews.

As with the Likert data discussed above, the social network analysis questionnaire was initially translated into Nepali in Kathmandu and was subsequently back translated, edited and amended, by the Research Assistant in Bardiya. As this questionnaire was simpler and more succinct than the Likert questionnaire, the pilot test of two park staff members indicated that it was not necessary to administer this questionnaire in person.

Questionnaires were then circulated to all park staff and 23 responses received from staff in all sections of the organisation.

Social network analysis responses were uploaded to Gephi, an open source software package which can be used to map social connections to uncover patterns, groupings and interactions in SNA responses. Names of personnel or organisations (referred to as nodes) and their reported relationships (edges) were inputted into Gephi which uses forced based algorithms to position linked nodes closer together whilst repelling none-linked nodes. Using an average path length algorithm the programme can then calculate betweenness centrality to identify the relative influence of individuals within the network. A modularity class value can then be generated to identify specific communities of participants.

Ultimately having undertaken this process for the SNA data obtained through these questionnaires, the decision was taken to exclude this data from the analysis of this study as it was felt to add little tangible value. Although the outputs from this process were visually impressive, the algorithms used to obtain statistics such as betweenness centrality were not entirely transparent, and the questionnaires only given to park staff, meaning that a full SNA including the opinions of none-park staff was not possible. Nevertheless this questionnaire and means of data analysis remained a useful tool for identifying the mean number of contacts and the mean frequency of contact of park staff in different sections of the organisation. The key organisations and individuals involved in the conservation of the BNPMA, identified through this process, were then followed up through semi-structured interviews.

3.4.4 Semi-Structured Interviews

Interviews are a useful, effective and flexible tool for conducting case study research. Semi-structured interviews utilise a list of questions on specific topics whilst remaining flexible in terms of the order in which they are asked, allowing the addition and removal of questions as the interview progresses (Bryman 2008). This type of interview has the added benefit of ensuring that interviewees feel comfortable and at ease, and are, therefore, more likely to provide honest and in depth responses than they otherwise might (ibid.). As such, in depth semi-structured interviews have a clear focus whilst retaining a degree of flexibility to ensure that any new, additional, or complimentary issues that come to light can be fully

considered. They therefore work to empower respondents by encouraging them to raise the issues that are of greatest importance to them (Rapley 2001).

In this study a total of 41 interviews were conducted with a range of stakeholders at the national and local levels. Respondents included BNPMA staff (n=9), buffer zone stakeholders and conservation partners (n=15), and national level stakeholders including NGOs, bilateral donors and government departments (n=17). Respondents at the local levels were primarily chosen through an analysis of SNA questionnaire responses which highlighted key individuals within the organisation, and buffer zone stakeholders playing a significant role in the conservation of the BNP. Interviewees at the national level were selected by employing a snowball, chain of referral, sampling technique in which respondents referred the researcher to other potentially relevant organisations and stakeholders.

Interviews were conducted using an interview guide (see Appendix 3.4) with questions moving from the general to the specific. In line with best practice, questions were neutral rather than leading and respondents were encouraged to talk freely; oral interventions from the researcher were kept to a minimum (Rapley 2001). Interviews lasted from 45 to 90 minutes and all respondents were given the option of having a translator present, however this offer was only taken up on nine occasions. The researcher enquired about the possibility of recording each interview, 26 respondents were happy to be recorded and on the 15 occasions the respondent declined, the researcher took extensive notes. Those respondents who were not happy to be recorded tended to be those in more junior positions and regularly cited their organisation's policy as the reason for eschewing the recording. These more junior respondents were also more likely to require a translator.

Interviews held at the park level enabled the researcher to obtain detailed information regarding the structure and operations of the BNPMA and other stakeholder organisations, as well as more in depth information pertaining to the organisation's drivers of change highlighted through the Game Scouts Focus Group. Responses also presented a more detailed account of the internal and external determinants of the BNPMA's adaptive capacity, as well as details of a number of past events to which the BNPMA was compelled to respond. At the national level interviews naturally had a greater focus on conservation and climate change activities in the international and national spheres and the mechanisms

through which such initiatives feed down to the local level. Questions of organisational and institutional structure added further detail to the situation at the national level and the factors working in this arena to enable and constrain local level action. The use of semi-structured interviews in this way, allowed detailed information to be gathered in a none intrusive way whilst enabling respondents to highlight, in their own words, the issues of greatest importance to them.

Interview responses were transcribed verbatim into NVivo, whilst for those which were not recorded comprehensive notes were added. Transcripts were then coded into thematic groups to link the raw data to the theoretical concepts discussed in the previous chapter, and to bring meaning to the respondent's words (Taylor-Powell and Renner 2003). Initially, in this key stage of analysis, broad categories were assigned to excerpts from the text to highlight the location of these overarching themes and to stimulate the process of reflection (Coffey and Atkinson 1996). A second level of coding was then created focused on more detailed subcategories, inspired by the respondent's own words. The creation of these codes and an examination of the connections and relationships between them enabled these data to feed back into the conceptual framework presented in the previous chapter. In addition it facilitated a more comprehensive understanding of the key drivers of change, components of adaptive capacity, and learning processes of the BNPMA.

3.4.5 Community Level Surveys

Unlike semi-structured interviews, questionnaire surveys ensure that each respondent is asked exactly the same questions in exactly the same order, enhancing the ease with which questions can be asked and responses recorded and processed. A focus on standardised closed-ended questions within this approach enables comparisons to be made between individuals and groups as well as cautious generalisations to be made about the defined population (Burns 2000). Such survey approaches to research have become increasingly common in studies of climate change since they enable the knowledge and perceptions of local residents relating climatic changes to be garnered and aggregated (for example Manandhar et al. 2011, Ban et al. 2013).

In this study questionnaire surveys were used to assess local resident's perceptions of climate change. Since livelihood strategies around the BNP are heavily dependent upon agriculture, local resident perceptions of climate change were deemed likely to provide a

reliable indication of climatic trends in the region which could then be analysed in conjunction with recorded values (Osbahr et al. 2011). Questionnaires administered to this end were short and succinct comprising questions concerning the respondent's age, occupation, perception of trends in rainfall, temperature and seasonality, and community impacts and responses to any observed changes (see Appendix 3.5). Only respondents over 30 who had been living around the BNP for at least 15 years were targeted. Initially the survey was piloted on two individuals and based on their responses modifications were made to allow for differences between the UK and Nepali calendar; questions were reframed to compare 'the recent past' with 'a long time ago' rather than the original numerically defined time periods which were found to confuse pilot test respondents.

Four key geographical areas were targeted for these surveys (see Figure 3.1) including to the West of the Geruwa River where water and forest resources are particularly scarce, to the south of the park close to the location of the headquarters of the BNPMA, to the North of the park at Chisapani, also the location of a station recording weather data, and to a village to the south of park headquarters which has been a recipient of significant financing and education programmes in recent years from WWF-Nepal. Within these broad areas villages were chosen at random with respondents selected opportunistically on the basis of who was present in the village at the time of survey. Surveys were undertaken during the wet season when the demands of agricultural labour are less severe, to increase the likelihood of villagers involved in agricultural work being present. Questionnaires in Manau were administered by the research assistant under the supervision of the researcher, with subsequent surveys being conducted by the research assistant alone. In total 86 responses were elicited from Dalla (n=25), Bethani (n=25), Chisapani (n=24) and Manau (n=12).

The translated data were transcribed into NVivo, and responses coded and categorised. This data was then added into Excel, given numerical values and analysed using simple descriptive statistics to derive the proportion of respondents who support a range of statements. Opinions regarding changes in annual and seasonal rainfall and temperature patterns, changes in the timing of seasons, observed climate impacts, and sources of support and information relating to climate change, were all quantified in this way.

Figure 3.1: A map showing the location of community based survey sites and weather stations around the BNP.

3.4.6 Hydro-meteorological Data

In order to identify recent climatic trends, hydro-meteorological data was obtained in the execution of this research and examined in conjunction with local perceptions of climate change. Meteorological and river discharge data collected over time represents a unique and valuable secondary source of data which provides information which would otherwise have been beyond the financial and temporal scope of this study. Such records are useful in allowing the researcher to describe the data, and also in enabling statistical tests to be employed to examine trends in temperature, precipitation and riverflow over time. Although initially only meteorological data was deemed of relevance to this study, as fieldwork progressed river discharge data was obtained as interview and survey respondents highlighted the important role of falling river levels in driving change within the BNPMA.

River discharge, rainfall and temperature data was requested from the Department of Hydrology and Meteorology in Kathmandu and the following was received: mean daily discharge of the Karnali River at Chisapani from 1962-2008 in m^3/second; daily rainfall data in mm at Chisapani from 1963-2010 and daily maximum and minimum temperatures measured in ˚C between 1965 and 2011 at the same location; daily rainfall data in mm recorded at Rani Jaruwa Nursery between 1976 and 2011, and daily maximum and minimum temperatures measured over the same time period. Figure 3.1, above, shows the exact location of these sites in relation to the BNP. Meteorological stations were selected on the basis of their proximity to the BNP and the length of the climatological record recorded at each location. On this basis data from weather stations at Tikapur and Guluria were not included, given their distance from the park and the fact that continuous data for the sites only covered the very recent past.

As Kundzewicz and Robson (2004) document, the necessary first step in analysing data of this type is to consider the form of the data and to transform it into a form appropriate to the aims of the study. Standard procedures in hydro-meteorological data analysis were therefore followed (Linacre 1992). Where less than 20 values were present in any one month the monthly mean temperature or total monthly precipitation were recorded as missing based on the recommendation of an expert climatologist from the Climatic Research Unit at UEA (pers. comm. Dr Craig Wallace). For total precipitation, available

values were summed to obtain total monthly precipitation, as this was judged to be an acceptable level of precision, preferable to the infilling of missing months with mean values for that month obtained from all other years for which data was present (ibid.). For river discharge the dataset was much more complete with missing values only recorded in 1984.

To analyse the climate data the following were calculated and plotted in graph form using Microsoft Excel: mean annual temperature; mean monthly maximum and minimum temperatures; mean seasonal maximum and minimum temperatures; total annual precipitation; total monthly precipitation; number of wet days per year; and total seasonal precipitation. For riverflow, mean annual discharge was similarly calculated and plotted. Data were then quality controlled through the visual examination of data plots to identify any outliers or anomalies indicative of problems commonly associated with hydro-meteorological datasets such as typographical errors, changes in measurement practices, thresholds, the location of instruments, or instrument problems (WMO 2011). On this basis the decision was taken to discount 2010 readings from Chisapani for total annual rainfall, total seasonal rainfall, and Monsoon rainfall. An apparent step change in mean number of wet days (NWD[3]) per year was also further investigated through the calculation of mean NWD/month for 1992 and 1993 to examine the monthly changes between these years to give an indication of whether observed changes could be the result of changing thresholds for NWD or whether perhaps they were representative of wider climatic changes.

Having tidied and visually assessed the hydro-meteorological datasets, trends in the data were analysed, initially through the application of a simple linear regression according to the equation Y = $mX + b$ (Kundzewicz and Robson 2004). M equals the gradient of the slope and therefore represents the amount by which the slope is increasing or decreasing every year; if m is positive the trend is increasing, if m is negative so is the trend. The correlation coefficient, 'r', measures the strength and direction of the relationship between time and temperature, riverflow, or precipitation, with r values ranging from +1 (direct relationship) to 0 (no relationship) to -1 (perfect inverse relationship) (Helsel and Hirsch 2002). R^2, the coefficient of determination, provides information on how well the linear regression line fits the data documenting the percentage variation in temperature, riverflow or precipitation that can be explained by variation in time (Burns 2000). What

[3] Defined as any day in which precipitation of 1mm or greater was recorded following WMO (2007).

such simple linear regression does not do, however, is account for seasonality within the data.

Hydro-meteorological data were then subject to the Mann-Kendall trend test. The Mann-Kendall test is a rank based none-parametric test which is commonly used to examine monotonic climatic and hydrological trends, both to detect trends and to determine their significance (Government of Australia 2009, Zeleňáková et al. 2012). Importantly this test does not require data to be normally distributed and it has also been shown to be insensitive, "to abrupt breaks due to inhomogeneous time series," (Drapela and Drapelova 2011 p 136). The null hypothesis (H_o) assessed by this test is that the data is independent and randomly ordered, that no trend is present. The Mann-Kendall Test Statistic is calculated using the following equation:

$$S = \sum_{i=1}^{n-1} \sum_{j=i-1}^{n} Sgn(X_j - X_i)$$

where X_i and X_j are the sequential data values, n is the dataset record length, and

$$Sgn(\theta) = \begin{cases} +1 & \\ 0 & if \\ -1 & \end{cases} \begin{matrix} \theta > 1 \\ \theta = 1 \\ \theta < 1 \end{matrix}$$

(Burn and Elnur 2002 p109).

In this test, each variable reading (temperature, riverflow or precipitation) is compared to all subsequent data values. Where a subsequent data value is higher 1 is added to S; where it is lower 1 is subtracted from S (Chandler and Scott 2011, Drapela and Drapelova 2011). Therefore where S is positive the trend in the data is positive; where S is negative the opposite is true.

Hirsch et al. (1982) first proposed a variation of the Mann-Kendall Trend Test to account for the impact of seasonality in datasets, termed the Seasonal Kendall Test. As with the former, the Seasonal Kendall Test does not make distributional assumptions about the data and it can be used where there is missing data. Unlike the Mann-Kendall Test the Seasonal Kendall Test only compares like months and comparisons are not made across seasons. As

Githui et al. (2010 p.2) observe the Seasonal Kendall Test accounts for seasonality by, "computing the Mann-Kendall Test on each of m seasons (m represents months) separately and then combining the results."

In this study the Mann-Kendall Test was used to assess the presence and significance of trends over time periods where seasonality was not an issue such as with mean annual precipitation and the mean temperatures of specific seasons. The Seasonal Kendall Test, on the other hand, was used to test for the presence of monthly trends. All calculations were computed using Addinsoft's xlstat software for Microsoft Excel which also calculated P values for each test. P values measure the statistical significance of trends and this was assessed in each case in order to confirm which observed trends are a result of more than just random variability. Following Klein Tank et al. (2009) a 5% confidence interval was selected to indicate strong confidence in an observed trend not merely being down to random variability, whilst a 1% interval was taken to indicate very strong confidence in the existence of a trend distinguishable from random variability.

3.4.7 Document Analysis

Document analysis refers to the examination of a heterogeneous range of data sources including official state documents, internal organisational documents, both official and unofficial, as well as media documents such as newspaper articles. Such secondary sources of data can form an important part of a research strategy as they allow the researcher access to a wide range of often detailed and topic specific information over a range of timescales. As Bryman (2008 p.522) observes, the examination of official documents from private sources including internal organisational policy and strategy documents, "can be very important for researchers conducting case studies of organisations using such methods as participant observation or… qualitative interviews."

In this study document selection was predominantly guided by information gained through the semi-structured interviews, as this enabled the researcher to select the policy documents of most relevance to the study, as well as those which although not directly related to the operations of the BNPMA nevertheless exerted an important influence upon it. Internal policy documents were also relied upon to shed light upon the official policies and working practices of the BNPMA. Documents were obtained through the BNPMA's Chief Warden and included annual reports, planning and strategy documents, unpublished

presentations, research documents and organisational charts. The analysis of these official and unofficial internal documents allowed the researcher to gain a fuller understanding of the organisation, its processes and procedures, and the means through which it operates, monitors progress, and measures success. The majority of these documents were available in English; where they were not, translations were carried out by the researcher's assistant.

Newspaper articles, widely available through online editions of English language Nepali newspapers, also proved a useful tool of this research. Whilst such sources may be susceptible to the partiality of the author, they have the advantage of providing up-to-date coverage of current events and breaking news, as well as providing day to day coverage of the development of past events through back issues. This is of particular relevance to the political context of this study, a complex and dynamic setting in which numerous key events and important developments occurred during the researcher's time in the field.

Whilst these diverse documentary sources have the advantage of being clear and comprehensible, providing detailed information of central relevance to this study, the information contained within them is necessarily understood in the context of those who commissioned or prepared each of the documents, for what purpose. As such these documents were critically viewed as representing the 'official party line' of the Nepali Government, the BNPMA itself, or the organisation which was responsible for its production. Close attention was therefore paid to observed differences between these documented policies, procedures and events, and how these were observed to play out in practice.

3.4.8 Observation

In its simplest form observation as a research tool simply entails the unstructured observation of events, situations, and behaviours by the researcher and the documenting of this data in a field diary (Burns 2000). The key benefit of using observation as a research tool is that it enables the researcher to directly observe behaviour and to record this behaviour as it occurs (Bryman 2008). Observation can, therefore, be used to verify the data collected from other sources such as interviews, where subjects are self-reporting their behaviour, or official documents from private sources that report upon the systems, procedures and policies employed by an organisation.

As part of this fieldwork the researcher was afforded the opportunity to attend a wide range of internal meetings and training sessions run by the BNPMA and its conservation partners for park staff. Most important amongst the numerous sessions attended were the two monthly Game Scout meetings at which the researcher was present. Attended by all of the BNPMA's Game Scouts and Senior Game Scouts, these meetings provided field staff with a forum in which to air issues and challenges faced in the execution of their duties. As with all of the meetings and training sessions attended, the researcher was accompanied by the Research Assistant who translated proceedings and took minutes whilst the researcher recorded observations in a field diary. Day-to-day observations including details of incidents of human-wildlife conflict, political demonstrations, and interactions between park staff and buffer zone residents, were recorded in similar fashion.

Similarly the researcher's experiences and observations of a number of local fieldtrips were recorded in a field diary. During the six months the researcher spent in the field a number of communities around the park were visited, including a four day walking trip to the remote Northern Sector of the park's buffer zone, inaccessible by road, and numerous visits into the core area of the park, including trips with park staff and their conservation partners. The researcher also attended local events and recorded observations, including the nationally renowned Community Based Anti-Poaching Day, organised by WWF and attended by senior conservation figures, film stars and Miss Nepal.

All of the observations and experiences recorded in the researcher's field diary were transcribed into NVivo and analysed according to the same protocol followed for the interview and focus group transcripts described above.

3.5 Ethical Considerations

Having examined the data collection tools employed in this study, the following section presents an analysis of the ethical dimensions of this research, a key factor in any research project. Fundamental ethical considerations pertaining to this research are predominantly centred on mitigating the risks associated with two key aspects of the study, the process of data gathering and the dissemination of research findings.

In relation to the process through which this research was conducted, obtaining ex ante informed consent from all participants, as well as ensuring the protection of their identity,

were key steps taken to mitigate the risks to those involved. All participants were fully briefed on the background to and purpose of this study and were offered the option of signing a consent form prior to the commencement of interviews and focus group meetings (see Appendix 3.6). The consent form was translated into Nepali and in cases where participants were illiterate, consent was obtained verbally. Verbal consent was also acquired in situations where participants were reluctant to sign forms and were more comfortable providing verbal agreement. In the event, this was by far the most common outcome of the consent process. All participants were asked whether audio recordings could be taken of interviews and focus groups. Consent was granted by all participants of the focus groups and, as mentioned, the majority of respondents agreed to having their interviews recorded. Where such consent was not granted, all participants provided consent for extensive notes to be taken by hand.

Participants in this research were asked to discuss issues concerning the day-to-day running of the BNP, about their relationships with other members of staff and organisations, and the activities that take place within their organisation, both those that are officially sanctioned and those that are not. Similarly research notes and observations recorded in the researcher's field diary had the potential to compromise the position of individuals within their workplace and their wider social standing. Where such methods involved the discussion of information that was not widely known, ethical considerations were of paramount importance in avoiding potentially serious consequences for these individuals and the organisations for which they work. To this end the research assistant was comprehensively briefed on the importance of ensuring confidentiality at all times, and was made fully aware of the reasons for this and the need to respect the anonymity and confidentiality of all participants. Similarly careful consideration was required in relation to the location of interviews and focus groups, to ensure that they took place in a private place in which respondents felt at ease, and discussions could not be overheard. Often, the most appropriate venue was a quiet spot in the grounds of BNPMA headquarters or an office or meeting room at the participant's place of work.

Anonymity is also clearly a pertinent consideration in relation to the dissemination of research findings. Research is a political activity which serves particular interests and consequently how, and to whom, research findings are disseminated becomes an important ethical consideration (Jeanrenaud 1998). A copy of this thesis will be made

available to park staff in fulfilment of the researcher's obligation outlined in the MoFSC's letter of permission to undertake research, and all participants were made aware of this and the fact that academic papers resulting from this research may be published at a later date. Consequently, ensuring the anonymity of participants in this research was an imperative; only the researcher has had access to the full record of unanonymised data. Qualitative data was anonymised as it was entered into NVivo, and names on original paper based notes and records redacted at that point. Alphanumeric codes were used to anonymise data and the research assistant was briefed and trained in this process of coding.

In order to ensure consistency during data collection, and also to minimize the risk of breaches of confidentiality, the intention was for the services of a single research assistant and translator to be secured for the duration of this study. In practice this was not possible as the translator recruited for the initial Game Scout Focus group was subsequently unavailable to assist with the interviews and surveys. To minimise the disruption and discontinuity caused by this, the researcher ensured that adequate training was given to his replacement during a handover period.

3.6 Limitations

In order to ensure the quality and integrity of this research it was essential to minimise the potentially detrimental impact of the multitude of pitfalls and limitations commonly associated with the chosen research tools. Indeed some authors take issue with the application of a case study method itself arguing that such an approach fails to produce generalizable findings, and that conclusions are not representative of the conditions and experiences of all cases. As Burns (2000) observes, an additional limitation of such an approach to research is the volume of data produced, which may lead to a greater likelihood of researcher selectivity and the biases associated with this. However as the purpose of case study research is to expand theories rather than to undertake generalisations, I would argue that such a study does not need to arrive at generalizable findings. Furthermore such an approach should facilitate the reader's own analysis and judgement about what they can take from it to apply to their own case or more widely (Burns 2000, Thapa 2008).

In addition to these perceived disadvantages of a case study approach, are the plethora of well-documented methodological limitations and sources of analytical bias associated with the assorted tools of qualitative research. Some authors, for example, argue that Likert questionnaires are of limited use as respondents have a tendency to misrepresent themselves and their organisations in a bid to portray them in a favourable light, a phenomenon termed 'social desirability bias,' (Moorman and Podsakoff 1992). Semi-structured interviews, on the other hand, are often criticised for their reliance on a limited sample size, whilst focus groups can suffer from group effects where the voices of some participants are lost, and where emerging group opinions can suppress individual ones (Bryman 2008). Surveys of climate change perceptions are vulnerable to the variable recall of respondents and questions surrounding what constitutes normal in terms of temperatures and levels of precipitation (Osbahr et al. 2011). Furthermore, the data derived from observation as a research tool is limited by the finite ability of the researcher to attend meetings leaving them able to observe a mere snapshot of the activities and interactions taking place within an organisation (ibid.). Document analysis on the other hand is constrained by the representativeness of the texts selected (Sullivan and Brockington 2004), whilst the effectiveness of surveys and questionnaires can be limited by their inflexibility and the difficulties associated with following up responses (Nyanga et al. 2011).

Whilst appropriate steps have been taken to minimise the impacts of the widely documented failings of these research methods through their judicious and cautious application, there are a number of additional methodological constraints of particular relevance of this study. As Roulson et al. (2003) argue, methods such as semi-structured interviews and focus groups represent sites where meaning is jointly constructed and the researcher's own beliefs, subjectivities and assumptions therefore necessarily impact upon how questions are formulated and posed, and on how responses are received.

In order to minimise the deleterious impact of this subjectivity on the overall quality of the research, a process of self-reflexivity involving the continual re-evaluation of the researcher's own positionality, values and biases and the impact that these may have had upon the study, has been applied throughout. This process involves self-examination, by the researcher, of their own position as an objective researcher, an acknowledgement of ones own biases and a consideration of how these may have impacted upon the research

and its findings (Hollway and Jefferson 2000). In terms of the former and how this may impact upon the information that the researcher was able to obtain, it was vital to consider how one might be perceived by those participating in this research. In some circumstances, particularly when interacting with impoverished local communities where the researcher may have been seen as being a rich, well-educated, white researcher from the UK, the researcher is in a position of relative power. In such circumstances it was important to be tactful and to clearly convey the value that was being placed on the respondent's thoughts, opinions, and responses. On other occasions the opposite was undoubtedly true. This was particularly the case when interviewing older more experienced stakeholders with senior positions in government or the BNPMA. In such cases the researcher had to work hard to pique and maintain the interest of these individuals to ensure their full engagement in the research.

In a similar vein the cultural, social, and gender-based characteristics of participants, whilst not the main focus of this research, were nonetheless an important consideration. In conducting this research it was important to be aware that not all female respondents would necessarily be willing to be interviewed by a male researcher. Equally, prior to conducting this research it was thought that issues of caste may affect the conduct of the research in that, in certain circumstances, members of one caste might be unwilling to openly discuss their opinions in the presence of individuals from other castes (either within the focus groups or in relation to the research assistant). In the event such encounters were approached tactfully and these issues did not arise.

Also of specific relevance to this study, was the more intractable issue of translation, both orally and of documents. The availability of English language versions of policy and organisational documents had the potential to exacerbate any bias that existed in the selection of documents, leading the researcher to focus on those published or translated into English, and likely to therefore be more mainstream documents, perhaps more representative of the hegemonic voice. Every effort was made to avoid falling into this trap, and all documents that were only published in Nepali that were made available to the researcher had, as a minimum, their titles translated by the research assistant to enable the researcher to assess their relevance.

In the execution of interviews and focus groups a translator was also required. These research assistants were fully briefed on the purpose of the research, the methods, and aims, were well acquainted with the local area whilst not being affiliated to any of the organisations examined in this study. In addition they were fluent in Nepali, Tharu, and English, and had previous experience of working on conservation and development projects in the region. Despite this, the very need to employ a translator created the potential for losing the nuances of language through the process of translation. The issues surrounding the translation of the questionnaires employed in this research, discussed earlier, serves as a useful case in point.

In addition to these limitations associated with the collection and analysis of qualitative data, a number of limitations exist in relation to the climate data that forms a central strand of this research. The first key issue, touched on earlier in this chapter, is that of the quality of the dataset itself. The data received from the DoMH included a temporally limited record of readings, missing data, and, for some years, data appeared to be of questionable quality. The process of tidying the data and deciding how to deal with missing values, will inevitably have impacted upon the results obtained. Whilst these issues have, to some extent, been mitigated by the additional inclusion of data on local perceptions of climate change, as Conway (2011) notes, it is difficult to integrate perceptions data with climate data and doing so throws up additional uncertainties.

Further hurdles exist in the analysis of these data. Chandler and Scott (2011) note that when analysing climate data, recent readings can skew overall trends. For example, if recent years have been extremely hot these observations should be omitted from the trend test as, “any random sequence will occasionally produce clusters of high values, and to test for trends only after observing such a cluster will naturally bias the results,” (ibid. p57). Such analysis also depends upon the assumption that data are, at some level, an independent random sample. However trend analysis relies on time series data and it is possible that successive observations in the time series will not be independent, (for example if one day is very hot then it is likely that the next one will also be above average). This dependence between successive observations (or auto correlation) where high values cluster together can sometimes mistakenly be identified as a trend. In examining temperature, rainfall, and riverflow trends over annual and monthly rather than daily timescales, the potential interference of this phenomenon has been minimised.

The issues and limitations outlined above are common to all research projects employing these methods and are not exclusive to this study. I believe, however, that the iterative and flexible application of a mixed-methods approach employed in this study, characterised as it is by methodological pluralism, has undoubtedly helped to overcome the limitations associated with a reliance on a single method and dataset. Triangulating data sources in this way, that is using a toolkit of complimentary sources that have different strengths, has helped to reinforce the validity of the findings of this study, demonstrating that a range of independent methods corroborate findings or, at the very least, do not contradict them.

3.7 Conclusions

In this chapter I have introduced the methodology employed in this this research to collect and analyse the data required to address the key research questions of this study. The modernist ontology, which sits at the heart of this study, facilitates a focus on the characteristics of the BNPMA, and is complimented by the adoption of a pragmatic critical realist epistemology so effective in studies of environmental change. The mixed-methods case study approach employed by this project has involved the application of a diverse range of quantitative and qualitative techniques of data collection and analysis, enabling a broad range of information to be gathered and findings to be triangulated between sources to strengthen validity.

All possible precautions have been taken to ensure the effective application of these methods, and their limitations have been identified and, where possible, addressed. Ethical considerations which represent a particularly important consideration in studies based in developing countries have been addressed prior to the commencement of fieldwork, and have been reassessed and evaluated throughout the data gathering, analysis and writing up process. The consistency and complementarity between these methods, and between them and the philosophical and ethical considerations underpinning this study, has ensured that the data collected to address the key questions of this study is robust, replicable, defendable, and of high quality.

4. Case Study Context

4.1 Introduction

This chapter uses secondary sources of literature including government publications and internal park documents to set out the context within which the BNPMA operates. In doing so it provides a platform from which to analyse organisational change, consider the relative importance of components of adaptive capacity, and examine processes of organisational learning in the BNPMA. Where possible, non-governmental sources of literature have also been used to corroborate or refute the claims of these official government documents.

The chapter begins by introducing the natural environment of the BNP, including its location and geographical features, the key species of fauna and flora that it protects and the key climatic characteristics of the region. The process of park formation and the wider social, political and legislative changes that helped to shape this process are then discussed. Subsequently the park's management authority is examined in detail through a discussion of the organisation's stated goal, the documented systems through which decision-making, planning, and monitoring and evaluation take place, its official structure and the human and financial resource capacities that the organisation has available in pursuit of its aims.

The third section of this chapter considers the wider organisational context within which the BNPMA operates. It begins by analysing the influence of national level actors on local level activities, before examining the role of key conservation partners and local civil society organisations in supporting the operations of the park management authority. The structure and significance of the organisations involved in Buffer zone management is also discussed. The chapter concludes with a consideration of the importance of this wider contextual information to the research questions at the heart of this study.

4.2 The Bardiya National Park

4.2.1 Natural Environment

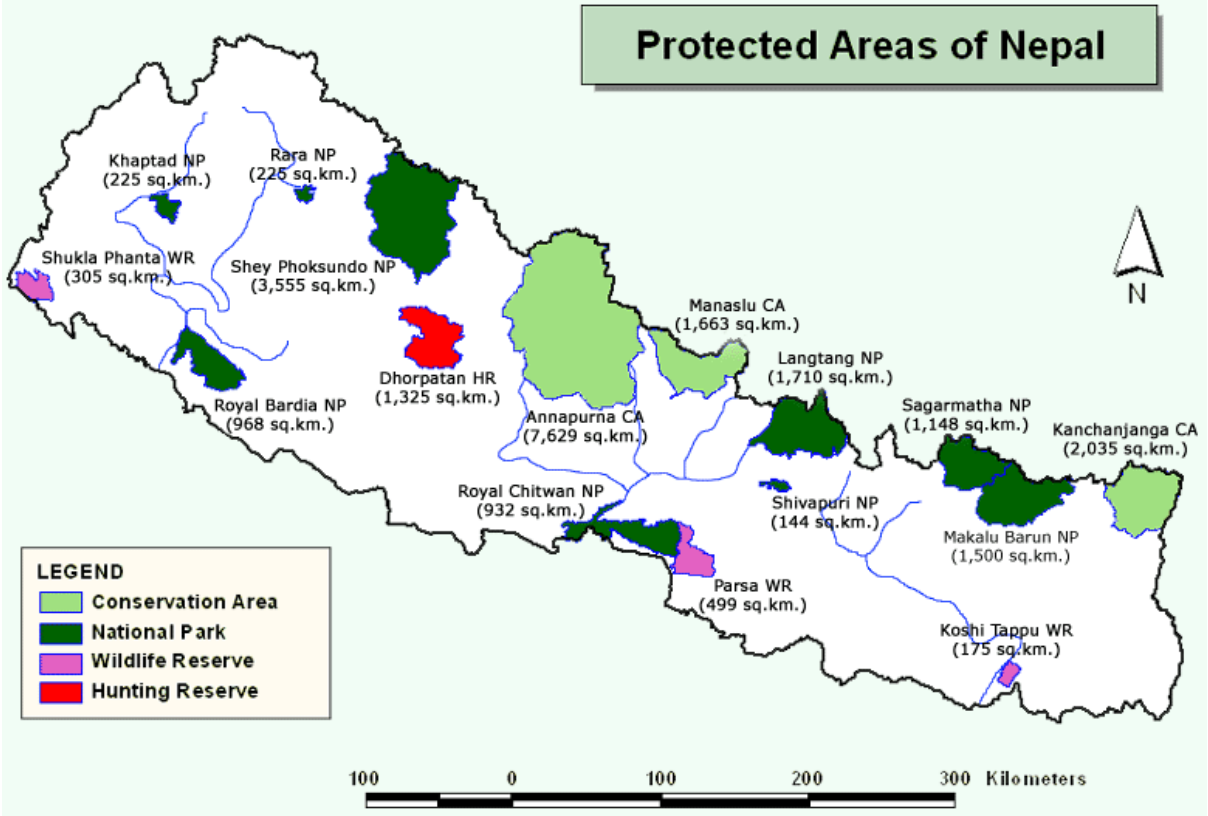

Figure 4.0.1 The Location of BNP at 28°15'-28°40' N, 81°15'-81° 40' E (TAL 2011, Adhikari 2012).

The Bardiya National Park, the largest of Nepal's lowland national parks, is an IUCN Category II Protected Area extending over 968km^2 of the Bardiya District in the Mid-Western region of Nepal. The park's buffer zone envelops the core park area, covering an additional 507km^2 and comprising 21 VDCs, 17,228 households and approximately 114,200 people (DNPWC/GoN 2012). This remote region approximately 500km to the west of Kathmandu is a world away from the picture postcard image of Nepal and its soaring snow-capped peaks, colourful prayer flags and steep mountain passes. Instead the landscape is much more suggestive of that of northern India, unsurprising given the proximity of the park to the border crossing at Nepalgunj.

To the north the park is bounded by the crest of the Churia Hills of the Siwalik range which rise above the otherwise flat and low lying plain. Late Tertiary in origin, the Hills are composed of fine-grained sandstone with pockets of clay, shale, conglomerate and limestone (Bhuju et al 2001 cited in TAL 2011). Sukramala, within this range, represents the highest elevation of the park at 1441m (Thapa 2008). The gravelly Bhabar foot-hills which

sit at the base of the Churia range, are swathed in dense sub-tropical forests and provide a sanctuary for numerous species of large mammals and other wildlife.

The western boundary of the park is demarcated by the eastern branch of the Karnali River, the Geruwa, which floods seasonally to create and maintain an outstanding riverine ecosystem habitat. The river's floodplains provide an extremely favourable habitat for a number of keystone and endangered species including tigers and the greater one-horned rhino; approximately 100km^2 of this floodplain in the south west of the park has been designated a biodiversity hotspot (DNPWC/GoN 2007).

Towards the eastern edge of the park lies the Babai Valley. Annexed to the park in 1984 this area comprises 131km^2 of riverine floodplain and 373 km^2 of valley slope, sandwiched between 2 parallel ridges of the Siwalik Hills (TAL 2011). The Babai River, which runs along the valley floor, is dammed at Parewa Odar as part of the Babai Irrigation Project preventing seasonal flooding of the river and resulting in increased aridity in this area of the park (DNPWC/GoN 2007). The eastern extreme of the park is represented by the Nepalgunj - Surkhet road, known locally as the 'black top' road.

To the south, the alluvial Terai flatlands which lie beneath the Bhabar foot-hills and constitute a large proportion of the park and buffer zone, extend to the Indian border. The southern extreme of the park is dominated by buffer zone settlements, agricultural land and sections of the East-West highway (DNPWC/GoN 2007) whilst the Khata corridor, which follows the Karnali's flood plain south, effectively links the forests of BNP to the Katarniaghat Wildlife Sanctuary across the border (DNPWC/GoN 2012).

Within this geographical context the park plays host to a large number of plant and animal species including 839 recorded species of flora and 642 faunal species (TAL 2011). Vegetation ranges from early successional tall floodplain grassland to Sal forest, which represents the climatic climax community within the park (ibid.). Within the five distinct land types outlined above, Thapa and Hubacek (2011, following Dinerstein 1979 and Jnawali and Wegge 1993) identify 7 major vegetation types within the park comprising 4 forest types and 3 varieties of grassland.

Sal forest, dominated by hardwood *Shorea robusta* trees, is the most common vegetation type in the park, covering approximately 66% of the total park area (TAL 2011). Khair-sissoo forests are the next most common encompassing around 11% of the park (ibid.). This forest type represents the 1st seral stage of succession and is therefore most commonly found on, or in close proximity to, the banks of the Geruwa branch of the Karnali River. Although less extensive, covering only 5% of the park's area, the park's riverine forests are found in similar riparian environments and are characterised by evergreen species such as *Syzygium cuminii* which are able to flourish in waterlogged areas and are tolerant to prolonged flooding (Orwa et al 2009). Mixed hardwood forests are the least abundant of the park's four forest types, containing species such as *Haldina cordifolia* and *Mitragyna parviflora* (TAL 2011).

Of the three grassland types present wooded savannah is the most common, covering approximately 7% of the national park (TAL 2011) and comprising grass species such as *Imperata cylindrical* interspersed with sparsely distributed trees, frequently found in areas disturbed by previous activities such as forest clearing, burning and domestic livestock grazing. Tall floodplain grasslands often grow on the alluvial deposits along riverbanks and cover 6% of the park area (ibid). These floodplain grasslands represent a key vegetation type for two of the park's megafauna, the greater one-horned rhino and the wild elephant, and are naturally maintained by seasonal monsoon flooding. Every year local villagers are granted access to the park for 3 days during the winter season to harvest these grasses for thatch[4], reeds, and canes (DNPWC/GoN 2012). The final key vegetation type present in the park is short, open grasslands, known locally as Phantas which make up less than 1% of the total park area (TAL 2011). The majority of the park's Phantas are a result of historical anthropogenic disturbance and they are commonly found in areas of the park that previously housed human settlements. Without intensive management, either naturally through flooding and other fluvial processes, or by human intervention, these grasslands rapidly develop into shrub land and woodlands through the process of ecological succession.

The diverse habitats present in the park play host to a total of 53 mammal species, 22 of which are protected by CITES (TAL 2011). Amongst these are the endangered Royal Bengal Tiger (*Panthera tigris*), the Asian Elephant (*Elephas maximus*) and the Hog Deer (*Axis*

[4] Thatch grasses are known as Khar-khadai (or Kharkhadai) which has become the colloquial term for the grass cutting season itself.

porcinus). The Bardiya National Park is also a key habitat for many of Nepal's endangered and endemic bird species. To date 438 species of avifauna have been recorded in the park including the critically endangered Bengal Florican (*Eupodotis indica*). In terms of aquatic fauna, the habitats provided by the park are home to over 120 species of fish and two species of crocodile, including the expressively named 'marsh mugger' and the critically endangered ghadiyal (*Gavialis gangeticus*). The Karnali River also hosts one of the last remaining populations of Gangetic dolphin (*Platanista gangetica*) an endangered species of freshwater dolphin found only in the Ganges-Brahmaputra-Meghna and Karnaphuli-Sangu river systems of Bangladesh and India, and in the Karnali river in Nepal (Smith and Braulik 2008). A list of the most important species protected by the park, according to the DNPWC's Five Year Plan for Bardiya National Park (DNPWC/GoN 2012 p.6) is included in Appendix 4.1 of this thesis.

The Bardiya National Park has a subtropical monsoon climate characterised by three distinct seasons. From mid-February until June it is hot and dry with temperatures continuing to rise until June when the monsoon breaks. The ensuing hot wet monsoon season lasts until mid-September when the cool dry winter season comes to the fore, running from late September until early February (DNPWC/GoN 2007, TAL 2011, DNPWC/GoN 2012). 90% of total annual precipitation falls during the monsoon months of July, August and September. The mean annual temperature is over 21°C, whilst the mean annual maximum and minimum temperatures are 30°C and 18.5°C respectively. May and June are the hottest months and temperatures at this time of year regularly exceed 40°C (DNPWC/GoN 2007, DNPWC/GoN 2012). Forest fires are common in the build up to the monsoon, and during the rainy season the area often experiences localised flooding. The strong seasonality of the local climate results in significant seasonal ecological changes with, for example, seasonal flooding and fires playing an important role in maintaining areas of early successional tall grassland (TAL 2011).

A growing number of authors have claimed that Nepal's climate has been changing in recent years, characterised by increased incidence of extreme events including fires and floods (Maharajan et al 2011), rising temperatures (Singh et al. 2010), increasing irregular monsoons and changing rainfall patterns (Manandhar et al. 2011). Indeed in their 2007 management plan the BNP themselves documented components of the changing climate noting that since the late 1990s a new climatic phenomenon has been observed every

other year, a cold wave which results in the area of the park being under thick cloud cover for up to four weeks (DNPWC/GoN 2007). However, most such information is anecdotal and there is little scientific evidence to substantiate these claims. Unfortunately additional evidence from climate modelling does little to substantiate of refute such claims since, in the Himalayan region, climatic projections using downscaled GCMs are fraught with inaccuracies stemming from their failure to accurately reflect the complexities of local topography and the influence of the South Asia monsoon system (Jones and Boyd 2011).

Despite a widespread network of hydro-climatic stations throughout Nepal there is also a severe lack of reliable hydro-meteorological data for much of the country. There are, however, a number of stations situated in and around the BNP at Chisapani (Karnali) and Rani Jaruwa Nursery, and if used with caution it is possible that the data recorded at these stations could be judiciously employed to shed more light on recent climatic trends. Indeed, a recent study by Bam et al. (2013) examined local perceptions of climate change around the BNP in conjunction with recorded climate data for the region, to identify current climate impacts and resultant changes in species biodiversity. These authors used the Mann-Kendall trend test to analyse temperature and rainfall data and found that, "the average annual precipitation is in decreasing trend in the region," and that the area, "is getting warmer in compare [*sic*] to the past decades," (Bam et al. 3013 p.136). However the authors of this paper, in employing the Mann-Kendal test, only used 15 years of climate data for trend analysis, arguably too short a time period within which to reliably identify climatic trends, and a questionable decision given the availability of over 35 years of readings at some of the stations. Furthermore the methods and findings of this study relating to local perceptions of climatic changes are unclear at best, and conclusions altogether absent. In Section 5.2 of the following chapter of this thesis I re-examine and reassess this climatic data using the full available records from two weather stations around the BNP. Simple linear regressions, the Mann-Kendal test and the Seasonal Mann-Kendal test, which takes into account the seasonality of the dataset and does not make comparisons across seasonal boundaries, are used as appropriate. Community perceptions of climatic changes in the area are also reconsidered using a more transparent and clearly defined research method (outlined in detail in Chapter 3 Section 3.4.5).

4.2.2 Park Formation

The development of Bardiya to its current incarnation as a National Park has unquestionably been influenced by more than the natural environment that it protects, and the iconic and endangered species therein. The creation of the BNP cannot be considered in isolation from the socio-political forces that helped to mould it. Indeed the birth of the national park, as it is today, is intimately entwined with the country's complex and often turbulent political and legislative evolution, which has helped to shape the development of modern conservation efforts in Nepal (also summarised in Appendix 4.2).

Historically Bardiya acted as an arena for national and global elites to exercise their right to hunt, which was traditionally seen as a key royal duty. In 1846, for example, King Edward VII visited the area, killing 120 tigers, 80 rhino, 27 leopards and 15 sloth bears in a single trip (WWF Nepal 2012). In 1951, King Mahendra regained power from the Rana Dynasty and so began a period of absolute rule by the monarchy that endured for 39 years (Bhatt 2003). During this pre-Andolan[5] period the monarch held complex, dual and conflicting roles as both hunter and conservationist; whilst continuing to engage in lavish hunting expeditions, King Mahendra also laid the foundations for the first national park through the introduction of the Wildlife Protection Act in 1958 (Heinen and Shrestha 2007). This piece of legislation became the nation's first conservation statute, establishing the legal protection of a number of key species[6] and introducing penalties of up to five years imprisonment and fines of as much as 3000RPS for those successfully prosecuted (WWF Nepal 2012).

Park development took another step forward in 1969 when an area of 368km^2 was declared a Royal Hunting Reserve and armed guards deployed for its protection. As a consequence, a number of communities of recently migrated hill people were forcibly relocated to areas lying outside the reserve boundaries including Baghaura and Lamkauli (TAL 2011). Whilst residence was prohibited, access to the forest area was otherwise unrestricted at this time and cattle were allowed to graze within the reserve boundaries (Allendorf et al. 2007). During this period park staff, particularly the Chief Wardens, enjoyed unchallenged authority as a result of their close ties to the monarchs who would often visit the park for Shikar Savaris[7] (Bhatt 2003). From 1972 however, under the rule of

[5] Prior to the People's Movement of 1991
[6] Including the Greater One Horned Rhino, the Bengal Tiger, and the Yeti.
[7] Royal Hunts

Mahendra's son, Birendra, the frequency of these hunts began to dwindle as the King's focus began to switch more firmly towards conservation efforts. This paradigm shift was reflected by the establishment, that same year, of a central office to oversee protected area management, the organisations which, in 2001, was to become the Department for National Parks and Wildlife Conservation (Bhatt 2003). In 1973 a second key piece of legislation, the National Park and Wildlife Conservation Act, was passed, a document strongly reflective of the fences and fines approach which characterised wider conservation thinking at the time. The increased detail and complexity of this document resulted from a number of conservation assessments undertaken with UNDP funding, which had been carried out in the wake of the Wildlife Protection Act (WWF Nepal 2012).

In 1976 the metamorphosis from hunting ground to conservation area was formalised with the transformation of the hunting reserve into the Royal Karnali Wildlife Reserve. Renamed the Bardiya Wildlife Reserve in 1982 the nascent park was extended to the east to incorporate the Babai Valley resulting in the eviction of a further 1,500 households (DNPWC/GoN 2007, TAL 2011). In that same year a Second Amendment to the NPWC Act was passed (HMG 1982), making provision for a small amount of local level extraction of park resources to occur, primarily related to the harvesting of grasses for thatch and fodder, mirroring wider international interest in approaches to conservation that considered the needs of local residents. In 1988 the evolution from hunting reserve to national park was complete with the gazetted area expanded to 968km^2 and renamed The Royal Bardiya National Park (Thapa 2008, TAL 2011, DNPWC/GoN 2012). In 1989 a Third Amendment was made to the NPWC Act (HMGN 1989 p2) which developed the park's tentative attempts to incorporate a social dimension to its work, allowing the park to be managed, "according to an integrated plan for the conservation of natural environment and balanced utilisation of natural resources," reflecting the accession to the fore of Integrated Conservation and Development thinking.

The political stability that characterised this period of Nepal's history came to an abrupt end in 1991 with the Jana Andolan, or People's Movement, which resulted in the establishment of multi-party democracy (Baral and Heinen 2006). Bhatt, 2003, argues that during this period the diminished importance of the Royal Family, and the cessation of royal visits to National Parks, precipitated a growing malaise in government bureaucracies, and a reduction in the esteem in which the public held park officials. The Royal Family and

their authoritarian systems had become viewed as being out-dated and undemocratic and the historically close ties of park staff to the royal family resulted in them being tarnished with the same brush. Where historically the social status of park staff elevated them above reproach, open conflict between villagers and park staff became more commonplace.

In a bid to address this growing conflict the NPWC Act was amended for a fourth time (HMGN 1992), to allow for the introduction of the concept of buffer zones into the legislature. This development reflecting a marked shift in conservation thinking in Nepal, away from a focus on fences and fines, towards a more participatory community led approach. Under this amendment 30-50% of income generated by a National Park was to be earmarked and expended for community development activities within the park's Buffer zone.

The following years saw mounting disillusionment with the newly won democratic political system and multi-party politics, which was judged to have failed to address the widespread poverty, socio-economic inequality, discrimination and corruption that existed under the previous regime (Baral and Heinen 2006). In 1996 the Communist Party of Nepal (Maoist) declared a People's War which quickly garnered support, particularly amongst the poor and disenfranchised, and ravaged the country for ten years (Murphy et al. 2005). In that same year, the Bardiya National Park and Buffer Zone Management Regulations were enacted, with a buffer zone covering an area of 327 km^2 created the following year (Thapa 2008, TAL 2011). Prior to this point the area immediately surrounding the park had been characterised by unsustainable land use practices and encroachment, and illegal use and extraction of resources was common. With the formation of the buffer zone and the adoption of the Buffer Zone Management Regulations the BNPMA aimed to address these issues and to achieve sustainable land use management and resource use whilst reducing people-park conflict in the area immediately adjoining the park.

During the period of the insurgency matters were further complicated when, in June 2001, Prince Dipendra massacred his father and eight other members of the Royal Family in the Narayanhiti Royal Palace before turning the gun himself (Baral and Heinen 2006). Gyanendra, the King's younger brother ascended to the throne and in response to the insurgency worked to suppress human rights and civic participation in government, in an attempt to restore the absolute rule of the monarchy (Singh 2013). The bloody conflict

came to a conclusion in 2006 when, on the 23rd of November, a ceasefire was declared and the Comprehensive Peace Accord, which allowed representatives of the Maoist Party to take part in government, was signed; a second Jana Andolan restored the parliamentary system and abolished all monarchical powers (Pokharel and Ojha 2006). An incidental consequence of the success of this People's Movement was another name change, with the Bardiya National Park losing its Royal prefix (DNPWC/GoN 2007).

Over the course of the Maoist conflict over 12,000 people were killed, thousands more injured, and approximately 200,000 internally displaced (Murphy et al. 2005). The extensive social and political upheaval which occurred during this period undoubtedly impacted upon the effectiveness of conservation interventions in the country and the capacity of conservation organisations both government and non-government alike, to successfully achieve their aims. Impacts on conservation efforts over the course of the conflict took a number of different forms. By 2004 the Maoist forces had destroyed 47 physical structures of the DNPWC (Baral and Heinen 2006) as the rebels targeted any infrastructure, including park guard posts, linked to the government, reducing the capacity of ground staff to monitor and protect their national parks.

As the Maoists stepped up their violent insurgency army staff, tasked with ensuring park protection, were redeployed to engage the Maoist forces, leaving parks open to poaching and illegal resource extraction. As one Chief Warden noted, "the RNA have returned to the barracks, the removed security posts have not been reactivated yet... not only poaching, even encroachment of the park is on the rise," (Kathmandu Post 2003 cited in Murphy et al. 2005 p9). In Bardiya eight rhinos were poached between April 2002 and March 2003 alone, and encroachment inside the park escalated following the redeployment of the park's eight security posts (Murphy et al. 2005).

Further impacts on conservation efforts were felt at this time as NGOs working around the park withdrew to regional centres due to the rapidly deteriorating security situation. A number of NGOs were targeted by the insurgents and in Bardiya the KMTNC (now NTNC) was specifically targeted due to its perceived ties with the royal family (Baral and Heinen 2006). Community based organisations who continued to operate at the grassroots level during this period of instability gained increased importance for conservation efforts as some NGOs started to channel their funds and resources through them (Murphy et al.

2005). The local organisations were, however, often infiltrated by Maoist sympathisers who commandeered funds for their own ends, or carried out practices of 'extortion by donation,' (Murphy et al. 2005, Baral and Heinen 2006) constraining the ability of these organisations to operate effectively. It was not just the funds for community based and other local organisations that were restricted during this period. Following the declaration of a national state of emergency by the government in November 2001, government funding of the environment sector was reduced as the government channelled its resources into quelling the Maoist rebels (Murphy et al. 2005). The impacts of this on conservation efforts was further exacerbated by a reduction in tourist numbers visiting the park by about 50% resulting in a drastic decline in revenue generation for conservation initiatives by the park (DNPWC/GoN 2007).

Following the signing of the comprehensive peace accord in late 2006 preparations were made for an election to form a Constituent Assembly, held in 2008. This body was mandated to draw up a new national constitution but despite the deadline for this being extended by two years the Constituent Assembly was dissolved at midnight on 27th May 2012 having failed in its aim (Bhattarai 2012). As a result the political arena in Nepal was left in limbo for almost two years as election deadlines came and went without action. Political disagreements between the major parties became increasingly polarised around the question of increased devolution of power from the centre, whether federalism should be adopted, and if so the modality that this should take. On the 19th November 2013 Nepal finally held a general election to select new members of their Constituent Assembly and the Nepali Congress party emerged victorious as the largest party in a Parliament with no overall control (Anonymous 2013). Suchil Koirala, the leader of the NC party was elected Prime Minister on the 10th February 2014 after a deal was struck between his party and the second largest party following the election, the CPN-UML (Bhattarai 2014).

Despite this recent political inertia at the central level, the impact of the post-insurgency political arena on conservation efforts has been broadly positive. In their 2007-12 Management Plan (DNPWC/GoN 2007) the BNPMA highlighted the fact that since the 2006 Peace Accord, government revenue, NGO spending, and tourist numbers in Bardiya have all been on the increase. The army have resumed their role as park protectors, and security posts within the park have been rebuilt, expanded and are staffed with Game Scouts once more (see Figure 4.2). In December 2010 an additional area of 180km^2 covering Taranga,

Hariharpur, Lekhparajul and Chinchhu VDCs was declared along the northern boundary of the park, bringing the total buffer zone area to 507km^2 and providing a clear sign of the slowly increasing capacity of the Nepali Government (TAL 2011).

The legislative history of climate change in Nepal is much shorter than that of conservation, stemming from the country's ratification of the UNFCCC in 1994. As a consequence of the ensuing political upheaval action on climate change then stalled. Since the first election of the Constituent Assembly, however, a number of key climate change policies have been approved by the government. Nepal's National Adaptation Programme of Action was published in 2010 and subsequently, in 2011, the government published its Climate Change Policy outlining the government's plans and priority areas for action in addressing the challenge of climate change. More recently still Nepal has become amongst the first countries in the world to publish their Local Adaptation Programme of Action framework, which is concerned with prioritising and identifying adaptation options at the local level to support implementation of the priorities identified in the NAPA. Although these recently published policy papers set out a clear country stance on what to address and how, in relation to climate change, unlike the biodiversity legislation discussed above, none of the positions and prescriptions laid out in these policies have been reified in law.

In addition to the national level climate and conservation legislation and policies outlined above and detailed in Appendix 4.3, Nepal is a signatory to a large number of international treaties and conventions related to climate change, biodiversity conservation, and forests including CITES (1975), the Ramsar Convention (1987) and the CBD (1993) (see also Appendix 4.3). A number of authors, for example Oli (1996) and Desai et al. (2010) have examined the degree to which Nepal has adhered to and successfully implemented initiatives under a number of these conventions and have found their progress to be somewhat lacking. This is not surprising given the significant political, technical, and financial constrains under which the government continues to operate (Oli 1996, Desai et al 2010, Forest Peoples 2010). The extent to which these treaties and agreements impact upon conservation activities at the local level is considered in more detail in Chapter Five of this thesis.

4.3 Bardiya National Park Management Authority

4.3.1 Organisational Goal

Having examined the antecedents of the BNP and the political and institutional context in which it developed, attention now turns to the Bardiya National Park Management Authority, the government organisation tasked with managing and ensuring the protection of the park's core area and buffer zone. Growing out of the Wildlife Reserve Office established in Thakurdwara in 1972 (Thapa 2008) and operating under the auspices of the Department of National Parks and Wildlife Conservation, the BNPMA's official stated goal is that, "Biodiversity of Bardiya National Park (representative ecosystems, endangered wildlife species and their habitats) is safeguarded, public support has improved, and ecotourism has enhanced," (DNPWC/GoN 2007 p.67). Within this broad overarching aim the BNPMA has committed to focus on six key areas in order to achieve their goal in the management of the core area of the park: institutional capacity building, the management and protection of the park's ecosystems, the effective conservation of key endangered species as well as other species of specific concern and the maintenance of viable populations of all these species, the effective control illegal activities such as poaching, encroachment and the extraction of forest resources whilst reducing human-wildlife conflict, scientific research related to the park, and ensuring the effective monitoring and evaluation of progress against these objectives (ibid.).

The BNP's management plan also includes a number of aims specific to the buffer zone, in pursuit of its overarching goal: improving cooperation and collaboration between park staff and people residing in the buffer zone, improving infrastructure provision within the buffer zone, enabling buffer zone communities to attain self-sufficiency in forest resources, providing direct support to local communities for skill development and income generation, improving knowledge and awareness of conservation issues, and formulating a policy on resource sharing and access to be endorsed by the Government of Nepal (DNPWC/GoN 2007). Two additional aims specifically related to tourism are also included in the Five Year Plan: establishing the Bardiya National Park as a popular tourist destination, and ensuring the Tourism Plan (2001-05) is endorsed by the National Government.

4.3.2 Organisational Systems

In terms of decision making and planning process, the activities conducted by the organisation towards its overarching goal are structured around a strategic management plan designed to address critical threats to the park, and key buffer zone issues. Planning is conducted on a quinquennial basis, under the direction of the Park's Chief Warden in close consultation with the Director General of the DNPWC (DNPWC/GoN 2007). The general framework and structure of this plan is developed through initial discussions at the central level with relevant DNPWC staff in Kathmandu. Specific programme activities are then formulated through internal group consultations involving the park's Assistant Wardens, Rangers, Game Scouts, and other officials based in the Park Headquarters (ibid). During this period of plan preparation, public field level consultations are undertaken with stakeholders from the public and private sectors, with further relevant information collected from government reports and scientific publications (ibid).

The draft report is then presented and discussed at the Annual Warden's Conference, a forum which affords Chief Conservation Officers from National Parks throughout the country an opportunity to come together to share their knowledge and experience of different approaches to addressing conservation challenges in Nepal. Once relevant feedback has been incorporated into the document, the Chief Warden submits the five-year management plan to the Director General of the DNPWC for comment. Once he is happy with the document it is submitted to the Secretary General of the Ministry of Forests and Soil conservation who, once satisfied, officially submits the document to the Ministry of Planning where it is ratified by the government.

The Park's five-year management plan contains not only a detailed list of activities to be undertaken over the subsequent five years, but also a detailed financial breakdown of spend projections against each activity. In addition to this five-year plan, annual plans are also produced. These are, however, solely concerned with the Park's finances, and detail expected against actual expenditure for each authorised activity.

Progress against the BNPMA's objectives as outlined in the five-year plan is formally monitored and measured through an examination of a number of key indicators[8], structured around a standard Logical Framework. These indicators relate to a range of

[8] The most recent management plan documents 87 key indicators.

issues including institutional capacity building, monitoring and enhancement of various species and habitats, buffer zone management and tourism (DNPWC/GoN 2007). A mid-term evaluation to examine progress towards these objectives measured against these indicators occurs three years into the term of the management plan and a more comprehensive review of the plan in its entirety takes place early in the final year of the plan, in advance of the preparation of the new five-year plan.

Specific monitoring of the Park's ecological performance occurs on a regular basis and is considered key to successful park management. This process of monitoring enables the BNPMA to gather the data needed to inform their management decisions, and enhances their understanding of the effectiveness of current management strategies, ecological processes, and changes in biodiversity and habitats over time, highlighting key knowledge gaps and important areas for future research (DNPWC/GoN 2012). Specific monitoring also takes place relating to the economic and socio-cultural impacts of the BNPMA's activities with a specific focus on tourism and residents attitudes towards the BNPMA. Undoubtedly, however, this monitoring in relation to the BNPMA's social objectives is of secondary concern to the monitoring of ecological performance. Indeed despite recommendations made in 2004 that the BNPMA's buffer zone impacts be regularly assessed, to date, monitoring protocols still have not been developed (DNPWC/GoN 2012).

4.3.3 Internal Resources

The BNPMA's human resources extend to 126 staff[9] who, in pursuit of the BNP's goals, conduct technical habitat management interventions, undertake park surveillance, coordinate people-park relations through the BZMC, regulate tourism, and perform general administrative activities including those relating to legal issues involving the park (DNPWC/GoN 2007). Park staff operate under the direction of the Chief Warden (officially known as the Chief Conservation Officer) whose responsibility it is to ensure the effective management of both the core area of the park, and the buffer zone. Indeed, under the National Parks and Wildlife Conservation Act 1973, the Chief Warden has the power to do anything that, "he deems necessary for the proper management of a National Park," (HMG 1973 p.5). Under the Chief Warden there are two Assistant Wardens who provide support to the Chief Warden and, in his absence, temporarily assume his responsibilities. Park field staff official comprise seven rangers, eleven Senior Game Scouts, and sixty Game Scouts,

[9] A full breakdown of staff numbers by position is tabulated in Appendix 4.4 of this thesis.

who are posted at locations within the core area of the park and the buffer zone (DNPWC/GoN 2012). Their duties are primarily concerned with patrolling the park to prevent the illegal extraction of forest resources and poaching activities, and to report any issues back to senior park staff.

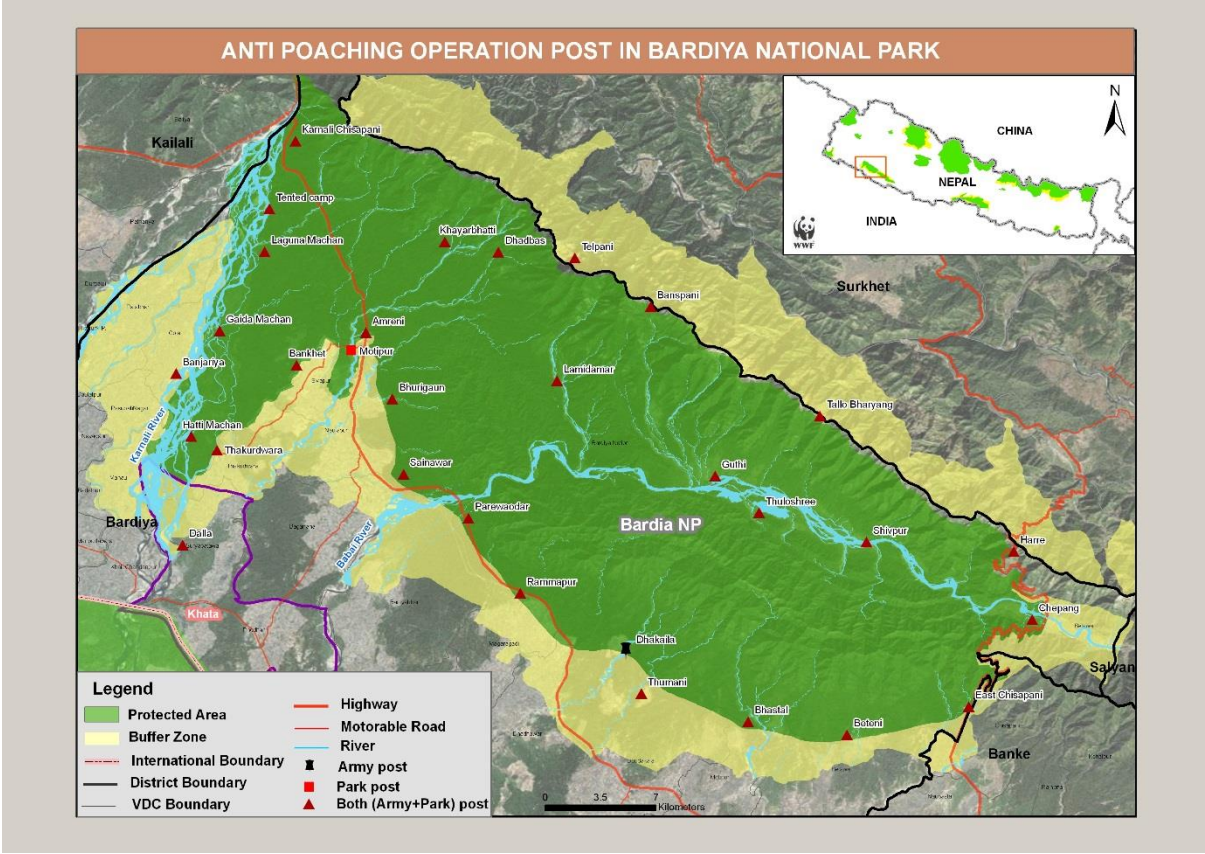

Figure 4.0.2 Map of Park Guard Posts (WWF Nepal 2012).

A further 33 park staff are based 3km to the south of park headquarters at Hattisar, the park's elephant stables. These staff provide additional support to park management for surveillance and patrolling, monitoring and evaluation and tourism activities, and provide daily care for the parks 16 domestic elephants (10 cows and 6 male calves) (DNPWC/GoN 2007). The staff at the elephant stables consist of a Subba (stable manager), a 1st class administrative officer who is in overall charge of Hattisar operations, and his deputies a Daroga, who holds similar responsibilities to the Subba, and a Raut who is primarily concerned with overseeing the elephant handling teams (Locke 2011). By law, each of the park's domestic elephants must be tended by a three man team comprising an elephant driver (Pharnet), a grass cutter (Patchuwa) and a stable cleaner (Mahut) (ibid.).

In addition to these 126 park staff, a battalion of the Nepal Army are stationed in close proximity to park headquarters. Army staff, under the direction of the Battalion Commander, are tasked with guarding the National Park and enforcing its rules and regulations. Although army personnel operate independently of the BNPMA, the Chief Warden and the Battalion Commander work closely together, meeting on a regular basis to discuss how best to work together. Army staff regularly go on joint patrols with the Park's unarmed Game Scouts and a number of the posts within the park provide accommodation for both park staff and army personnel. Soldiers are posted to the park on a 2 year rotation and some authors (e.g. Allendorf et al. 2007) have argued that as a consequence, they have little vested interest or incentive in building relationships at the local level.

In terms of financial resources the BNPMA, as a public sector organisation, is funded by the Government of Nepal through its annual budgetary provision. This funding stream is allocated predominantly for activities concerned with the management of the park's core area, although a small portion of this income contributes to supporting buffer zone management and conservation and awareness raising programmes in the communities bordering the park. Additional revenue streams come from the park's conservation partners particularly the National Trust for Nature Conservation and WWF Nepal, although this income is less regular with financial support provided on a project by project basis, and often earmarked for specific management activities.

Table A.4.5a (Appendix 4.5) summarises park income from government sources over the last ten years. Between 2000 and 2005 park income from Government sources fell significantly as government income was diverted to fund the fight against the Maoist insurgents, leaving the park with negligible income from government sources. Data is not available for 2005/6-2006/7, the period of the culmination of the conflict. Following the signing of the Comprehensive Peace Accord on 21st November 2006 and the subsequent establishment of the Constituent Assembly, income from government sources became more significant and more reliable. However, between 2007 and 2012 government contributions still only accounted for between 21% and 35% of total park budget, highlighting the relative importance of non-government contributions, particularly those contributions from the park's conservation partners, in the effective management of the park.

Table A.4.5b (also in Appendix 4.5) includes information on park spending by activity over the last five years with financial projections for the next five, as detailed in the Bardia National Park and Buffer zone Management Plan 2012-17 (DNPWC/GoN 2012). Total park spend under the core area budget is projected to be 37% higher over the next five years than it was over the previous period, with 'Protection and Conservation of Biodiversity' and 'Support to buffer zone Management,' unsurprisingly being the activities in receipt of the most significant financial contributions. Spending on buffer zone management activities however, appears to have decreased over the last 10 years, with projected spend over the period 2012-17 down around 43% on the previous 5 year period (Appendix 4.5). On closer inspection, however, this reduction in buffer zone budget over the second planning period is more than compensated for by a substantial increase in funding allocated to buffer zone support and management through the BNPMA's core budget. Despite this apparent change in modality of funding for buffer zone activities, the BNPMA's total conservation budget has remained relatively stable over the last 2 planning periods.

In terms of buffer zone income, additional funding is made available by the park through the fourth amendment to the National Park and Wildlife Conservation Act (HMGN 1992) which stipulates that 30-50% of a park's income from tourism activities should be expended on buffer zone management for the economic development of local people. This buffer zone management budget is augmented through additional revenue streams including additional funds allocated from VDCs, income generated through BZCFs, and by funds drawn through NGOs operating in the buffer zone and their associated development projects. According to the Buffer Zone Management Guidelines (HMGN 1996) income generated through park receipts and allocated to the buffer zone through the BZMC must be spent as follows: 30% on conservation programmes; 30% on community development activities; 20% on income and skill generation activities; 10% on conservation education programmes; and 10% on administrative expenses.

4.4 Organisational and Social Context

A wide variety of organisations operating at a range of scales influence and impact upon the operations of the BNPMA. At the national level a number of key government departments influence local level activities through a range of mechanisms including the creation and implementation of new legislation. At the local level, the BNPMA cannot

operate in isolation from the plethora of quasi-governmental and civil society organisations that operate in the park's buffer zone.

4.4.1 National Context

At the national level the Nepali Government comprises three main branches. The legislative branch, headed by the Constituent Assembly, is the key law making body of the government; the judicial branch comprises the country's court system including district courts, the Supreme Court and the Court of Appeal; and the executive branch which is headed by the Prime Minister and managed by the Ministers of the 27 Ministries. A comprehensive list of all of the government ministries is included in Appendix 4.6 of this thesis.

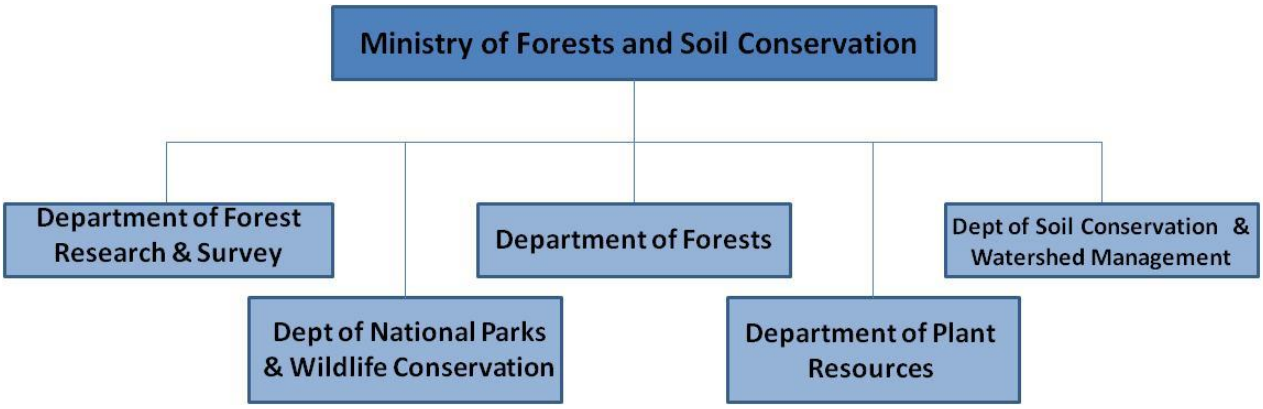

Figure 4.0.3 The structure of the MOFSC and its associated departments.

The MoFSC is the primary policy making body in Nepal for issues pertaining to the effective management of forests, conservation, and wildlife management. The Ministry is made up of five departments (see Figure 4.3) each of which has a different focus and role in engaging with these issues. The DNPWC is specifically focused on conservation issues and with ensuring the effective conservation of endangered species and their habitats through the creation and management of Protected Areas, including National Parks and buffer zones. Given this focus the DNPWC is the key national level department of relevance to this study, however its lack of engagement with climate change issues means that it cannot be viewed in isolation from other relevant organisations at the national level.

Also of relevance to this study is the Department of Forests, under the MoFSC, which is concerned with both the conservation of Nepal's forest resources which lie outwith the country's Protected Areas, and with enabling and ensuring people's participation in forest

management for their economic development, particularly through community based natural resource management initiatives such as community forestry. The DoF are also involved in climate change issues through the REDD+, Forestry and Climate Change Cell which is hosted in the Department. The REDD+ Cell has a focus on mitigation activities and is responsible for coordinating Nepal's REDD readiness process under the World Bank's Forest Carbon Partnership facility.

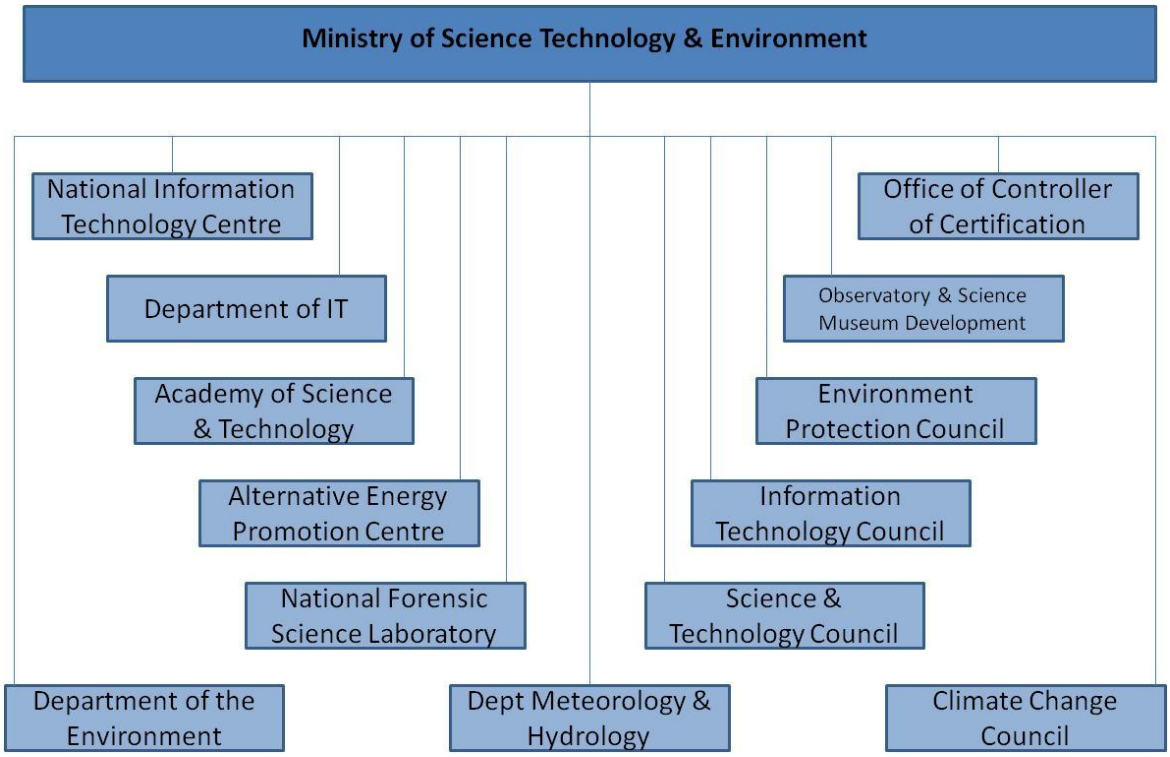

Figure 4.0.4 The structure of the MoSTE and its constituent Departments.

Despite the presence of the REDD+ Cell in the MoFSC it is the Ministry of Science, Technology and the Environment which acts as the focal Ministry for all climate change related issues in Nepal, and which is therefore tasked with formulating the country's climate change policy. All climate change related funds pass through this Ministry which also acts as the focal Ministry for the International Negotiations of the UNFCCC.

Within the MoSTE there are two key departments which are of direct relevance to this study. Firstly, the Department for Meteorology and Hydrology which through its national network of hydro-meteorological stations monitors the hydrology and meteorology of the country. Data collected by this Ministry includes the information on temperature, precipitation, and river flow which forms the foundation of the analysis of climatic trends around Bardiya, discussed in the following chapter. The Climate Change Council, the 2nd key

department of the MoSTE of relevance to this study, is chaired by the Prime Minister and is the highest level climate change body in Nepal. The CCC has representatives of sectoral Ministers, a chief secretary, and eight expert members from the private sector and is mandated to provide policy guidance on climate change issues in Nepal to all other government departments.

4.4.2 Local Context

At the local level, management of the park's buffer zone is undertaken through a hierarchical set of quasi-autonomous community-led organisations whose members are democratically elected by community members. At the grassroots level each community forms a Buffer Zone User Group to manage the dispersal of buffer zone funds for community development initiatives, conservation education and compensation for losses and damage caused by wildlife. The elected chairperson of each BZUG is appointed to act on their community's behalf on the Buffer Zone Users Committee which represents the next highest level of buffer zone management organisations. The chairperson of each BZUC has a place on the Buffer Zone Management Committee, which sits at the apex of the buffer zone management organisations, and represents the only direct link between the subordinate buffer zone management organisations and the BNPMA. The BZMC is headed by an elected Chairperson and the park's Chief Warden sits on the council as Member Secretary; three representatives from each of the District Development Committees covered by the Buffer zone (Banke, Bardiya and Surkhet) also hold places on this committee as observers (DNPWC/GoN 2007).

An additional collection of quasi-independent buffer zone organisations, Community Forestry User Committees, exist within this structure at the grassroots level to manage Community Forest User Groups. The organisations, however, stand in comparative isolation from the BZMC and its subsidiaries members are not entitled to representation on any of the aforementioned management committees. Figure 4.5, below, illustrates the structure of the quasi-independent buffer zone management organisations operating around Bardiya.

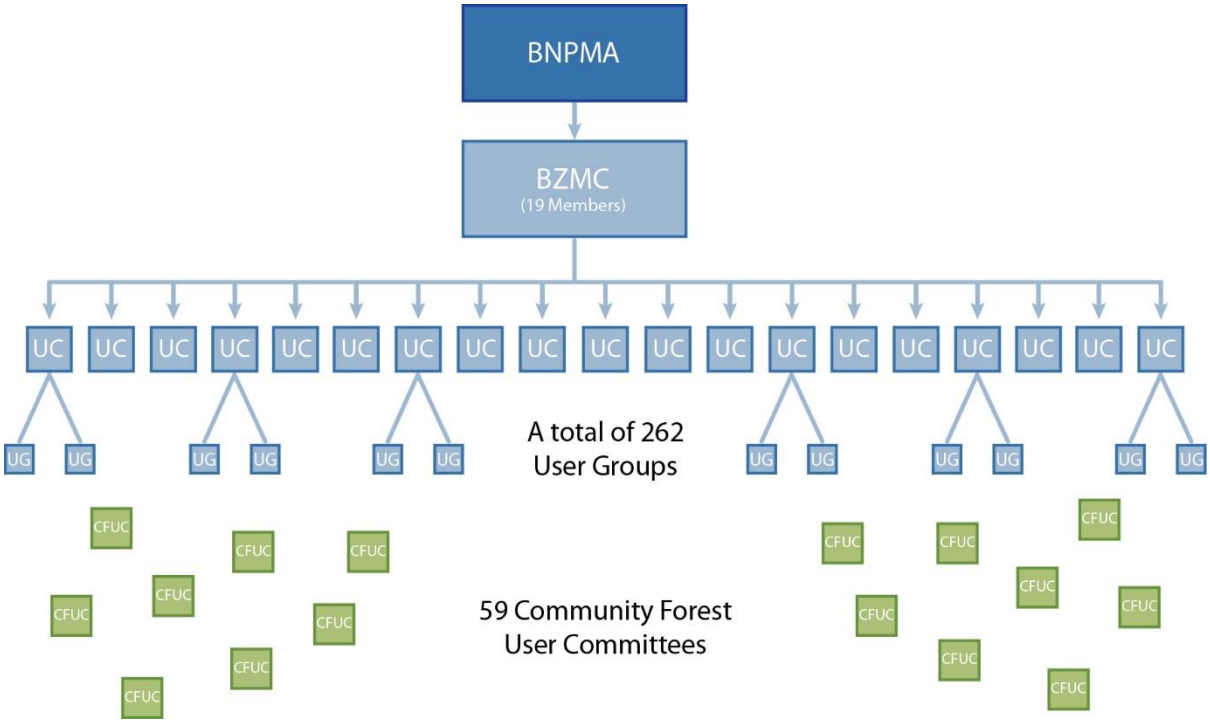

Figure 4.0.5 Structure of BZ Management Organisations (adapted from Adhikari 2012).

As discussed above, buffer zone management activities are funded through park gate receipts, with income supplemented by core funding from the BNPMA, additional funds received from the park's conservation partners, and through money received directly from VDCs. Income received from park receipts is transferred directly from the park to the BZMC on the basis of the five year Buffer Zone Action Plan. Funds are then distributed to the 19 BZUCs, from where it feeds down to the grassroots BZUGs. Once established, CFUCs do not receive additional income through this mechanism, rather they rely on money generated through community forestry activities including the harvesting and selling of timber and NTFPs, to sustain themselves.

A number of non-governmental organisations which operate in the park's buffer zone also have an important role to play in ensuring the effective conservation of the park and its environs. Although vital to the park, this is not limited to their financial contributions to park and buffer zone management activities which supplement the extremely limited government budget outlined above. Additional non-monetary support is provided to the park by these organisations in the form of training, the sharing of knowledge and expertise, and the provision of equipment.

Two organisations in particular are so vital to the successful running of the park, through the financial contributions and non-monetary support that they provide, that they are referred to as the 'conservation partners' of the BNPMA. The National Trust for Nature Conservation (formally the King Mahendra Trust for Nature Conservation) is a conservation NGO that was established in 1982 to preserve the natural heritage of Nepal whilst improving the quality of life of its people. The NTNC first began work in Bardiya in 1982, and in 1989 it established a permanent base next to park headquarters and launched the Bardia Conservation Programme (Thapa 2008). The BCP aims to build the capacity of local natural resource management institutions as well as undertaking local livelihood development activities. It also carries out monitoring and evaluation work in the area and conducts research into pertinent issues in and around the park. In addition to these initiatives the NTNC, through the BCP, provides significant financial contributions towards the running of the park. Between 2007 and 2010 the NTNC committed 27,175,000 Nepali Rupees (approximately £170,000) to the park; this equates to almost 50% of Government contributions over the same period.

The BNPMA's second key conservation partner is WWF Nepal, operating in Bardiya through the Terai Arc Landscape project. Begun in 2001 the TAL project focuses on conservation issues and sustainable livelihoods development in the Terai region of Nepal through the promotion of community forestry, sustainable natural resource management, infrastructure development, and the promotion of gender equality. As well as implementing their own projects in Bardiya's buffer zone, WWF provide direct financial support to the BNPMA. Between 2007 and 2012 the WWF TAL project committed 342,162,000 Nepali Rupees (over £2 million) in support of the BNPMA, over six times Government contributions over the same period.

Whilst the contributions of both of these organisations are vital to the effective management of the park and buffer zone, neither is specifically concerned with climate change issues. More recently, however, WWF in conjunction with the NTNC, CARE Nepal and the Federation of Community Forest Users Nepal, have begun the five year Hariyo Ban Programme which provides US$30 million over five years to reduce the negative impacts of climate change and threats to biodiversity in two regions of Nepal including the Terai Arc Landscape of which Bardiya is a part. Although initiatives under the Hariyo Ban programme are not directly linked to the running of the BNPMA, the work carried out by WWF

indirectly benefits the work of the park by reducing pressure on biodiversity in the core area of the park and buffer zone, and by raising awareness of conservation and climate change issues in the park environs.

In addition to the work undertaken by these large moneyed programmes operating around the BNP, a plethora of smaller community based NGOs are working in the park's buffer zone to succour the work of the BNPMA. Although these organisations do not provide financial assistance to the park, indeed they are themselves often beneficiaries of NTNC support, organisations such as the Women's Environment Sub-Committee, the Nature Guides Association, the Ecotourism Association, and numerous local cooperatives, all work to improve livelihoods and reduce human pressures on the park and buffer zone and to raise awareness of the importance of conservation in the region.

4.5 Conclusion

This chapter has provided a detailed account of the organisational, social, environmental, political and economic context within which the management authority of the BNP operates. A thorough understanding of the situation within which the BNPMA is located and the opportunities and constraints that this places upon the organisation in achieving its goals is a prerequisite for attaining a comprehensive understanding of the factors that drive change within the organisation, the capacities and constraints it faces in addressing these challenges, and the processes through which the organisation operationalises its adaptive capacity. The organisation cannot justifiably be viewed in isolation from its context.

It is important to note that this information is, for the most part, derived from unpublished internal organisation documents and official government sources, and as such represents the 'official party line' on the context within which the park operates. Where additional information and analyses are available from secondary sources these alternative viewpoints have been included and discussed. The subsequent three chapters of this thesis present the results and analysis of my study and, where appropriate, offer a critique of this official line, based on the author's observations and research findings gathered during the fieldwork stage of this study.

Chapter 5 - Drivers of Organisational Change in the BNPMA

5.1 Introduction

This analytical chapter builds upon the detailed historical, political, and environmental context provided in the previous chapter, and presents an analysis of the key challenges and drivers of change confronting the Bardiya National Park Management Authority. Drivers of organisational change, hereafter drivers of change or simple drivers, are, as discussed in Chapter Two, those new challenges facing an organisation to which they must effectively respond in order to achieve their aims and objectives. In this chapter a combination of data collected through semi-structured interviews, focus groups, community-based surveys, and weather stations, supplemented by field observations, are used to identify the BNPMA's key drivers of change and to assess the relative importance of these multi-scalar challenges to which the BNPMA is having to respond.

Consideration is also given to the mechanisms through which the BNPMA scans its external environment to identify these challenges, gather data on them and resolves to respond. Analysis of these processes is loosely structure around Daft and Weik's Model of Organisational Interpretation Modes (1984) examined in detail in Chapter Two. This model characterises the processes through which an organisations scans its external environment to gather information on its drivers of change, as being either active or passive with the environment either viewed as analysable or not. The channels through which an organisation conveys this information about its drivers to senior decision-making staff, is identified in the model as being internal or external, active or passive. Framing the study in this way emphasises the relationship between the BNPMA and its external environment and, furthermore, enables the complex and important links that exist between the BNPMA's distinct drivers of change to be highlighted and the implications of associated trade-off to be examined.

This chapter begins by documenting the key environmental drivers of change influencing operations in the BNPMA highlighted by this research including climatic change, water availability, grassland succession, invasive species and fire regimes. Attention then turns to a number of anthropogenic drivers of change facing the BNPMA including human-wildlife conflict, park-people conflict, and international agendas. The chapter concludes with an acknowledgement that whilst environmental changes are the most important drivers of change for park management authorities, the links and dependencies between each of the

identified challenges render the analysis of a single factor in isolation impractical and unproductive. The factors that govern the organisation's ability to adapt to these divers of change are then examined in detail in Chapter Six.

5.2 Environmental Change

Johnson et al. (1997 p.581) define environmental change as, "a change or disturbance in the environment caused by human influence or natural ecological processes." Importantly, such changes may be driven by natural processes, by anthropogenic interventions or, more commonly, by a combination of the two. Such transformations may be gradual as with the process of ecological succession, or involve a step change in the natural environment. For the BNPMA, such changes may have either positive or negative impacts on the organisation's pursuit of its overarching goal. In the park environs where poverty persists and communities are heavily dependent upon natural resources for their subsistence, human actions have a particularly significant role in driving environmental change and accelerating natural ecological changes. The burgeoning human population and associated issues including the illegal extraction of park resources (discussed in more detail in Section 5.3.2) have the potential to exacerbate natural processes of ecological change, and to act as drivers of change in terms of effective park management.

Since the creation and effective management of protected areas is fundamentally founded upon notions of permanence and stability in the natural environment, and given the range of issues encompassed by this concept, this section of my thesis evaluates the importance of environmental change as a driver of organisational change for the BNPMA using a number of different methods (as discussed in detail in Chapter Three). Almost three quarters of interview respondents regarded environmental change to be an important driver of change for the park management authority making it, as an aggregated category, the most commonly cited driver of organisational change for the BNPMA. Within this category climate change was most frequently identified as being an important challenge, followed closely by water availability. The conversion of grasslands to forests, the presence and proliferation of invasive species, and changing fire regimes were also highlighted as key environmental factors driving change within the park. The relative coding of interview responses is documented in full in Appendix 5.1.

In the following section of this chapter I examine these specific environmental changes in more detail. The impacts of changing temperatures and precipitation patterns on the operations of the BNPMA are analysed through trend analysis of temperature and precipitation records, in conjunction with survey results of local perceptions of climate change and semi-structured interview responses. Temperature and precipitation data is taken from 2 weather stations, 1 situated in Chisapani nestled at the foot of the Churia Hills, the second at Rani Jaruwa to the south of the park on the wide, open, alluvial Terai flatlands (see Figure 3.1).

To provide a greater understanding of water availability as a driver of change, trends in the discharge of the Karnali River are then examined using the Seasonal Mann-Kendall test, in conjunction with interview responses. The specific impacts of the succession of grasslands to forests, the proliferation of invasive species, and changing fire regimes on park management are then considered in more depth, before attention turns to the range of anthropogenic factors driving change within the organisation.

5.2.1 Temperature

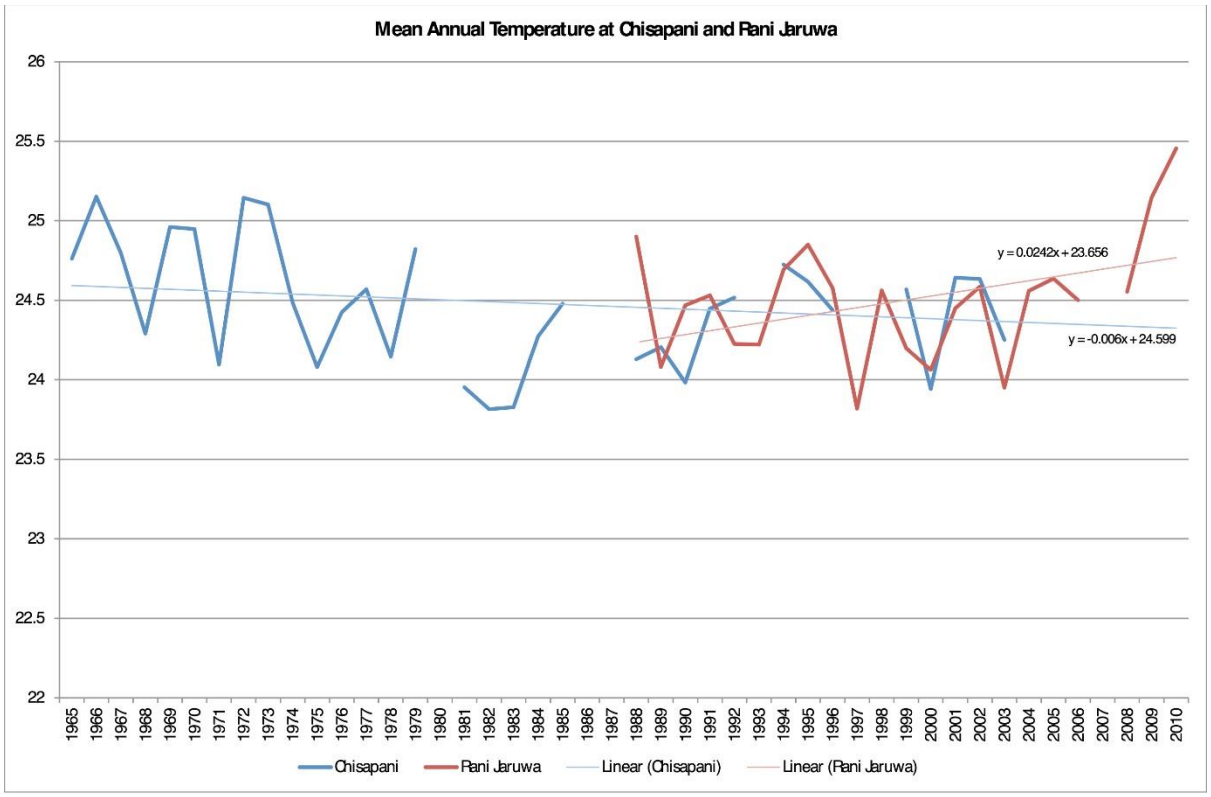

Figure 5.0.1 Mean annual temperature at Chisapani and Rani Jaruwa (1965-2010).

Figure 5.1 plots mean annual temperature data for both Chisapani and Rani Jaruwa against time. Visual inspection of the data suggests an apparent downward trend in average annual temperatures at Chisapani over the 42 year time period, however whilst simple linear regression trends corroborate the presence of a slight decreasing trend over 42 years, an increasing trend is identified when the data is plotted over 30, 20 and 10 year time periods (see Appendix 5.3). SLR gradients suggest that the rate of increase in mean annual temperature is rising indicating a greater rate of temperature increase over the recent past. The Mann-Kendall (MK) trend test, applied to temperature readings for Chisapani, identifies no significant trends over any of the four time periods examined. At Rani Jaruwa SLR data suggests an increasing trend in average annual temperature over the last 26, 20 and 10 year periods, with the magnitude of this trend increasing over this time period. These results are corroborated by the MK test results (see Appendix 5.3), however as at Chisapani, trends are not found to be statistically significant.

In their recent paper, Bam et al. (2013) examined climate data trends for four meteorological stations in Bardiya District including Chisapani and Rani Jaruwa Nursery. Despite the significant limitations of this paper, discussed in the previous chapter, the authors draw similar conclusions to those outlined above, namely that mean annual temperatures at both stations have been increasing over the last 15 years.

Results from the surveys of community perceptions of climate change lend weight to the notion that temperatures around the BNP have been increasing over the last 20 years. Of those respondents who claimed to have observed temperature changes, 96% agreed that temperatures have been increasing, with the remaining 4% claiming that temperatures have become more variable. Indeed the most common perception in terms of temperatures was that, '*temperatures are increasing day by day*,' (e.g. RMSBVS, LRYDVS, and KBPDVS).

Location	Variable	Time Period	Test Applied	Test Results	Significance Level
Chisapani	Mean Monthly Maximum Temperature	1965 - 2011	M-K Seasonal Trend Test	Kendall's tau: -0.146 S': -1582.000 P value (two tailed): <0.0001 Alpha: 0.01	99%
Chisapani	Mean Monthly Maximum Temperature	1991 - 2011	M-K Seasonal Trend Test	Kendall's tau: 0.074 S': 1556.000 P value (two tailed): 0.116 Alpha: 0.01	99%
Rani Jaruwa	Mean Monthly Maximum Temperature	1985 - 2011	M-K Seasonal Trend Test	Kendall's tau: 0.121 S': 437.000 P value (two tailed): 0.003 Alpha: 0.01	99%
Chisapani	Mean Maximum Monsoon Temperatures	1965 - 2011	M-K Trend Test	Kendall's tau: -0.322 S': -277.000 P value (two tailed): 0.002 Alpha: 0.01	99%
Chisapani	Mean Minimum Monsoon Temperatures	1966 – 2011	M-K Trend Test	Kendall's tau: 0.323 S': 278.000 P value (two tailed): 0.003 Alpha: 0.01	99%
Rani Jaruwa	Mean Minimum Monsoon Temperatures	1986 - 2011	M-K Trend Test	Kendall's tau: -0.298 S': -97.000 P value (two tailed): 0.034 Alpha: 0.05	95%
Chisapani	Mean Maximum Winter Temperatures	1966 - 2011	M-K Trend Test	Kendall's tau: -0.259 S': -212.000 P value (two tailed): 0.017 Alpha: 0.05	95%
Rani Jaruwa	Mean Maximum Winter Temperatures	1992 - 2011	M-K Trend Test	Kendall's tau: 0.453 S': 86.000 P value (two tailed): 0.005 Alpha: 0.01	99%
Chisapani	Mean Minimum Winter Temperatures	1966 - 2011	M-K Trend Test	Kendall's tau: 0.266 S': 229.000 P value (two tailed): 0.013 Alpha: 0.05	95%
Rani Jaruwa	Mean Minimum Winter Temperatures	1992 - 2011	M-K Trend Test	Kendall's tau: 0.389 S': 74.000 P value (two tailed): 0.016 Alpha: 0.05	95%

Table 5.0-1 Selected MK and Seasonal MK test results, temperature data.

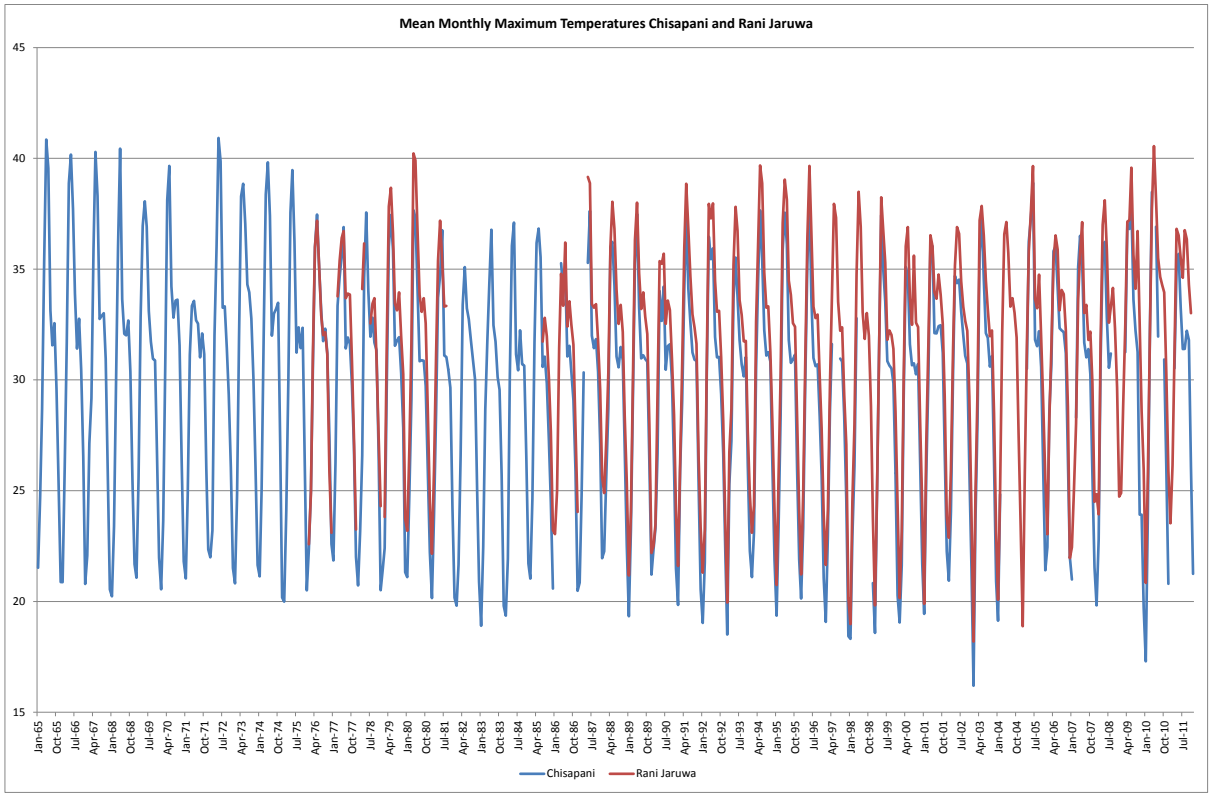

Figure 5.0.2 Mean monthly maximum temperatures at Chisapani and Rani Jaruwa.

No significant annual temperature trends were identified using the MK test at either Chisapani or Rani Jaruwa over any time period. Figure 5.2 plots mean monthly maximum temperatures at both locations, allowing the MK Seasonal Trend test to be applied, in order to uncover monthly trends in the data by accounting for the strong seasonality of the Nepali climate. Whilst no significant trends were identified for mean monthly temperatures at either Rani Jaruwa or Chisapani, the MK seasonal trend test identified a significant trend of decreasing mean monthly maximum temperatures at Chisapani over the 49 year time period but a significant increasing trend over the last 20 years (see table 5.1). No commensurate trends were identified for mean monthly minimum temperatures. At Rani Jaruwa Seasonal MK test results are less equivocal, finding statistically significant increasing trends in mean monthly maximum temperatures at Rani Jaruwa over 26, 20 and 10 year time periods. As at Chisapani, no significant trends were found in mean monthly minimum temperature at Rani Jaruwa.

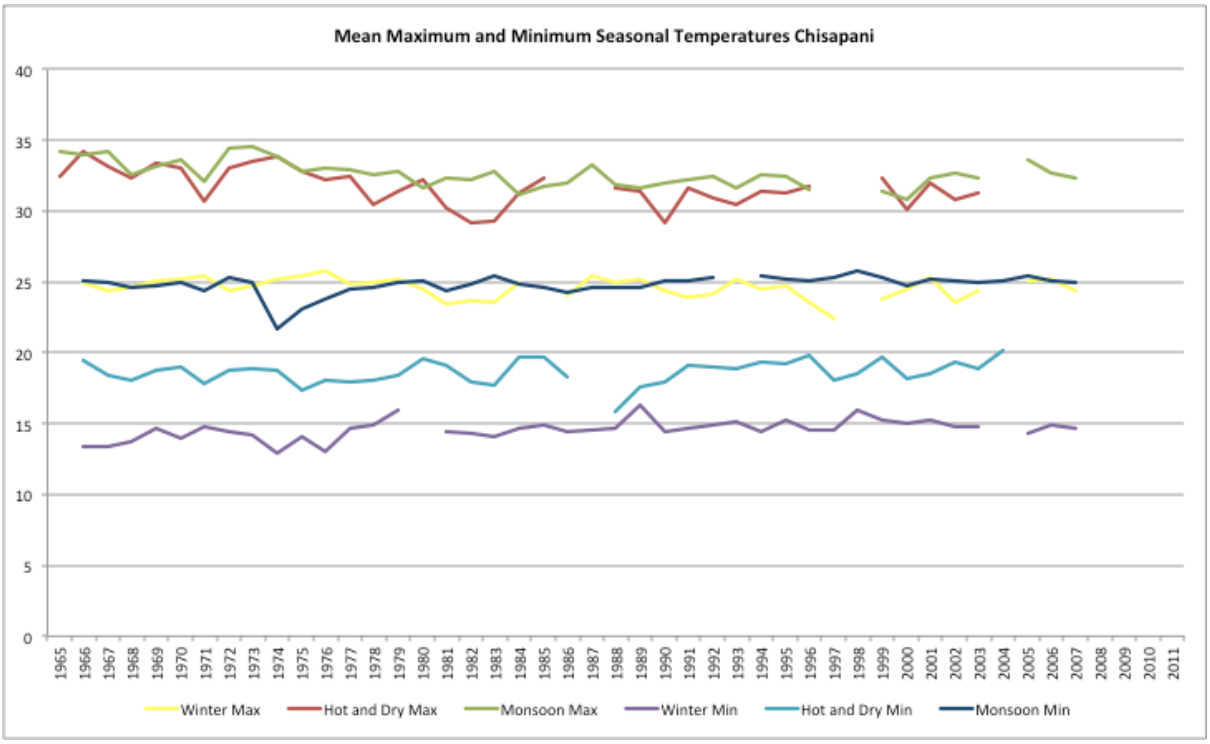

Figure 5.0.3 Mean maximum and minimum seasonal[10] temperatures at Chisapani.

Figure 5.3 provides a more detailed visualisation of seasonal temperatures at Chisapani, illustrating an apparent small decreasing trend in average seasonal maximum temperatures for all seasons. SLR trends corroborate this impression, indicating the presence of slight decreasing trends in maximum temperatures for all seasons, as do the results of the MK test which indicate trends of decreasing maximum winter and monsoon temperatures over the last 46 years (see Table 5.1). Conversely the data for average seasonal minimum temperatures indicates an apparent small increasing trend at Chisapani for all seasons suggesting reduced diurnal daily temperature variability; less extreme variation within days. This is substantiated by the SLR trends which indicate increasing minimum temperatures for all seasons, and the MK test results over 46 years which highlight significant trends of increasing minimum temperatures in the winter and monsoon seasons, with P values of 0.013 and 0.003 respectively.

[10] As outlined in Chapter Four the climate in Bardiya is strongly seasonal. For the purposes of this analysis Winter is defined as running from 1st October to 31st January, the Hot and Dry season from 1st February to 31st May, and the Monsoon season from 1st June to 30th September. Officially the start of the monsoon season in Nepal is defined as, "the day with at least 25mm in 1 or 2 days starting after 1st June," (Karmacharya 2010 p.4).

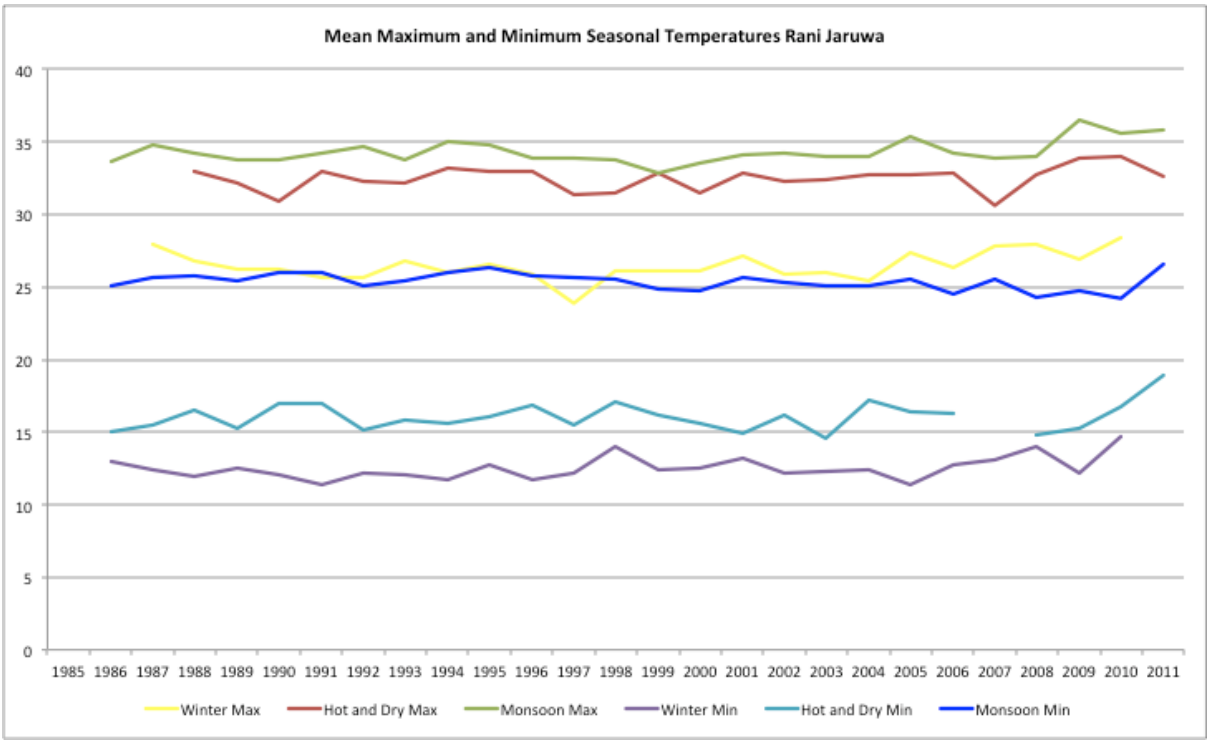

Figure 5.0.4 Mean maximum and minimum seasonal temperatures at Rani Jaruwa

Although the plot of mean maximum seasonal temperature data for Rani Jaruwa highlights no apparent trend (Figure 5.4), SLR trends suggest that maximum temperatures are increasing for all seasons although these trends are only found to be significant in the winter season, over the last 20 years. Average seasonal minimum temperatures at RJ for both the hot and dry and winter seasons appear to be increasing whilst there is an apparent decreasing trend during the monsoon. MK test results identify a significant trend of falling minimum monsoon temperatures and increasing minimum winter temperatures, over the last 26 and 20 years respectively (see Table 5.1).

96% of survey respondents from all locations who documented their perceptions of seasonal temperature changes were of the opinion that winter temperatures are increasing, substantiating the temperature readings discussed above. There was less consensus regarding summer temperatures as only 71% those that responded to this issue were of the belief that summer temperatures have increased (only one respondent was of the opinion that summer temperatures have decreased – the remainder all said '*no change*'). This could be, in part, due to the fact that summer temperatures in Bardiya are so extreme, with temperatures regularly exceeding 40°C in May and June, that a small difference in maximum temperature may be less perceptible than comparative changes in winter temperatures.

Whilst survey respondents did not explicitly refer to changes in maximum and minimum temperatures such changes were often implied in their responses. Respondents, through reference to a number of environmental indicators including winter frosts and the persistence of mosquitos during the winter season implied that minimum winter temperatures at all survey locations have been increasing. As a respondent from Manau village observed, '*When I was young we used to see the frost but now we don't in the winter season so the temperature is definitely rising*,' (STMVS). Another respondent concurred, '*It used to be very cold in the winter here, and there used to be frost, but now we don't have any*,' (STFMVS).

Further evidence for rising minimum winter temperatures comes from numerous other respondents including YRT from Dalla who observed that, '*20 years ago in our village we did not suffer from mosquito throughout the year but now we have to use mosquito net throughout the year*.' A sentiment echoed by AB from Chisapani who observed that over the last 20 years, '*temperatures are increasing in January, now mosquito are also biting in January*.' These results echo those of Bam et al. (2013) whose findings highlighted the increased use of mosquito nets in the winter months as an indicator of increasing temperatures.

The lack of equivalent environmental indicators for summer temperatures is perhaps reflected in the fact that a lower proportion of respondents perceived increases in summer temperatures. As one respondent from Manau observed, '*In relation to temperatures in the summer season I am not sure whether there have been any changes, it is hard to say. I can't say because I don't have any evidence*,' (STFMVS). In addition, none of the survey respondents referred specifically to temperature changes during the monsoon season and this is perhaps a function of the fact that during the monsoon season, rainfall is the issue of greatest concern rather than temperatures.

Overall, then, the evidence from the temperature records at Chisapani and Rani Jaruwa indicate that, although no significant trends in mean annual temperatures were identified, mean monthly maximum temperatures have been increasing at both Chisapani and Rani Jaruwa over the last 20 and 26 years respectively. Data from community perception surveys appears to substantiate these findings with the majority of respondents contending

that temperatures have been increasing over the last 20 years. Broad agreement was found between each of the survey sites suggesting that temperature changes are being similarly experienced across the geographical study area. Both weather station data and community perceptions concur that winters have become less cold than they have been in the past, however trends relating to changes in the hot and dry and monsoon seasons are less pronounced. In terms of the latter, rainfall patterns are undoubtedly of more interest, and these are examined in more detail in the following section.

5.2.2 Rainfall

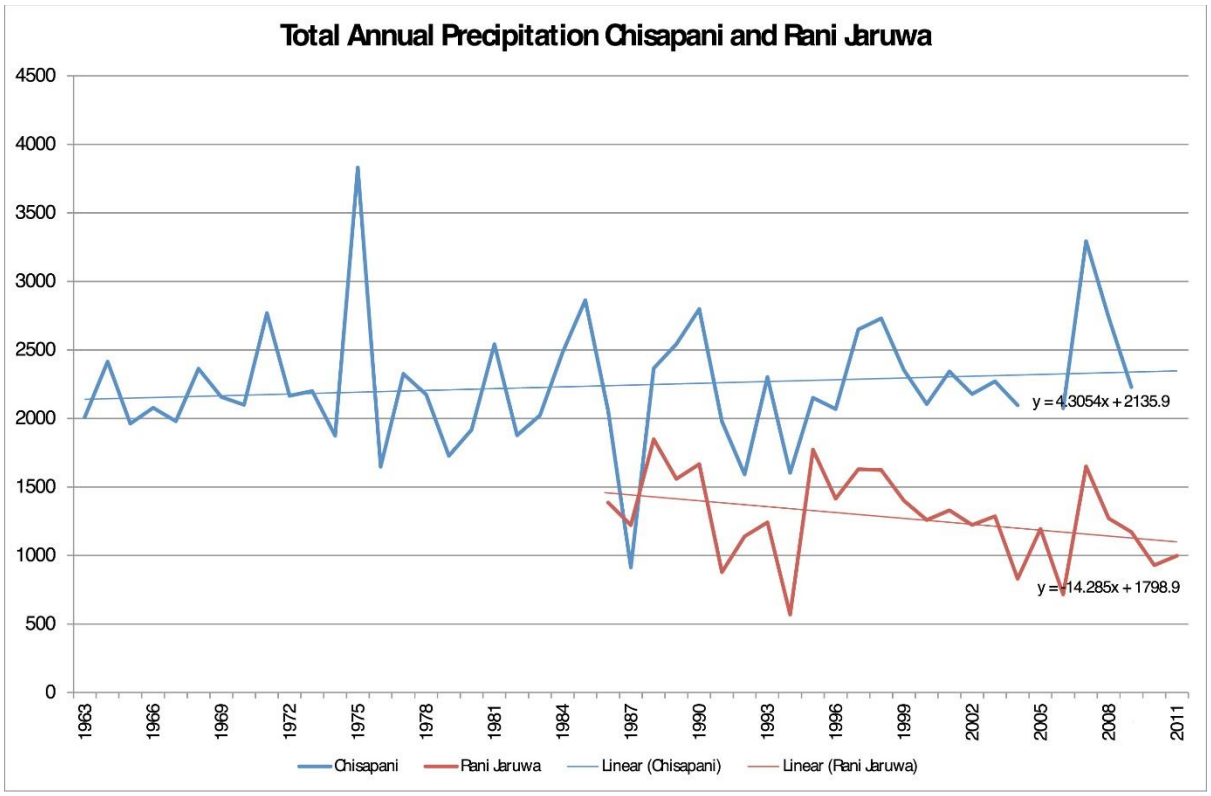

Figure 5.0.5 Total annual precipitation at Chisapani and Rani Jaruwa

In addition to the temperature records from Chisapani and Rani Jaruwa, discussed above, precipitation records for both stations were plotted against time to uncover trends. Figure 5.5 illustrates that total annual precipitation at Chisapani shows a modest increasing trend over the full 47 year period, with SLR trends over the last 10, 20 and 30 years for which data is available also indicating increasing trends (see Appendix 5.2). Analysis of the data using the MK trend test indicates, however, that these trends are not significant (see also Appendix 5.2). At Rani Jaruwa, SLR trends suggest that there is a decreasing trend over all time periods with plots over the last 20 and 10 years for which data is available indicating

that total annual rainfall is decreasing at a slower rate over the more recent past. The MK test results (see table 5.2) corroborate this finding, identifying, with a high level of confidence (P=0.047), a drying trend at Rani Jaruwa over the last 26 years.

In terms of survey results, 89% of respondents were of the belief that total annual precipitation has been decreasing or becoming more variable over the last 20 years, with no clear differences by survey location, lending weight to the recorded climate data trends from Rani Jaruwa. A respondent from Manau neatly summarised the prevailing opinion of respondents, *'In the past we used to experience lots of rainfall and big storms, and there was water throughout the year in the irrigation canals; now there is no more rainfall and the canals are dry*,' (JLMVS).

Similarly 71% of those at Chisapani were of the opinion that rainfall has decreased or become more variable over the last 20 years, and whilst this represents the lowest proportion of respondents by location it remains a marked contrast to the recorded precipitation data discussed above. There are a number of possible reasons for this disparity. If the climate data is accepted as being accurate then the assumption must be that local perceptions of changes in precipitation are inaccurate. This could be due to the fact that, unlike the other survey sites, Chisapani is a relatively large settlement whose primary function is as a market town and centre for local tourism rather than agricultural production. Only two of the respondents from Chisapani were employed in agriculture and respondents may, therefore, have been less aware of changing precipitation patterns as their lives and livelihoods are not inherently linked to the weather in the same way that those of a farmer are.

However, given the broad agreement between the perceptions of respondents from this location of precipitation changes, and given the assent in perceptions of precipitation trends between respondents from this and the other survey sites, it seems possible that the climate records are at fault in this case. This could be due either to the inaccurate recording of data at this station, to the influence of missing data on precipitation trends (discussed in detail in Chapter 3) or, perhaps, to the location of the weather station.

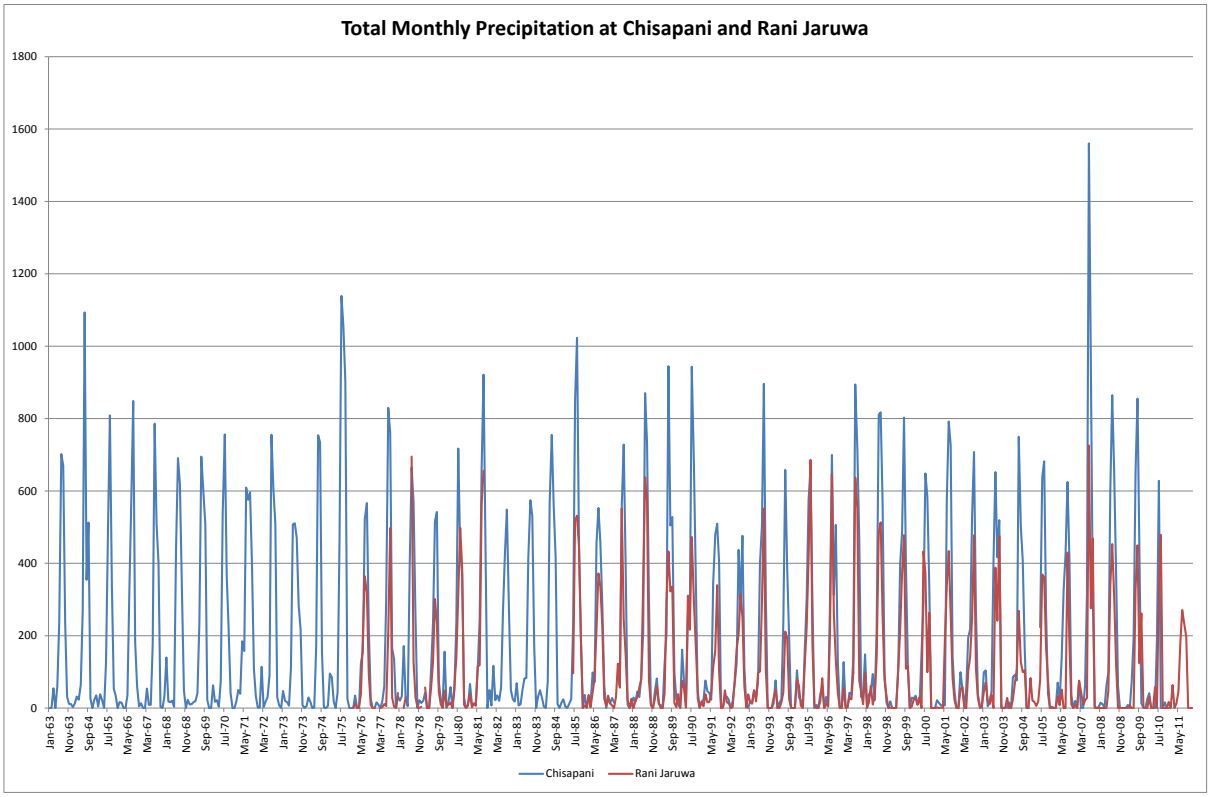

Figure 5.0.6 Total monthly precipitation at Chisapani and Rani Jaruwa

Location	Variable	Time Period	Test Applied	Test Results	Significance Level
Rani Jaruwa	Total Annual Precipitation	1986 - 2011	M-K Trend Test	Kendall's tau: -0.280 S': -91.000 P value (two tailed): 0.047 Alpha: 0.05	95%
Rani Jaruwa	Total Monthly Precipitation	1986 - 2011	M-K Seasonal Trend Test	Kendall's tau: -0.169 S': -591.000 P value (two tailed): <0.0001 Alpha: 0.1	99%
Rani Jaruwa	Number of Wet Days/Year	1986 - 2011	M-K Trend Test	Kendall's tau: -0.540 S': -174.000 P value (two tailed): <0.0001 Alpha: 0.1	99%
Rani Jaruwa	Number of Wet Days/Month	1986 - 2011	M-K Seasonal Trend Test	Kendall's tau: -0.299 S': -1032.000 P value (two tailed): <0.0001 Alpha: 0.01	99%
Rani Jaruwa	Monsoon Precipitation	1985 - 2011	M-K Trend Test	Kendall's tau: -0.276 S': -97.000 P value (two tailed): 0.045 Alpha: 0.05	95%
Chisapani	Winter Precipitation	1980 - 2009	M-K Trend Test	Kendall's tau: -0.284 S': -115.000 P value (two tailed): 0.032 Alpha: 0.05	95%

Table 5.0-2 Selected MK and Seasonal MK test results, rainfall data

The MK seasonal test applied to monthly precipitation data at Chisapani (see Figure 5.6) to highlight trends in total monthly rainfall found no significant trends over any time period. In contrast, there is evidence from the MK Seasonal trend test of a statistically significant trend of decreasing monthly rainfall at Rani Jaruwa over last 26 years (see Table 5.2). Kendall's Tau over all time periods suggests the presence of a small positive correlation between total monthly rainfall and time. S values suggest the trend is strongly negative, that is to say total monthly rainfall at Chisapani shows a negative trend when examined over the last 26 and 20 years.

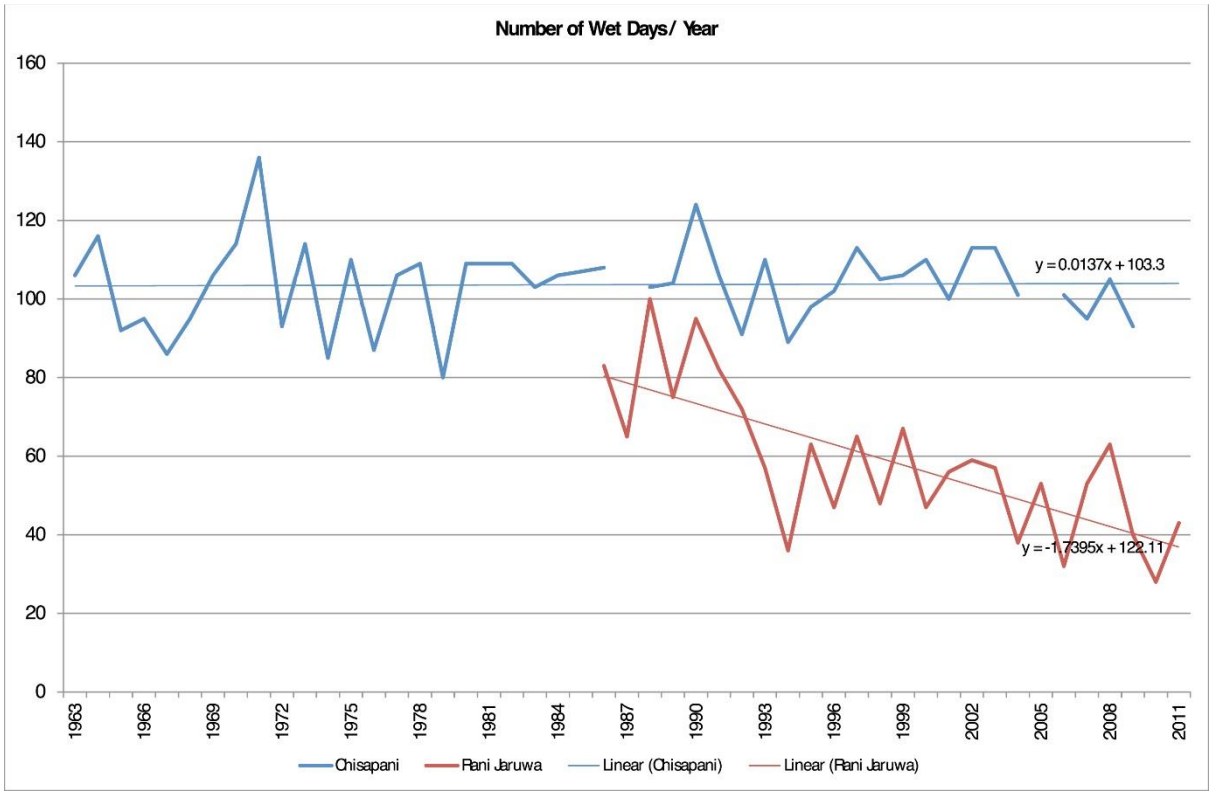

Figure 5.0.7 Number of wet days per year at Chisapani and Rani Jaruwa

A visual inspection of Figure 5.7 suggests that the NWD/year at Chisapani has remained relatively stable. Applying SLR to the data over different time periods highlights a decreasing trend in the NWD over the 30, 20 and 10 year time periods, with the NWD/year decreasing at a more significant rate over the more recent past. The MK seasonal test was used to examine trend for NWD/month, however no significant trends were detected over any time period (see Appendix 5).

At Rani Jaruwa SLR trends suggest that there is a decreasing trend over the 26, 20 and 10 year time periods, with the NWD/year decreasing at a more significant rate when viewed over a 26 year timeframe, likely a result of the apparent step change around 1992. Results of the MK Test indicate the presence of a statistically significant decreasing trend in the number of wet days per year at Rani Jaruwa over the last 26 years for which data are available (see Table 5.2). Kendall's Tau suggests the strongest negative correlation between total NWD/year and time is over a 26 year timeframe whilst S values suggest the trend is negative, that is to say the NWD/year at Rani Jaruwa has been decreasing over all time periods.

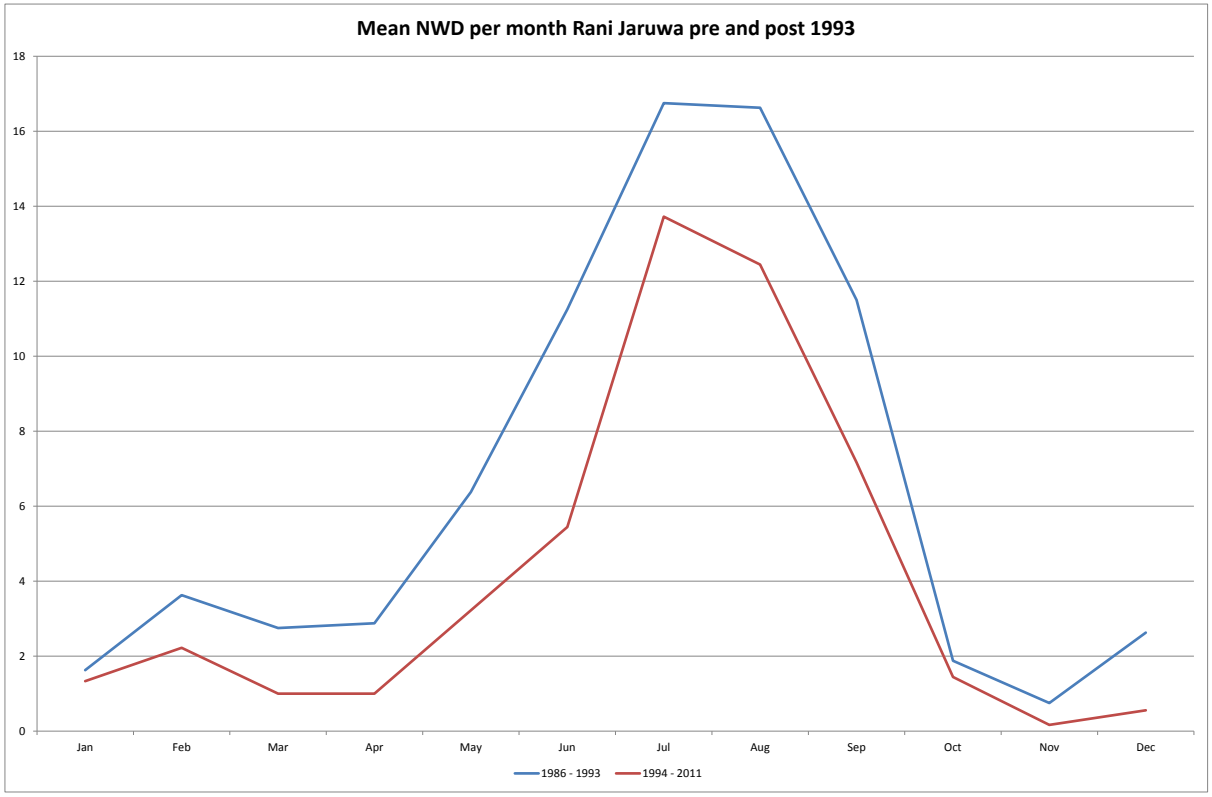

Figure 5.0.8 Mean NWD/Month Rani Jaruwa, pre and post step change

It is important to consider the potential interference of the apparent step change in the NWD at Rani Jaruwa around 1992 highlighted in Figure 5.7. Figure 5.8 plots the mean NWD/month at that location for the periods before and after that date, demonstrating that that mean NWD/month has decreased in all months with biggest drop experienced in June, suggesting late onset of the monsoon season. May, July, August, and September, have also seen significant decreases in NWD representing either a significant reduction in monsoon season precipitation or if this is not the case, a significant increase in the intensity of rainfall events over this period.

Survey responses provided evidence to support a trend of fewer rainfall events characterised by increasing intensity. As STBVS observed, '*50 years ago a lot of rainfall occurred. We used this rainwater in crop irrigation and we used to grow well… When rainy season started it was fixed and now it is not fixed, if rainfall starts it continues for 4 or 5 days so we are now facing a problem of floods*.' A farmer from the same village observed that, '*it used to rain with lower intensity but for a long time and now it rains with a high intensity*.' (BPTMVS).

A respondent from Dalla portrayed a similar situation. '*Compared to 25 years ago rainfall intensity is now completely different. 25 years ago a lot of rainfall occurred, we used this rainwater in irrigation and our crops used to grow well… Now if rainfall starts it continues heavily for 4 or 5 days so we are facing flood problems in farming*,' (BBKDVS). Another respondent noted that:

'*When I was child it used to rain a lot but this rate is diminishing. Now if rainfall starts then it continues for 3-4 days, and a result of this rainfall is that all the settlement is damaged by flood. All the agriculture land is washed out by flood. When we planted our paddy in our fields floods wash them out, this is the main problem of heavy rainfall*,' (GYTDVS).

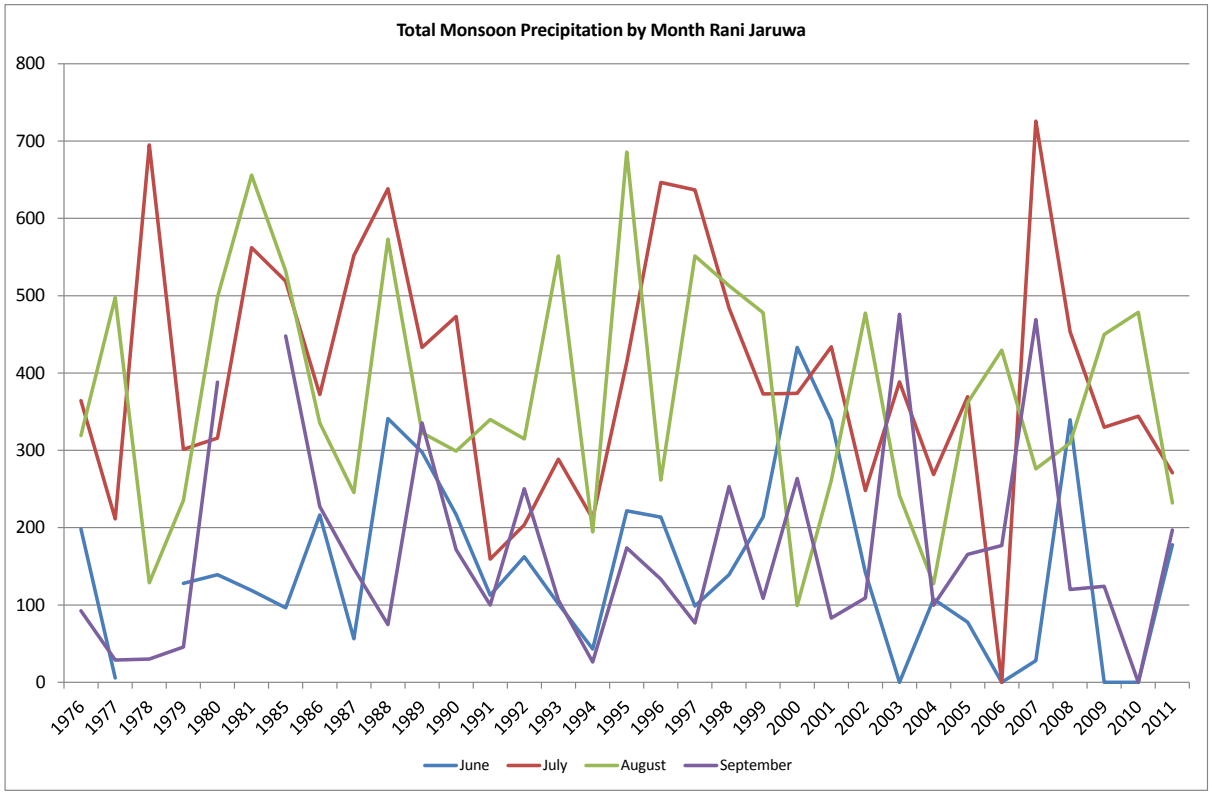

Figure 5.0.9 Total monsoon precipitation by month Rani Jaruwa

Given the marked decrease in monsoon rainfall events at Rani Jaruwa illustrated in Figure 5.8 and the apparent increase in intense rainfall events highlighted through the survey, it is important to examine total monthly precipitation during the monsoon season. Figure 5.9 demonstrates that June, July, and August show decreasing trends whilst September is getting wetter, providing further evidence of a delayed monsoon season. Variability is increasing for all months. SLR trends suggest that there is a trend of decreasing monsoon season rainfall over the 27, and 20, year time periods (see Appendix 5). The results of the MK test (Table 5.2) highlight a negative correlation between total monsoon season rainfall and time. Correlation is greatest over the 27 year period with S values suggesting the trend is negative, that is to say total monsoon rainfall at Rani Jaruwa is decreasing over all time periods. The MK test results highlight a significant trend of decreasing monsoon precipitation at Rani Jaruwa over the last 27 years.

At Chisapani, in contrast, no apparent precipitation trend was detected for any month during the monsoon season. SLR trends suggest that there is a slight increasing trend over all time periods with total monsoon rainfall increasing at a faster rate over the more recent past, however the MK test results indicate that there are no significant trends at Chisapani over any time period. This disparity between precipitation trends at both locations may,

perhaps, be due to their distinct locations and to associated topographical factors which, as Jones and Boyd (2001) observe, can play an important role in local climate. Rani Jaruwa Nursery is located on the low lying Terai plain to the south of the park, whilst Chisapani is nestled on the southern slope of the Churia Hills. Sill and Kirkby (1991 p.60) document the rain shadow effect that occurs to the north (lee-side) of the Churia Hills and, given the location of Chisapani on the south side of the Churia Range, this provides a plausible explanation for higher rainfall at that site.

Responses obtained from community surveys provide further evidence of the changing seasonality of rainfall documented in the climate record at Rani Jaruwa. 62% of all respondents perceived that the onset of the rainy season has been delayed, with this figure rising to 97% when increasing variability in start date was taken into account. As with total annual rainfall there was little discernible pattern by location. As a farmer from Manau Village attested, '*we used to have to put our umbrella hats on our heads when we went out to the fields and we didn't take them off until we came home. These days we finish sewing our paddy before the rain starts and we have to use groundwater*,' (STFMVS). A respondent from Chisapani recounted a similar tale, '*I am remembering when I was child. At that time farmers farming time was the same every year, fixed, but now days are changing for the timetable or month of farming. I think it is because the rainy season start time is changed so farmer are also changing their time*,' (GSCVS).

Respondents broadly agreed that in the past the monsoon season regularly started between the last week in May and first week in June. The significance of the timing of the start of the monsoon season is a result of its importance for traditional farming practices. As HBK from Chisapani elaborates, '*30 years ago the rainy season started timely, in first week of June, and ended September… the crop farming and rainfall seasons matched and a huge quantity of crop was grown by farmers*.' Another respondent, a farmer from Dalla, had experienced similar changes, '*25 years ago we used rain water for paddy cultivation and got huge quantities because our farming time and rainfall time was matching. Now we are using water pumps for drawing water from the ground and river because our cultivation time and rainfall time is not matching*,' (CLTDVS).

Of the respondents who specified a new start date for the monsoon season the majority, such as JRT from Dalla, claimed that it now begins in July, '*The rainy season is starting later,*

the time is shifting. Now it starts in the last week of July and after 25 days the rainy season is finished so we are obligated to use chemicals and pesticides because we cannot grow the crop in time,' (JRTDVS). Others noted that the timings are more variable than in the past, '*25 years ago the rainy season was at a fixed time, and then duration of rainfall was also fixed… but now it is not fixed. Some years it [the monsoon] starts from the first week of June, some year it starts from last week of July*,' (RYDVS).

Far fewer respondents specified a new end date for the monsoon season although some claimed that the monsoon season is now much shorter, lasting as little as 15 days. This limited consensus around the monsoon end date may be a symptom of the fact that the end of the wet season hasn't changed significantly or, more likely, as a consequence of the fact that in agricultural terms the monsoon start date is of far greater importance as it is intimately linked to agricultural patterns and planting regimes.

The findings from these surveys, along with the precipitation data from the Rani Jaruwa weather station, combine to paint a picture of reduced annual and monthly precipitation, with fewer wet days per year combined with increasingly intense rainfall events. They provide robust evidence that the start of the monsoon season has shifted towards July, and that this has impacted upon the agricultural practices of farmers around the BNP. These results are supportive of the findings of Bam et al. (2013) who document the delayed monsoon and the associated agricultural impacts that this brings.

Despite the apparent unambiguity of these findings, it is important to add a note of caution. As discussed in Chapter 3, the strength of these results and the significance of the climatic trends identified are determined, to a large degree, by the quality of the climate data available (Linacre 1992). The inaccurate recording of data, the influence of missing values and outliers, and changes in measurement practices may all have impacted upon the quality of these data (WMO 2011). The limited length of the climate record available, and limitations relating to the analysis of these data such as the impacts of auto-correlation (Chandler and Scott 2011) further require that these apparent trends be viewed with some caution.

That said these changes in precipitation patters, in conjunction with the temperature changes outlined in the previous section, appear to constitute a new and urgent threat to

the success of conservation efforts in the BNP. Climatic changes including the delayed monsoon season, reduced rainfall, warming winters, and increasing maximum temperatures, increasingly threaten the integrity of the park's ecosystem whilst simultaneously heightening human pressures on park resources. As one high level park official explained, '*climate change is a major issue in every corner of the world and every time temperatures or rainfall change it leads to changes and other things change. For example wildlife change their habitat and they and we all have to adapt to new conditions*,' (ABBNPMA).

The recognition of the perception of climate change as a driver of change facing the park is exemplified by its inclusion, for the first time, in the 2012-17 park management plan. This document highlights the role of climate change in increasing pressures on the park's natural environment, and directly impacting upon the park's wildlife and the habitats that it provides. The plan contends that as a result of climatic changes, "fragile ecosystems and species which are already at risk may be pushed over the edge," (GoN 2012 p.22). The park's Chief Warden provided a more specific account of climate impacts upon their operations:

'Because of the climate change, right, we are facing the long drought in the hot summer season… we lost some guard post from the thunderstorms and the long drought can impact on the habitat of wildlife. Sometimes the waterholes dry up, animals move out from that area to search the waters, right, then that is a problem,' (TRABNPMA).

This statement highlights some of the ecological impacts of the climate variability that could be associated with climate change, but also alludes to some related impacts with which park managers are having to contend. As the park ecosystem becomes drier and water and food scarcer, animals from within the park increasingly range outside park boundaries leading to increased incidence of human-wildlife conflict (discussed in Section 5.3.1). Correspondingly, reduced agricultural productivity resulting from changing climatic conditions increases the likelihood of buffer zone residents entering the park illegally to extract natural resources.

Furthermore, these climatic changes impact upon a number of additional facets of environmental change. Reduced water availability within the park and buffer zone, the

associated rate of grassland succession, the proliferation of Ban Mara, and the rising frequency and intensity of forest fires, discussed in the following sections, are all posing related challenges to conservation outcomes. Taken together these drivers of organisational change represent the foremost challenge threatening the success of the BNP, to which the BNPMA must effectively respond.

5.2.3 Water Availability

In addition to the climatic changes, discussed above, water availability was found to be a significant environmental challenge facing the BNPMA, specifically in relation to the Geruwa branch of the Karnali River which borders the western boundary of the park. Semi-structured interviews with key stakeholders highlighted the importance of this challenge in the pursuit of successful conservation outcomes by park managers.

The Karnali River, or '*Restless River*' as one respondent referred to it (DGBKMS), flows past the western edge of the BNP, dividing into two major channels south of Chisapani. The Geruwa branch of the river plays a vital role in the maintenance of the park's riverine ecosystems (discussed in more detail in Chapter Four) however in recent years this branch of the river has experienced rapid drying. As a Senior Game Scout from the park observed, '*one important challenge is that the main stream of the Karnali river is now running very very low and most of the water now flows in the channel away from the park. This has had serious impacts on the park*,' (MrNBNPMA). Another respondent, a member of a Buffer Zone Users Committee, reminisced that in the past, '*the river that you see beside the Hattisar [the Geruwa], and even across the river, these rivers were full of water throughout the year and people had to cross using the boat but nowadays they can go on foot*,' (NCTBZUC).

The implications of the Geruwa drying are severe, given the river's role in maintaining the riverine ecosystem grassland which supports the highest concentrations of biodiversity within the park, and provides the most appropriate habitat for the parks megafauna. The drying of this branch of the river therefore has potentially disastrous consequences for the park's biodiversity. Aquatic species such as the Gangetic dolphin, and ghadiyal crocodile are no longer supported by the increasingly shallow river, and mammal species that reside within the riverine grasslands are losing their habitat and experiencing severe water shortages. As SP (BCFUG) noted, '*this forest gets older and older, then this river floods*

again. When it moves like this it really renews the land and brings new species, a very new type of atmosphere. But when this river sticks some way away then suddenly this land gets old and old and the grassland disappears, and the water holes of course.'

The drying of this branch of the river is having additional impacts on the human populations residing near the park. Not only are these residents contending with the reduced rainfall and changing monsoon patterns described in the previous section, the drying river has radically reduced the amount of water available to them to irrigate their crops. As one of the BNP's Assistant Wardens summarised, '*This is now causing a problem in the park, particularly problems for dolphin and ghadiyals and birds and also the local people are affected because there is no longer water available for them to irrigate their crops and they have no alternative sources of water*,' (RKTBNPMA).

The impacts of such changes are particularly keenly felt in communities residing between the two branches of the Karnali, including Manau, the location for one of the perceptions surveys. Respondents from this village were at pains to stress the impacts of the drying of the Geruwa branch of the Karnali observing that, '*the river that flows by this village used to be very deep but now it is very shallow. We used to get roofing grass from the riverbank but now this is lost*,' (NCMVS). Not only then are these communities losing the water required to irrigate their cops, but also other vital natural resources provided by the riverine ecosystem.

Whilst the scale and potential severity of this challenge is not in question, the causes of the river drying are less well defined. A number of interview respondents attributed these changes to natural environmental changes, including the increased availability of sediment upstream leading to sedimentation of the Geruwa, whilst others saw it as the natural result of the 'Restless River's' meandering. The majority of respondents however were of the opinion that these changes were a result of human activities including the removal of stones and gravel from the western branch of the river, and the creation of a new irrigation channel at Chisapani. As one of the park's conservation partners elaborated, *'one of the main causes is the extraction of gravel and sand from the riverbed of the western branch of the river. Where the river flows inside the buffer z one the park can manage and limit this extraction of gravel and sand but those areas where it flows outside the park don't fall under the same rules*.'

Analysis of river discharge data (see Appendix 5.4) at Chisapani would appear to support the theory of anthropogenically driven changes in riverflow since, as illustrated in Figure 5.10, mean annual river discharge has been very stable at Chisapani over the last 47 years, particularly when the dry period around 1965 is taken into account.

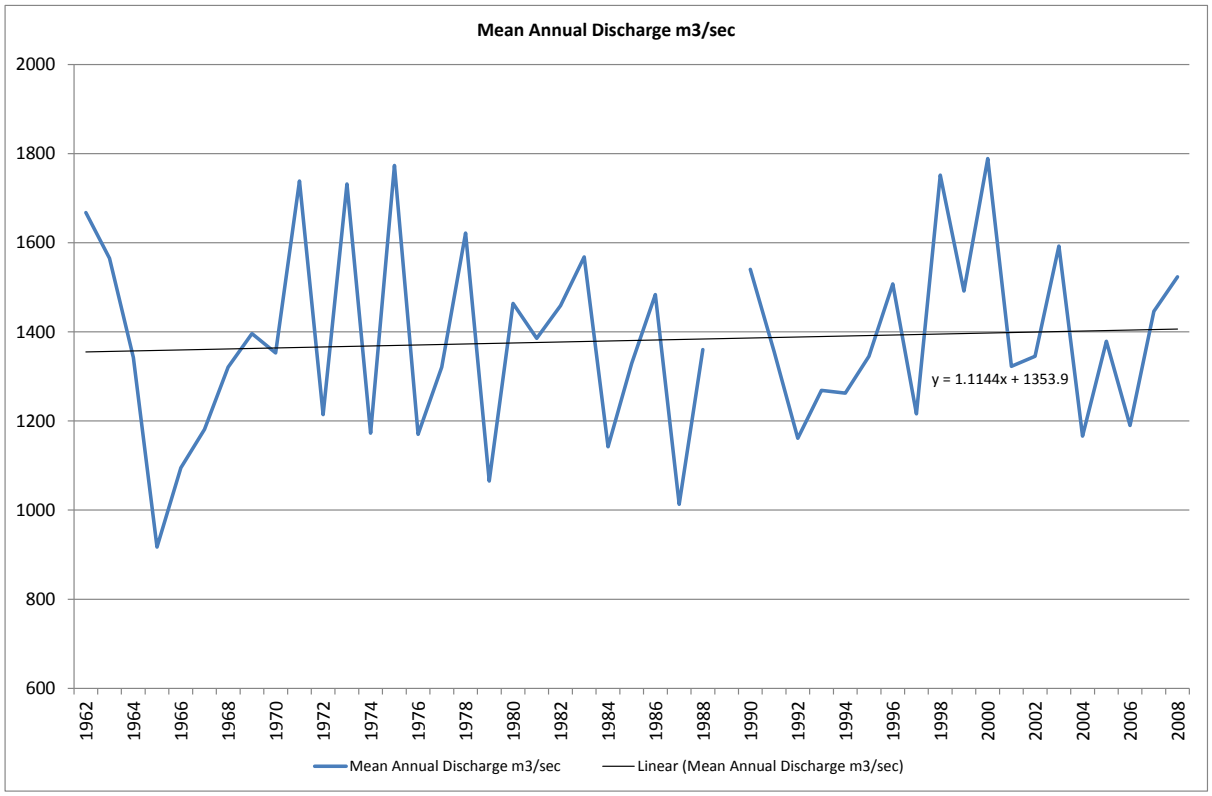

Figure 5.0.10 Mean annual river discharge at Chisapani.

MK trend test results indicate the presence of a significant trend of increasing monthly river discharge over a 30 year time period (see table 5.3 below). The hydrological station which records this data is situated above the section of river that splits into two branches, lending weight to the theories that the over-extraction of sands and gravels from the unprotected western branch of the Karnali, combined with increased water extraction for irrigation at Chisapani, have resulted in the rapidly receding river levels in the Geruwa branch of the Karnali.

Location	Variable	Time Period	Test Applied	Test Results	Significance Level
Chisapani	Mean Annual Discharge (m^3/sec)	1979 - 2008	M-K Seasonal Trend Test	Kendall's tau: 0.079 S': 412.000 P value (two tailed): 0.034 Alpha: 0.05	95%

Table 5.03 MK Seasonal Trend Test results for river discharge at Chisapani.

5.2.4 Grassland Succession

Closely linked to both the issue of reduced water availability around the park, and to the climatic changes discussed above, is the issue of the increasingly rapid succession of grasslands to forests, identified as a major challenge by a number of key interview respondents. As one of the park's Assistant Wardens summarised:

'The key challenge within the park is related to the grasslands and riverine forest where changes in climate have led to rapid succession of the ecosystems to forested land. Given the scarcity of the water in the park at the moment and the likelihood of increased droughts in the future this is the main future challenge of the park,' (ABBNPMA).

Respondents described how, over the last 15 years, the grassland habitats of the park have been changing with unpalatable species replacing palatable ones as a lack of water availability resulting from reduced and increasingly variable rainfall, as well as less frequent flooding from the Karnali river, have led to increased drought and reduced soil moisture content. This has resulted in changes in the composition of grass species supported by the park (ABBNPMA). The natural process of ecological succession was also highlighted as being an important factor in this changing make up of grasslands with the head of one of the parks conservation partners noting that, '*there is the succession, you know, the grassland after a long time it automatically is converted into the tree land, it's a natural phenomenon*,' (RKNTNC).

Although many of the respondents who spoke on this issue attributed these changes to climatic factors and to the natural process of ecological succession, it became clear that these outcomes were not devoid of direct human interference. As another of the park's key partners observed:

'*We have grassland in the park but it is artificial, it is not natural – it is actually a relic from the settlements and agricultural fields which used to be situated within the park boundaries. There are some natural grasslands in the park but very few, they are located along the river as the river floods and this plays an important role in maintaining the grasslands. When the park was established communities were evicted from inside its boundaries and so now the park has to maintain this grassland*,' (PKWWF).

Similarly, in the past local villagers were allowed to graze their cattle within the park boundaries and this ensured that there was no opportunity for ecological succession to occur. Now such activities are no longer permitted within the core area of the park the succession of grasslands to forest is occurring at a much faster rate.

The importance of the park's grasslands for both the biodiversity supported by the park, and for local populations, cannot be underestimated. Over and above the undoubted importance of the riparian grasslands, discussed in the previous section and in Chapter Four, in providing the appropriate habitat for a large variety of the park's biodiversity, the park's grasslands also have a specific role to play in the conservation of an iconic species; the Royal Bengal tiger. The grassland represents the park's key habitat for its ungulate species and is therefore vital in ensuring the maintenance of sufficient prey numbers for the park's large carnivores.

An additional key motivation for ensuring the effective maintenance of the park's grasslands was highlighted by the Chief Warden:

'*If you are not going to manage the habitat then animals can move out and it can create the problems with the local communities, they can enter to the village and cause problems, right. If you maintain your grasslands then the animals generally stay in the grassland and never go to the village, that is one of the important things*,' (TRABNPMA).

The challenges posed by these issues of human-wildlife conflict are looked at in more detail in section 5.3.1 of this chapter.

A further challenge related to the rapid succession of grasslands to forests, is that as part of this transition grasslands develop into scrublands which provide an ideal habitat for a number of invasive species. As one respondent observed, '*Scrubland means the, you know, Lantana Camara, commonly the Bardiya gets lots of Lantana Camara, and that is the major problem. I think that this is an environmental challenge for us*,' (RKTBNPMA). The challenge of invasive species in ensuring the successful conservation of the BNP is considered in more detail in the following section.

5.2.5 Invasive Species

The presence and growing prevalence of invasive species within the BNP, particularly Lantana Camara known locally as Ban Mara (literally 'forest killer') a woody shrub that has spread rapidly throughout the national park over the last 20 years, is posing a new and growing challenge to the successful management of the park's ecosystems. Ban Mara spreads quickly and densely, particularly in unforested areas, reducing the diversity of native species, compromising soil fertility, and inhibiting the process of natural ecological succession (Taylor et al. 2012). Furthermore the plant's ability to outcompete native grasses reduces food availability for the park's ungulates for whom it is an unpalatable species, potentially resulting in reduced numbers of prey species for the parks large carnivores. As a senior nature guide for the park observed:

'You can see this what we call Lantana Camera, Lantana, this is spreading everywhere in the forest, this is another challenge you know. This grass is killing every other tree. This was not native when I started my guiding, this you could see only one plant maybe but now it is really spreading and this kind of thing is bringing some really big challenges,' (SPBCFUG).

The invasion of Lantana is most severe along the Karnali floodplain, and the only effective means of removing it and preventing further spread is through the labour intensive and expensive process of digging it up. One of the park's key partners documented the painstaking process through which this is achieved:

'*If we burn Lantana it again grows up and it spreads everywhere. It spreads densely, you know. For half a month there is no Lantana but then again lots of sprouting comes and covers the area. If you remove the Lantana by digging out, only one year digging it does not completely remove the Lantana... If we remove again the 2nd year the same as in the 1st year, if you needed 100 labour [the first time], then the 2nd year you need only 10 labour, and in the 3rd year you need only 2 labour; if you continue for 3 years then you can totally remove the Lantana*,' (RKNTNC).

More recently, however, an unanticipated benefit of this Ban Mara invasion has come to light. Villagers removing Lantana from their community forests have been converting the dead plants into briquettes for fuel. In an area where legal sources of fuel wood are in short

supply this unforeseen advantage could work to reduce the human pressures on the park described later in this chapter.

5.2.6 Fire

The final environmental challenge cited by interview respondents as an important challenge facing the BNPMA in pursuit of their goals, was forest fires. As a manager from the National Trust for Nature Conservation in Bardiya noted, *'sometimes it is quite intense and it is very difficult to manage; even last year the BNP had some intense forest fires. Every year the intensity of forest fires is increasing*,' (SKTNTNC).

In their interview responses, park managers presented a more nuanced account of this challenge, distinguishing between the role of natural and managed forest fires in the regeneration of forests and grasslands, and the increase in fire events resulting from human activities. The Chief Warden observed, '*generally we do not mind about the fire because our forest needs that*,' (TRABNPMA) whilst also noting the usefulness of fire as a cost effective grassland management tool. The challenge for park managers then, is not those fires that occur naturally as part of the park's ecosystem processes, or those intentional fires used to manage the parks grassland, rather it is the increased frequency and intensity of these fires resulting from reduced water availability within the park, and human activities. The Chief Warden believes that in recent years many fires have started outside the park boundaries and spread to the core area. He also highlighted the incendiary contribution of poachers and honey collectors who enter the park illegally and set fires which can then spread if they are not extinguished. The challenges posed to the park through such park-people conflicts are considered in more detail in Section 5.3.2.

5.3 Anthropogenic Change

Whilst the distinct components of environmental change discussed above have, to varying degrees, anthropogenic traits, this study identified a number of additional drivers of change that result more exclusively from human actions. Anthropogenic change in this context refers to those new challenges facing the BNPMA, which result from the presence of human populations around the park and the actions that they undertake in their day-to-day lives. Around the BNP such changes are heavily influenced by the rapid population growth which began in the 1970s following the control of Malaria in the area, and has continued apace. In Bardiya District, population density increased from 65.33 to 211 people

per km^2 between 1971 and 2011, with total population increasing from 101,793 to 426,576 over the same period (ICIMOD 2003, GoN 2012). Such significant increases in human populations have undoubtedly served to increase pressures on natural resources, particularly in the rural context of the park, where livelihoods are heavily dependent upon farming and the utilisation of forest resources and alternative livelihoods options extremely limited.

Anthropogenic drivers of change were cited by semi-structured interview respondents as a key driver of change. Whilst this category was found to represent a less significant driver of change than the environmental changes outlined in the previous sections, it nevertheless constitutes an important grouping of challenges to which the BNPMA is having to respond. Within this category the role and influence of international agreements and organisations was found to be the preeminent challenge. Although predominantly operating at the international level, international agendas retain a significant influence at the grassroots level, mainly due to the financial rewards that they provide to those undertaking initiatives in a way which complements their goals. Indeed, semi-structured interview responses highlighted their importance in driving changes within the BNPMA, with 49% of respondents citing this as a key driver of change.

Park-people conflicts were also found to have a significant influencing role on the operations of the BNPMA with 46% of respondents in Bardiya highlighting the importance of this challenge. The findings from the Game Scout focus group and Game Scout meetings, attended by the researcher, corroborated this whilst emphasising the specific issues this challenge posed for the BNPMA's field staff. The final significant component of anthropogenic change identified was human-wildlife conflict, cited by 44% of interview respondents. As with the issue of park-people conflict, data gathered from the Game Scout meetings and focus group again highlighted the specific importance of this to those park staff posted in the field.

In the following section these diverse dimensions of anthropogenic change are examined in more detail and their impacts upon the BNPMA, its aims, activities and operations, analysed. The links between these components of anthropogenic change are considered and the means through which the BNPMA identifies these challenges as a threat to the successful conservation of the BNPMA analysed.

5.3.1 Human-Wildlife Conflict

Human-wildlife conflicts occur when the lives of humans and wild animals converge. Such encounters have doubtless existed since the dawn of humankind, and today human-wildlife conflict is a common by-product of national parks and protected areas, where growing human and wildlife populations co-exist in artificially bounded geographical areas. The situation in the vicinity of the BNP is no exception to this and minimising incidence of human-wildlife conflict has become a key challenge facing the BNPMA in the effective conservation of the core park area and buffer zone. Indeed a recent briefing paper by the park's Chief Warden (Adhikari 2012 p.9) highlights the importance of human-wildlife conflict as a key challenge facing the organisation. The challenges associated with human-wildlife conflict are not limited to the immediate and tangible issue of the destruction of property, crops, and threats to human life, but run further, encompassing the resultant anti-park and anti-conservation sentiments that such events engender. This driver is therefore intimately linked to the issues of park-people conflict, discussed in Section 5.3.2.

Almost 90% of semi-structured respondents from Community Based Organisations referred to human-wildlife conflict as a key challenge, whilst three quarters of park staff cited it as a key driver of change in their organisation, with no distinct pattern by position within the organisation. The disparity between these two figures may be accounted for by the fact that the impacts of such conflicts are most readily apparent in the buffer zone communities within which these organisations work and in which their staff reside. Park staff, in contrast, are often posted in remote locations within the core area of the park, far away from buffer zone communities and therefore somewhat removed from these issues.

In the focus group human-wildlife conflict was the joint most coded reference and ranked as the second most important driver by percent coverage, demonstrating the perceived significance of this driver to park field staff. Analysis of the transcript from the first game scout meeting corroborates the findings from the focus group with human-wildlife conflict having the joint second highest number of references.

The concept of drivers of organisational change relates to *new* challenges faced by an organisation to which they are obliged to adapt their practices, procedures and activities, in order to maintain the effective pursuit of their goals. Human-wildlife conflict is not a new

phenomenon in Bardiya, and it could therefore be reasonably argued that in the case of the BNP it does not represent a driver of organisational change. However whilst this is undoubtedly an ongoing challenge facing the BNPMA, the significant increases in fauna populations protected by the park in recent years, in concomitance with the burgeoning human population in the buffer zone, has led to a rapid rise in human-animal encounters and therefore levels of human-wildlife conflict. Indeed this catch-22 situation in which improved performance by the park in pursuit of its overarching goal results in outcomes which are detrimental to its future success, is characteristic of a new driver of change.

Tables 5.4-5.7, below, show recent changes in wildlife population within the park's core area, limited by the species for which recent information is available.

Year	1995/96	1999/2000	2009	2012	2013
Breeding Tiger Population	30-32	32-40	17-29	37	45-55

Table 5.0-4 Growth in breeding tiger population in the Bardiya National Park (DNPWC/GoN. 2012, WWF Nepal 2013).

Year	1985	1993/1994	1997	2002	2012	2013
Adult Elephant Population	2	22	41	60	86	Over 100*

Table 5.0-5 Growth in adult elephant population in the Bardiya National Park (TAL 2011, DNPWC/GoN. 2012, ABBNPMA).

*unofficial estimate by park warden

Year	2000	2007	2008	2011
Adult Rhino Population	67	31	22	24

Table 5.0-6 Decline in adult rhino population in Bardiya National Park (DNPWC/GoN. 2012).

Year	1996	2001	2012
Adult Swamp Deer Population	73	100	105

Table 5.7 Growth in adult swamp deer population in the Bardiya National Park (HMG 2012).

Whilst rhino numbers have, until recently, been in decline due to increased incidence of poaching during the Maoist insurgency, the numbers of other species commonly associated with human-wildlife conflict have experienced significant increases. As a high level park official observed during one semi-structured interview:

'*In recent years elephant numbers have increased significantly and we now have more than 100 elephants in the park. The size of the park and the habitat that it provides at present is*

not really sufficient for these numbers of elephants and this results in elephants leaving the park and entering villages where they raid the community's crops,' (ABBNPMA).

Similarly human populations have been increasing exponentially in recent years with the population of the 20 VDCs bordering the park experiencing a 55% increase between 2001 and 2011 (GoN 2012). The impacts of these changes and the linkages between population growth and human-wildlife conflict were highlighted by an interview respondent working for one of the park's conservation partners who noted that, '*The key threats to conservation in the buffer zone include population growth, I mean human population, and this directly affects the forests and ... human-wildlife conflict*,' (Respondent PKWWF).

The inevitable result of this mutual growth in human and wildlife populations has been increased conflict. The BNP annual report 2012-13 (DNPWC/GoN. 2013) documents that between July 2012 and July 2013 two buffer zone residents were killed by elephants and a further two were injured. There were also 83 incidences of elephants destroying property. Rhinos were responsible for one death (during the grass cutting period) and one injury. Tigers were not responsible for any human deaths but had a significant impact on local livelihoods, killing six buffalo, forty cows and one ovicaprid. Leopards were responsible for the loss of ten cows, one hundred and eighty-eight sheep and forty-four pigs. Python killed five goats and crocodile killed one. In total there were 295 reported cases of domestic livestock being killed by wild animals (ibid.) although the actual number is probably far higher since park authorities are often reluctant to verify that livestock has been predated by wild animals, unless indisputable evidence exists, as they are then obliged to pay compensation to the livestock owner. As one of the park's Game Scouts elucidated:

'*Because of the wildlife, many domestic animals are being killed and communities are having their crops raided by the animals, but they do not receive the proper compensation. The compensation hasn't been given to the communities and this has become a major challenge to the protection of the park because if communities don't get the right amount of compensation then they won't actively support our conservation efforts*,' (STBNPMA).

Observations recorded in the researcher's field diary provide further evidence of prevalence of human-wildlife conflicts around the park, documenting an incident in which a herd of wild elephant entered Bethani Community Forest, bordering the core area of the

park. Local villagers lit fires and banged pots to scare the elephants off and, after several hours, the elephants returned to the core area of the park. Whilst no one was injured and damage was limited to the forest itself, this incident serves as an excellent illustration of the latent threats to lives and livelihoods posed by the wildlife protected by the park and the limited capacity of local communities and park staff to effectively respond to this challenge.

The increase in human-wildlife conflict, discussed above, results not only in direct impacts such as increased loss and damage to those residing in the buffer zone and the consequent adverse impacts on their lives and livelihoods, but also, importantly, indirect impacts which if neglected by park staff will encourage feelings of negativity towards the park and its goal. Since successful conservation in human-natural environments can only begin with a consideration of the needs of local people, a failure on the part of the BNPMA to adequately address issues of human-wildlife conflict will jeopardise the attainment of the organisation's goal. As an interview respondent from one of the park's conservation partners neatly summarised, '*without the communities it is not possible to conserve wildlife and the park*,' (BBNTNC). Preventing such incidents from occurring, and responding effectively to those cases which do occur, is therefore a key imperative of the BNPMA in ensuring local support for its objectives. A response provided by a resident of Thakurdwara during a semi-structured interview sheds further light on this chain of causality:

'*I can hear sometimes the people say, 'our forest is getting thick and within will be lots of leopards and we will get another problem and we will face another problem.'... It has been starting already because of the leopards down from the temple side, a little bit down from the temple side, it has been going every day and catching some goats and a couple of days ago a leopard was found dead... We don't know exactly but we can doubt, we can doubt how it got killed. It may* [have been] *killed, I very much suspect, because it was going every day and catching goats and they found it dead, some piece of body only and maybe it fought with the tiger, but you can suspect it*,' (SPBUCFUG).

This quote further illustrates not only the tensions between local resident and the BNPMA's conservation aims that incidents of human-wildlife conflict can engender, but also the increased distrust between community members stemming from such events, an outcome examined in more detail in the following section.

5.3.2 Park-People Conflict

Distinct from human-wildlife conflict, discussed above, park-people conflicts represent the human-human dimensions of conflicts resulting from human interactions between those motivated by conservation objectives, and those who prioritise alternative goals (Redpath et al. 2013). Commonly, such conflicts result in negative outcomes for both conservation efforts and livelihoods, however on occasion, where they are effectively managed, park-people conflicts can positively influence change.

As with the challenge of human-wildlife conflict, the issue of people-park conflict in Bardiya has deep roots, stemming from the formation of the earliest configuration of the park as a Royal Hunting Reserve in the 1960s. The subsequent legislative changes outlined in Chapter Four, which have resulted in progressively tighter regulations constraining the range of sanctioned activities within the core area of the park, have undoubtedly led to increases in park-people conflict in recent years, as the livelihoods goals of those motivated by non-conservation objectives are marginalised by the BNPMA whose primary motivation is conservation. As one Game Scout elucidated,

'Before the park was formed the local communities used to use the land for grazing their cattle, and also do wood cutting and extract firewood for their own use. But when the National Park was gazetted these activities were no longer allowed, but what else could they do? They had to stop these traditional activities and this resulted in a big conflict between the park and the local people,' (JBKBNPMA).

Park-people conflict was found to be an important driver of change for the BNPMA with 70% of semi-structured interview respondents based in and around the BNP citing it as a significant challenge facing the organisation. However, only half of park staff interviewed were of the belief that park-people conflict posed significant challenges to the successful pursuit of their aims, compared to two-thirds of park field staff. The results of the Game Scout focus group emphasise the distinct importance of this driver to the park's field staff, with park-people conflict emerging as the most frequently discussed driver of change. Similarly, in minutes taken from the two monthly Game Scout meetings attended by the researcher, park-people conflict was overwhelmingly the most coded reference, mentioned over four times as much as the next most commonly cited driver of change. This discord

between the views of headquarters based park staff and field staff posted within the core area of the park stems from their distinct roles in the conservation of the BNP. Game scouts are the park's frontline staff and as such frequently have to deal with the results of such conflicts where they bubble to the surface. As one Game Scout observed:

'*If we perform our duties strictly then we are likely to be in positions where confrontation may happen. If some level of confrontation does happen between us and community members or visitors, then we do not always feel secure. I don't feel that we have the support of the management and they are often reluctant to support us in these situations,'* (STBNPMA).

The implications of park-people conflict for the BNPMA's ability to successfully pursue its goals are significant. The marginalisation of the livelihood objectives of buffer zone residents in favour of the BNPMA's conservation goals foments discontent and fosters feelings of resentment amongst local people towards conservation in general and the BNPMA in particular. As a consequence, communities engage less with conservation issues, are less cooperative in their dealings with park staff, and are less inclined to adhere to park rules that prioritise conservation needs over their own. As one Game Scout elucidated:

'*Sometimes when we go into the villages we hear them say 'we have lost our goats, we have lost our grains' and so on. They say that if they got the proper compensation we would not go into the park, we would be satisfied. Their attitude is if the park is not cooperating with us why should we cooperate with the park?*' (R3FGBNPMA).

As the above quote intimates, a key outcome of this disenchantment with the BNPMA and its rules is an increasing prevalence of illegal resource extraction by buffer zone residents. As a respondent from the Game Scout focus group neatly summarised:

'*Most of the people around Thumania don't have fear, don't have shame, they just come illegally into the park, steal firewood and take it away. In terms of grass and firewood, it is uncontrollable. Even though the locals have a community forest given by the park, they keep on coming in and stealing. They don't even care about conservation*,' (R2FGBNPMA).

The impact of increasing park-people conflict and associated illegal resource extraction is, as the preceding quote implies, the degradation of the park's ecosystems and the habitats that it provides. These impacts have been exacerbated, in recent years, by rapid population growth in the park's buffer zone which has resulted in increasing scarcity of natural resources outwith the park's core area. Furthermore, recent migrants to the area do not attach the same cultural and economic importance to the local ecosystems, nor do they have the history and knowledge of sustainable use of local resources that the original Tharu communities have (Maharjan et al. 2011). As a result they have even less vested interest in attaining successful conservation outcomes and are more inclined to engage in the illegal extraction of park resources. As a Game Scout from the post at Bas Tal (literally 'Bamboo Lake') observed:

'*A significant amount of wood is stolen from the hill areas and is transported by ox cart to the village. In this area there used to be eight adult tigers but now there are very few left because of poaching. The area is starting to recover and the tigers are returning but it is a very very sensitive part of the park. When people have been caught illegally extracting wood they have been fined however most of it is stolen during festival time when park staff are away and resources stretched*,' (GSBNPMA).

In recent years escalating conflicts between the BNPMA and communities have necessitated a proactive response from the management authority to address this driver of change. In order to win public hearts and minds to their conservation cause, the BNPMA has initiated a range of community education programmes to increase local knowledge and understanding of the need for, and importance of, conservation, directly and through their conservation partners. The park's Chief Warden highlighted the importance of these awareness raising activities:

'W*ithout the support of the local community it is not possible to get better cooperation from the local community. So we need to develop a good relationship with the local communities. We teach the local people... the importance of the conservation of endangered species, large mammals and the like, so that then they will be very proud to be involved in conservation*,' (TRABNPMA).

In addition to these awareness raising initiatives, the BNPMA has attempted to address the livelihoods concerns of communities by increasing payments to the BZMC and providing higher levels of compensation to those adversely affected by the park's conservation activities. The head of the Buffer Zone Management Committee documented the BNPMA's attempts to address this driver of change and alleviate one facet of park-people conflict, noting that, '*before there was not any rule of compensation for the death case by wildlife, and first we lobbied and became able to receive RPS150,000 and then later on again we pressurised and then nowadays as a compensation its being paid RPS300,000*,' (DDBZMC).

These initiatives have met with some success and have, to a degree, served to reduce the gulf between those actors whose primary motivation is conservation and those with alternative priorities. However, as will be shown in the following chapter, in some respects the BNPMA's ability to adequately address this driver of change is constrained by a number of factors operating at the national and international scales, including international organisations and their agendas. It is to this component of anthropogenic change as a driver of organisational change that consideration now turns.

5.3.3 International Agendas

In today's increasingly globalised world, international agreements and the work of donor agencies can also have a significant role in driving organisational change at the local level. These international agendas may impact upon local operations either directly, through the work of donor agencies and the funding that they provide, or indirectly through the trickle-down of the aims of international conventions and agreements which influence national level policies and result in local level directives being promulgated. In Bardiya, several donor agencies and international NGOs, most notably WWF and USAID, have a significant impact upon park operations through the financial and technical resources that they provide. The impact of international treaties and agreements are also keenly felt as the National Government is a signatory to in excess of 16 multilateral agreements relating to conservation and climate change. As many semi-structured interview respondents made clear, these agreements are not, as is the case in some western countries, taken lightly by the government. Rather they feel that, as signatories, it is their duty to fulfil their associated obligations, a situation succinctly summarised by a high level official from the MoFSC who observed that, '*there is an influence because we are parties to these conventions and we have a responsibility to implement what was agreed*,' (KPAMoFSC).

Whilst the impacts of this driver of change are unlikely to have a significant influence upon the organisation's culture and structure, they undoubtedly impact upon the organisation's aims and the activities that it implements in pursuit of them. Almost half of semi-structured interview respondents were of the belief that international agendas act as a significant driver of change for the BNPMA. Of those who identified this as being a significant driver of change, 90% believe the role of donors to be particularly significant, compared to two-thirds who referred to the influence of international treaties and conventions on BNPMA operations.

The process through which international agendas indirectly drive change within the BNPMA was neatly summarised by a respondent from the second focus group undertaken as part of this research. The respondent observed that although the direct impact of such treaties is minimal, '*once these agendas are set elsewhere in the international forums, then there are agents of bringing those agendas into practice, through the national policy process, and if not through policies, then through national plans and programmes*' (R3FGFA). When the government ratifies an international convention, the MoSTE will send a directive to the DNPWC who will, in turn, circulate the directive to all of the country's protected areas. It is then the responsibility of each of the National Parks to ensure that these new prescriptions are adhered to.

In 2010, for example, Nepal signed the St Petersburg Declaration of the Global Tiger Recovery programme, and in doing so committed to double tiger numbers within the country by 2022. In the 2007-2012 Park Management Plan the BNP already had a significant focus on tiger conservation through the WWF funded Tiger Action Plan, which made RPS157,500,000 available primarily for tiger monitoring activities. In 2012, post St Petersburg Declaration, however, the increased emphasis on tiger conservation within the park was made clear with the addition of the explicit and significantly more ambitious aim of, "address[ing] international commitment to achieve the national goal of doubling the population of tigers by 2022," (DNPWC/GoN 2012 p16). This is one instance, then, of international agendas influencing the aims and operations of the BNPMA at the park level, however these impacts do not exist in isolation. This increasing focus on tiger conservation may have knock-on effects in terms of the dimensions of conflict discussed in the previous two sections of this chapter. As tiger numbers increase, instances of livestock predation

and other forms of human wildlife conflict are likely to increase. Park-people conflicts may also escalate as locals witness the increasingly polarised and intractable aims of the park. As one interview respondent, from a forest conservation focused NGO observed, such international conventions are '*often ignoring the problems the local communities are facing around the national parks… you cannot compromise men to keep tigers*,' (DKFA).

Similarly, international donors may also impact upon and drive changes in the aims and operations of the BNPMA, albeit through more direct means. In Nepal, the current political instability at the national level outlined in the previous chapter, has resulted in many donors electing to circumvent the political morass of the national arena, instead turning their focus to the implementation of local level initiatives which they view as being a more effective and efficient means of achieving meaningful results. WWF, for example, have a significant role to play in Bardiya as one of the BNPMA's key conservation partners. Through their Terai Arc Landscape programme WWF have committed almost $10million in support, to be disbursed between 2004 and 2014. These funds are disbursed following the ratification of an annual work plan drawn up by the park authorities in conjunction with representatives from WWF. As a high-ranking officer from WWF elucidates, 'w*hat we do is that before every new year we undertake a process of planning. We meet with the park authorities - the Chief Warden and his team - and we then discuss what kind of activities they need us to support*,' (PKWWF). In this way the agenda of WWF has a clear and significant influencing role upon the activities undertaken by the BNPMA.

A number of bilateral funders have a less pronounced but nonetheless important influencing role on the BNPMA. USAID's five year $30 million Hariyo Ban programme, with its dual focus on climate change adaptation and conservation, is targeted in Bardiya at communities within the park's buffer zone and surrounding areas. Their work has nevertheless impacted upon the BNPMA. As a result of Hario Ban's initial interventions in Bardiya District there is a growing understanding of climate change and its associated terminology amongst senior park staff. A consequence of this has been a subtle shift in the framing of the park's activities, perhaps best illustrated by the inclusion, for the first time, of a climate change section within the latest five year management plan. As a respondent from one of the park's key conservation partners highlighted:

'*Obviously the BNP management authority need support from other conservation organisations, partners, to assist and help them in achieving their local goals. So in that case, ok, these are the things that the BNP authority is doing, if we can look through the lens of climate change then these are the aid donors that can support you*,' (SKTNTNC).

5.4 Driver Identification and Response

The preceding sections of this chapter have examined the role of a range of environmental and anthropogenic factors in driving change within the BNPMA. The following section analyses how the BNPMA becomes aware of these challenges and recognises them as drivers of change to which they must respond, following Daft and Weick's model of organisations as interpretation systems (1984, discussed in Chapter Two). Despite its original conception as a model relating to private sector organisations operating in the developed world, it was found to represent a useful means of structuring the analysis and interpretation of data in the case of the BNPMA.

In terms of the environmental changes outlined above, the BNPMA may become aware of such challenges through the regular field visits undertaken by park staff, or by the park's Game Scouts in the execution of their day-to-day duties. In this instance the BNPMA view their external environment as being analysable, intruding into it to interpret information on new environmental challenges; in Daft and Weick's terms, through the active process of discovering, using internal personal data sources. A senior member of park staff recounted one means through which this occurs. '*From the field visit they* [the park managers] *see the whole grasslands are converted into tree lands and then they decide, they find the resources and they mobilise their manpower and they mobilise labour to remove trees*,' (ABBNPMA).

Similarly, evidence of new environmental challenges may be collected as part of the park's regular monitoring programmes, akin to a process of discovering using internal impersonal data sources. A member of the park's rhino monitoring team described how this occurred recounting how, during rhino and tiger monitoring excursions, participants are required to fill in a form. Not only does this form require detailed survey information relating to the species in question to be filled in, it also provides a space to record additional observation such as the presence of Lantana (RBSNAGA).

The identification of new environmental challenges by the BNPMA may also occur, in whole or in part, through more passive means such as direct observation by local residents or other key stakeholders, termed condition viewing by Daft and Weick. One of the park's assistant wardens recalled how the issue of the drying river first came to their attention:

'This is a fairly new challenge that was first noticed only two or three years ago, and it really came to our attention through the observations of local people and through the observations of park staff. This information was fed back to us informally up the chain of responsibility in the park and through official meetings with communities, but also informally through personal contacts and informal meetings. As I said, the locals used to get water for irrigation from the river and now it is blocked so they tell us their problems and then we respond,' (RKTBNPMA).

In this case data is transferred to senior park staff primarily through internal and external personal means. Ecological indicators may also provide evidence of new challenges to park staff. The Chief Warden noted that:

'*If the water will dry out the animals will move out and sometimes animals they have a fight when they are all congregated in one water hole, and at this time there is fighting. Maybe fighting between the tigers, fighting between rhino and rhino sub-adult, and sometime rhino must kill the sub adult, they fight at the water hole. So we can get certain symptoms*,' (TRABNPMA), a process perhaps analogous with Daft and Weick's undirected viewing, as data may be collected through the chance discovery of animal conflict or its aftermath. In this case data is fed back to decision makers through personal means either internally by BNPMA field staff or externally by nature guides of other non-park stakeholders working within the core park area.

There are also examples of instances in which the BNPMA gathers data on its drivers of change through the process of enacting. In the case of invasive species, for example, data is often gathered through controlled field experiments and then conveyed to senior staff through the full range of modalities. In some cases staff report their findings through internal personal channels, as exemplified by one of the Parks Assistant Wardens:

'*Lantana camera… poses a new and growing challenge to the successful management of the park's ecosystems. We are trying different means of controlling the lantana in different plots and are leaving one plot untouched to see what the outcome will be. We are doing this scientifically to get an indication of the best and most effective means of addressing this new challenge*,' (ABBNPMA).

On other occasions findings are fed back to senior staff through external personal means, where researchers or the park's conservation partners present the findings of their studies. In other instances external impersonal channels are more important, particularly where research reports are submitted to the BNPMA, as has been the case with the management of the park's grasslands (discussed in more detail in Chapter 7.2.3).

In relation to the climatic component of environmental change discussed in Sections 5.2.1 and 5.2.2 of this chapter, the means through which the BNPMA identifies and gathers information on this driver of change is similarly complex, perhaps a reflection of the greater uncertainties surrounding this driver of change. At present, the BNPMA rely on passive conditioned viewing to gather information on climatic changes facing the park. Data may be received from external personal sources, as people residing around the park pass on information relating to the changes that they are experiencing. Similarly data may be received from external sources through impersonal means including NGO reports and national and international papers documenting climatic changes within the country. Data may also be received through internal personal channels, that is to say through staff sharing their perceptions and observations of climatic changes with their colleagues.

The multifarious mechanisms through which the BNPMA has become aware of the range of anthropogenic drivers of change discussed in Section 5.3 and recognised the need to respond, mirror, to some degree, those outlined above. Conditioned viewing with data conveyed through external personal means may occur where cases of human-wildlife conflict are reported directly to park staff stationed in the buffer zone. A respondent in the Game Scout focus group residing in a remote village within the park's buffer zone observed:

'*The biggest problem is that animals from the park go into the rice fields and eat the villager's crops. This makes them angry, and because I am in quite a remote post, when the*

villagers come to me and are aggressive there can be big problems, so I have to report this information back to the park headquarters,' (R1FGBNPMA).

Human-wildlife conflict may, of course, occur in areas of the buffer zone where BNPMA staff have a minimal presence. In these circumstances the BNPMA's knowledge and awareness of these incidents is frequently mediated by their conservation partners and other community based organisations. Individuals whose lives and livelihoods are impacted upon by the park's wildlife are entitled to government compensation for loss of life and livestock as a result of human-wildlife conflict. For compensation to be paid to the affected individuals they must inform the BNPMA, provide them with evidence of their loss, and lodge an official claim. In this way the park are informed about, and keep records of, all reported cases of human-wildlife conflict which result in material damage to local people. Often, particularly where widespread damage has occurred affecting numerous households, the BNPMA's conservation partners and other external community based organisations assume a coordinating role taking these issues to the BNPMA on behalf of all those villagers affected, providing data on this driver of change through impersonal means.

Where park-people conflicts occur, the BNPMA becomes aware of this driver of change through a process of discovering, with information gathered through external personal channels. The latent resentment of local residents towards the park may come to the organisation's attention through stakeholder meetings with their conservation partners and local community organisations, which allow these diverse stakeholders to air their concerns and grievances. The existence of strong social networks, discussed in more detail in the following chapter, is also of paramount importance in ensuring the identification of such conflicts and the implementation of effective responses by the BNPMA to address local concerns.

As one of the park's Assistant Wardens noted, '*we have stakeholder meetings to share knowledge and ideas and input is sought from all stakeholders around the park because we cannot be successful on our own. We use both formal stakeholder consultations and also our own personal relationships with them. Both of these are very important*,' (RKTBNPMA).

A second route through which the BNPMA becomes aware of park-people conflict and recognises it as a driver of change is through formal reporting by Game Scouts; that is,

discovering through internal personal channels. Where latent conflicts between the motivations of the BNPMA and local people are manifested in illegal activities such as resource extraction from within the park's core area, those park staff who apprehend the offenders relay the information about the dispute back to park headquarters, from where further action is taken.

There is less ambiguity surrounding the demands of high-level international agreements, which emerge as edicts at the park level, than with the other drivers discussed in this chapter. Similarly the demands and constraints imposed by donor projects at the park level do not involve the detection of uncertain signals in the organisation's environment, to the same degree as other drivers. Consequently the park gathers information on international agendas as a driver of change more directly and passively, through a means akin to conditioned viewing, with data provided through external impersonal channels.

As this preceding analysis has shown, the model of organisational interpretation modes is broadly relevant to the case of the BNPMA, demonstrating the utility of this model as a framework through which to structure the analysis of primary data. Daft and Weik's (1984) typology is therefore relevant not only for the study of private sectors organisations, but also to the analysis of public sector bureaucracies. Similarly the author's classification of the means through which this knowledge is conveyed back to decision-makers within the BNPMA has been shown to be broadly relevant in the case of the BNPMA. The examination of this model in conjunction with the operation of the BNPMA and its drivers of change has, however, added some important clarifications to Daft and Weik's original model.

Firstly what this analysis has elucidated is that the four modes of organisational interpretation outlined by Daft and Weik should not be assumed to be mutually exclusive. The BNPMA may be engaged in more than one means of interpretation whilst gathering data on any distinct driver of change and furthermore, each interpretation mode may provide a different type of information and evidence about that driver. To take the case of Lantana as an example, data on the spread of the plant in and around the BNP may be gathered and interpreted through a process of conditioned viewing as a result of regular patrolling within the park and buffer zone or in some cases, where incursions by the plant are detected by chance in the pursuit of other duties, through a process of undirected viewing. A process of discovering, on the other hand, would provide more detailed and

structured information on the spread of the species which could potentially be complimented by information on community perceptions of the problem and potential solution. A process of enacting, meanwhile, could also be relevant, providing another body of information to aid interpretation, specifically concerned with the means through which the problem can be addressed and brought under control.

Therefore, whilst Daft and Weik's model necessarily represents a simplification of reality, it is vital to be explicit about the fact that the use of one mode by an organisation does not preclude the use of another; each driver of change may be interpreted using a plurality of approaches. Indeed this will likely be beneficial since, as outlined above, the use of distinct interpretation modes may provide different information concerning a driver of change resulting in a greater breadth of information that may ultimately reduce the high levels of uncertainty which characterises decision-making in conservation.

Similarly the means through which this knowledge is transmitted to decision-makers to aid the process of interpretation, defined in the original model as being a dichotomy of internal-external personal-impersonal is, in reality, more complex. As outlined above the BNPMA employs each of these means of transmitting knowledge to its senior staff and in many cases, as with the case of human-wildlife conflict, more than one modality is used in response to a single driver of change. Moreover it seems likely that the means through which this mediation of knowledge occurs will not be static, but will change over both time and space. To return to an earlier example, in some locations, where park staff are present, information about instances of human-wildlife conflict may be directly gathered by staff and reported back to the BMPMA headquarters through what may be characterised as internal personal means. On other occasions, at another time or in another location, park staff may not be present and in such a case a different means would be needed to feedback information to park staff.

Furthermore these observation are closely linked to another salient issue alluded to in this discussion and throughout this chapter, that of interdependence across scales. The interconnectivity of the drivers of change affecting the BNPMA uncovered through this research and discussed in this chapter can be said to fall along a sliding scale where absolute environmental and purely anthropogenic drivers representing the unattainable extremes. Falling river levels and increased aridity resulting from global environmental

changes which lead to an increased rate of grassland succession to forests would, for example, initially appear to be an unalloyed environmental driver. However in the case of the riverine grasslands it has been shown that a degree of human interference is involved, through the extraction of stones and gravels from the western branch of the Karnali river, whilst the grasslands in the park's interior are themselves relics of previous human settlement and the national level political and legislative changes that facilitated this.

Similarly issues of park-people conflict could be attributed to the poor relationship between park staff and buffer zone residents, however this would be to neglect the untold environmental issues ranging from globally driven environmental change, to local riverflow, to reduced agricultural productivity, that impact upon these relationships. International agendas, in contrast, appear less readily impacted by environmental issues at the local level but nevertheless such factors have significant impacts for the BNPMA and its buffer zone residents, not least through the globally driven environmentally agendas that motivate their work.

The implication of this tangling and entwining of the BNPMA's drivers of change is, simply put, that to successfully address its drivers of change, the organisation cannot consider them in isolation. Responding to this convoluted web of drivers therefore becomes a complex task which may be characterised either by trade-offs, where drivers require competing responses, or multiple benefits where a response to one driver will impact positively on another. Trade-offs and their associated conflicts stem from the fact that the BNPMA is operating within very restrictive financial and human resource constraints, a constriction examined in more detail in the following chapter. As one of the BNPMA conservation partners elucidated, a focus in recent years on a process of manually uprooting Lantana Camera has been implemented to the detriment of wider grassland management initiatives:

'*The park authorities get very very less money for grassland management and so depending on donors and on TAL sometime they do not have the money they need so they have to make a controlled fire because this is the cheapest way to manage the grassland. The problem with this is that it causes the deaths of many birds, reptiles and small mammals, and many more lose their eggs. So this method is not ideal but it is good for the habitat of*

tiger prey but it is not all about tigers so it is better if we can do more manual things like cutting and uprooting, but this is more expensive,' (PKWWF).

This inhibitive financial and human resource context also increases the value and importance of identifying responses which can impacts positively on more than one driver of change. The erection of a solar panel fence by the BNPMA, for example, whilst implemented as a response to increasing incidents of human-wildlife conflict, has additional benefits in relation to conflict between park staff and local residents. As a member of staff from the DNPWC recalled from his time in Bardiya:

'*If you can confine the wildlife within the National Park through different means… with the help of the electric fence and this and that, then wildlife doesn't come out and there will also be less conflict between the park and the public. Conflict between park and the public is a major issue*,' (BBDNPWC).'

However, perversely despite such opportunities, it is not always more productive to focus the BNPMA's scarce resources on responses that facilitate double wins, as trade-offs in the form of opportunity costs still necessarily result. In their management of park, senior BNPMA staff must therefore decide on a case by case basis whether the anticipated outcome of any given intervention, whether single- or multiple-win, will ultimately be more effective in ensuring that the BNPMA achieves its aims. The impacts of the resource constraints within which the BNPMA operates, as well as a range of additional factors influencing the capacity of the organisation to adapt, are examined in more detail in the following chapter of this thesis.

5.5 Conclusions

The distinct components of environmental and anthropogenic change, discussed above, represent the complex, interlinked, and dynamic range of factors to which the BNPMA is having to respond. In this chapter I have identified and examined these key drivers of organisational change facing the BNPMA in pursuit of its aims, presenting and analysing my results to demonstrate the relative importance of these drivers. In addition I have assessed how the BNPMA identifies these drivers and becomes aware of the need to respond, as well as the complex links that exist between them.

Environmental change, including climatic changes and myriad related environmental changes such as grassland succession and the lack of water availability, have been shown to be significant challenges facing the park. The components of anthropogenic change, discussed in this chapter, including human-wildlife conflict, park-people conflict, and international agendas have similarly been shown to be important in driving change within the BNPMA.

This chapter has demonstrated that Daft and Weick's model of organisations as interpretation systems is a useful lens through which to identify and analyse the mechanisms through which the BNPMA gathers information on a diverse range of challenges, and identifies them as drivers of change to which it must respond. Whilst the categories of Daft and Weick's model are found to hold true, in the case of the BNPMA responses to its drivers of change may be characterised by distinct or compound mechanisms of scanning, data collection, and problem recognition over space and time. In addition, park staff, buffer zone residents, and other conservation stakeholders have been found to play a key role in bringing these challenges to the attention of park managers, both through formal reporting and interpersonal channels. As highlighted by Grothmann and Patt (2005), the role of stakeholder perceptions in this process, principally in the personal exchange of data pertaining to these challenges, plays a particularly prominent role in problem recognition and driver identification by the BNPMA.

A key conclusion of this study is that these distinct drivers of organisational change, whether human induced or natural in origin, are inherently linked. Changes in the environment in the core area of the park and its environs can, for example, exacerbate incidents of human-wildlife conflict as changing habitats within the core area of the park force the park's fauna to roam further afield in search of food. Concurrently, changing weather patterns can impact upon the livelihoods of buffer zone residents whose agricultural productivity is increasingly impeded by changing and increasingly variable weather patterns resulting in a growing rift between the priorities of local populations and the BNPMA, precipitating increased park-people conflict and its associated impacts including illegal resource extraction. An important consequence of the inherent linkages between these drivers of change, is that decision-making within the organisation is characterised by inherent trade-offs, an issue exacerbated by the resource constraints

within which the BNPMA is having to operate. Even where multiple drivers can be addressed through a single action, such trade-offs remain.

Although introduced and addressed separately in this chapter, it is clear that the distinction between anthropogenic and environmental drivers of change is, to some extent, a false one. It is, therefore, essential to acknowledge the inherent interconnectivity between these drivers, as well as the influence that they have upon each other and the trade-offs that exist in addressing them. Whilst this chapter has shown environmental change to be the most significant driver of change confronting the BNPMA, it is important that the linkages between environmental and anthropogenic change and their components are openly acknowledged, given their vital role not only in driving organisational change but also in influencing other key challenges facing the BNPMA. The characteristics of the BNPMA that enable it to effectively adapt to this complex intertwined array of challenges are the focus of the following chapter of this thesis.

Chapter 6 – Components of Adaptive Capacity

6.1 Introduction

Having documented and analysed the BNPMA's key drivers of change, this chapter moves on to consider the multitude of factors that enable and inhibit the BNPMA's ability to effectively respond to these new challenges. In doing so the analysis presented in this chapter answers the second key research question of this thesis, namely 'what are the main factors that facilitate and constrain the adaptive capacity of the BNPMA.'

Adaptive capacity is defined in this thesis, following Moser et al (2008 p.646) as, "the adaptation space within which decision-makers in any system… might find feasible [response] options." The selection of this relatively broad definition of adaptive capacity facilitates a consideration of the factors that enable and constrain the responses of the BNPMA to its full gamut of drivers of change whether or not they can be conclusively attributed to increasing climate variability and change. Moreover, as demonstrated in the previous chapter, the inextricable links that exist between the organisation's environmental and anthropogenic drivers of change means that to try to isolate responses to those drivers resulting solely from increasing climate variability and change would not be possible in practice. Using a more restrictive understanding of adaptive capacity, for example the IPPC's (2007) definition which refers specifically to adjustments in response to climate change, would severely constrain the range of data through which the BNPMA's components of adaptive capacity could be examined.

Data collected through Likert questionnaires, administered to park staff, is used to identify the key elements which together constitute the organisation's adaptive capacity. Semi-structured interview transcripts, focus group responses, meeting minutes, and observations recorded in the researcher's field diary are then used to identify and further analyse the relative contribution of these distinct components of organisational adaptive capacity. Whilst questionnaire responses enable basic quantification of their relative importance as well as a simple means of categorising the components of adaptive capacity, their utility in the case of the BNPMA was found to be limited. Examining these responses in conjunction with other sources of data was therefore important in achieving a more comprehensive and nuanced understanding of the role of these elements in constraining and facilitating the organisation's adaptive capacity.

In the following section of this chapter the components of adaptive capacity which are endogenous to the BNPMA are examined, and their contribution to the organisation's adaptive capacity assessed. Subsequently consideration turns to those identified determinants of adaptive capacity that are predominantly exogenous to the organisation, that is those factors which are related to the wider environment within which the BNPMA is situated. These external components of adaptive capacity are then considered in conjunction with the previously identified determinants of internal adaptive capacity and the links between them and their relative importance examined. The chapter concludes with a consideration of the limitations and wider implications of these findings.

6.2 Internal Components of Adaptive Capacity

Internal components of adaptive capacity are those core characteristics of an organisation, over which it has a strong degree of control, which enable or constrain responses to its drivers of change. As discussed in detail in Chapter Two, in the wake of the IPCC's 2001 assessment report a growing number of authors have identified and categorised the various components of adaptive capacity in a variety of ways, broadly corresponding to a range of groupings including organisational planning, knowledge exchange, organisational culture, networking and advocacy, and perceived adaptive capacity (e.g. Gupta et al. 2010, Tompkins et al. 2010, Runhaar et al. 2012).

The responses of park staff to the Likert questionnaire administered as part of this research indicate, in the case of the BNPMA, a slightly different composition of categories. Four broad components of internal organisational adaptive capacity were found to exist encompassing culture, systems, knowledge generation and sharing, and resources, with each of these dimensions comprising a number of different but related determinants. Since questionnaire responses were constrained along a five-point scale, a degree of quantification was possible to determine staff perceptions of the overall contribution of each of these dimensions and their components to the BNPMA's internal adaptive capacity. Building upon the conceptual framework presented in Chapter Two, questions most frequently rated 'strongly agree' were understood to represent a strong positive contribution to the BNPMA's internal adaptive capacity; those rated 'strongly disagree' assumed to have a strongly negative contribution.

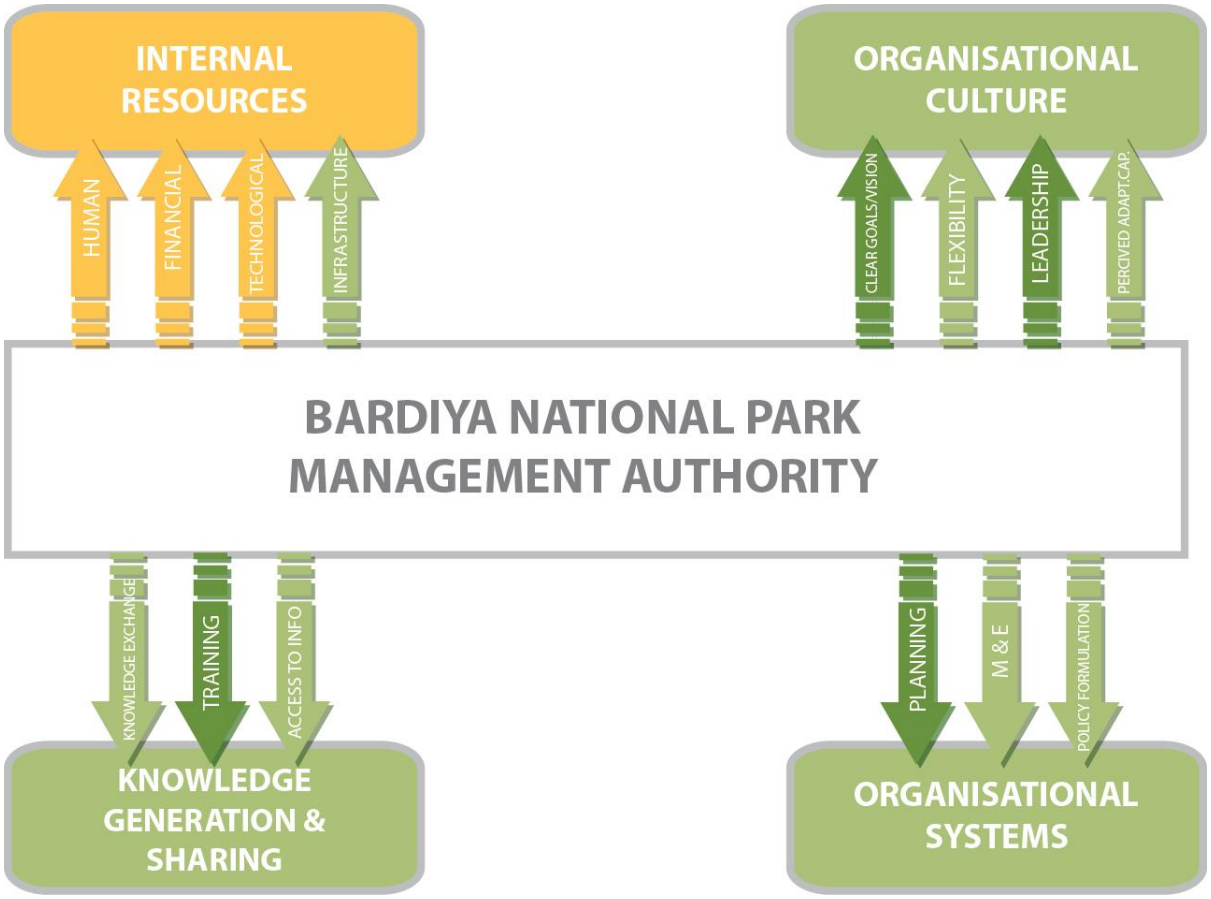

Figure 6.0.1 Internal components of adaptive capacity illustrating the relative contribution of the constituent components of internal organisational adaptive capacity, to the overall adaptive capacity of the BNPMA. For questions where Likert responses were most frequently 'strongly agree' a value of +2 was assigned, shown in the diagram above as dark green and representing a strong positive contribution to internal adaptive capacity. 'Strongly disagree' was not found to be the most frequent response for any component of adaptive capacity. Where 'agree' was the most frequent response, a value of +1, represented by the light green sectors, was assigned; where it was 'disagree' a value of -1 was assigned represented above as orange. The colour of each of the four higher-level components reflects the overall mode of its constituent categories.

In the following section of this chapter these headline results are critically examined in conjunction with semi-structured interview responses from park staff and buffer zone stakeholders, focus group responses and fieldwork observations. In doing so a number of significant areas of disagreement are highlighted and discussed, enabling a more nuanced understanding of the relative contribution of the organisation's internal components of adaptive capacity to be attained.

6.2.1 Knowledge Generation and Sharing

The knowledge generation and sharing element of internal organisational adaptive capacity comprises three key components, access to information, training, and knowledge exchange within the BNPMA. Knowledge generation and sharing has a potentially positive role to play in the ability of organisations to respond to new challenges (Runhaar et al. 2012); organisations which have access to high quality information will be best placed to recognise

the need to adapt, will have knowledge of a wider range of potential adaptation options, the technical expertise to assess and select the most appropriate, and the awareness to understand how to best implement the selected option (IPCC 2001, Jianhua et al. 2010, Chhetri et al. 2012). This is particularly true in the case of conservation organisations which, by their very nature, are intrinsically concerned with complex technical issues characterised by high levels of uncertainty in a changing world.

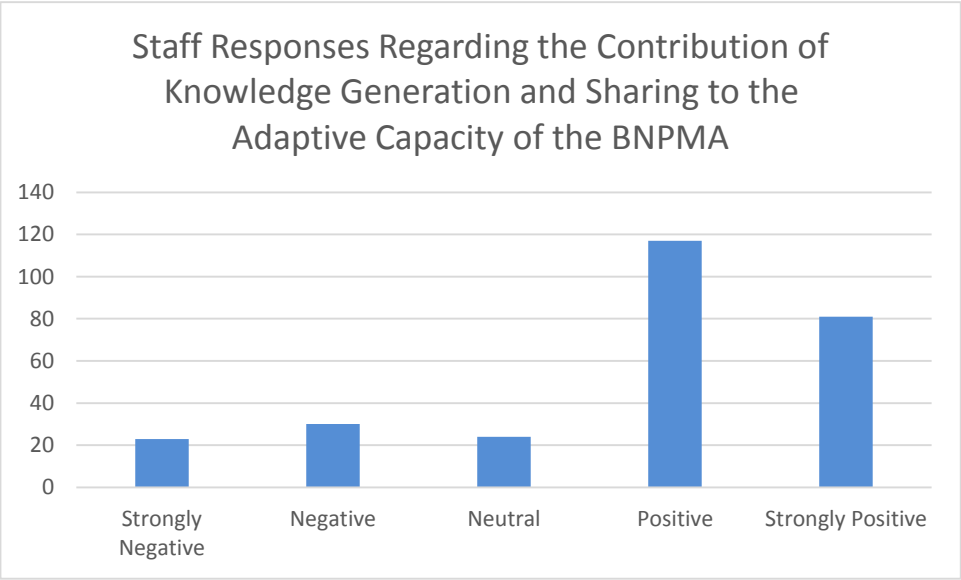

Figure 6.0.2 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's knowledge generation and sharing systems and practices to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

In the case of the BNPMA, responses to the Likert questionnaire summarised in Figure 6.2, suggest that access to information, training and knowledge exchange within the BNPMA all contribute positively to the organisation's internal adaptive capacity. Responses indicate that staff believe their opinions are regularly sought and that new ideas, which have the potential to lead to concrete changes in the way that the organisation operates, originate from all levels of the organisation. The BNPMA facilitates formal knowledge sharing opportunities for staff however there is broad consensus that informal knowledge sharing between staff remains more common than knowledge sharing through formal channels. Furthermore, responses indicate a belief amongst staff that they receive appropriate training when required and that they have access to all of the technical information they require to effectively carry out their roles. When faced with new challenges staff trust that park managers quickly and efficiently disseminate information to them to ensure that they are aware of these new challenges and how they may best be addressed. As the experience of one Game Scout exemplifies:

'*I have received many trainings through the park from orientation training to different trainings on conservation. This training normally is formal and is delivered by the more senior staff in our organisation, but it is also very important for me that I continue to receive direction, suggestions, advice, and information from my colleagues and seniors; this is also extremely important but it happens in a much more informal way*,' (KJBNPMA).

This quote highlights the dual aspects of knowledge generation and sharing within the BNPMA. All BNPMA field level staff receive initial training from the Human Resource Development Section of the DNPWC, and in taking up their role many receive additional training in management and administration, but also in relevant technical fields including habitat management, census techniques, and species specific ecology. Further formal opportunities for knowledge sharing occur on a monthly basis with formal staff meetings held in the third week of every month, providing a forum for staff to feed back concerns, issues and challenges to colleagues and senior park staff.

As the preceding quote intimates, informal information and knowledge exchange also takes place within the BNPMA, representing an important facet of knowledge generation and sharing. Indeed such informal channels often come to the fore where more formal channels founder; a second Game Scout observed:

'*The problem is that the number of trainings is not enough and the number of spaces on each training event is very limited. There is no certainty about when we are able to attend training and there is no fixed pattern of training for any one Game Scout. Because of this we often have to rely on each other's knowledge and skills,*' (STBNPMA).

The above quote casts a modicum of doubt on the effectiveness of the organisation's formal training systems, alluded to in the preceding response. In highlighting the importance of informal channels for knowledge sharing the second respondent draws attention to the limited capacity within the organisation to facilitate more formal training session to all park staff, and the haphazard and desultory pattern through which formal training occurs. Whilst aggregate Likert responses imply that the presence of effective formal and informal channels of knowledge generation and sharing serves to augment the internal adaptive capacity of the BNPMA, creating a solid foundation upon which the

organisation can construct its responses to new challenges, interview responses with park staff demonstrate that in practice the situation is more complex.

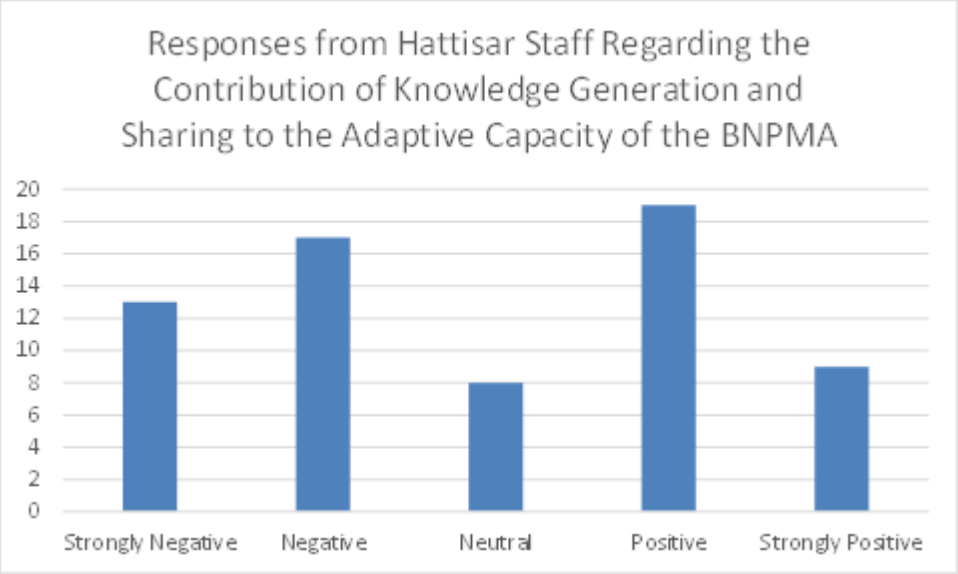

Figure 6.0.3 An illustration of aggregate Hattisar staff responses to questions relating to the contribution of the BNPMA's knowledge generation and sharing systems and practices to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

In addition, despite broad consensus on the positive contribution of knowledge generation and sharing to the BNPMA's adaptive capacity, a more detailed analysis of questionnaire responses identifies the presence of a number of dissenting voices, specifically from those staff based in Hattisar (Figure 6.3, above). The staff of the elephant stables most frequently felt that they lacked opportunities to share their thoughts and recommendations on park operations with senior park staff, believing that their ideas and opinions are rarely taken into account by decision-makers. Questionnaire responses indicate that Hattisar staff are experiencing a degree of isolation in relation to field and HQ based staff, perhaps stemming from the detached location of the elephant stables. Consequently whilst aggregate Likert responses provide evidence that this component of adapt capacity positively impacts upon the overall adaptive capacity of the BNPMA, it is important acknowledge the internal differences that exist, highlighted through closer scrutiny of Likert data in conjunction with interview responses.

6.2.2 Resources

Resources represent the second key component of the BNPMA's internal adaptive capacity identified by this study. In this context resources refers to the human, financial, technological, and infrastructure resources required by the BNPMA to successfully achieve

its aims. It is self-evident that, *ceteris paribus*, an organisation with a shortage of appropriately trained employees will have a more circumscribed capacity to deal with new challenges. Where there is a misallocation of staff, for example with skilled staff based in urban centres and unskilled staff predominantly posted in field positions, management effectiveness and therefore responsiveness to new challenges will be constrained (Jianhua et al. 2010). Similarly, an organisation lacking the necessary finances, technology or infrastructure to achieve its aims will struggle to adapt in the face of new challenges when compared to an organisation that boasts a surfeit of such resources (IPCC 2001, Pandey et al. 2011, Chhetri 2012). Where an organisation has access to adequate financial resources, where staff numbers are sufficient and staff are allocated to roles appropriate to their skills and training, and access to relevant technology facilitates a wider range of potential responses to new challenges than would otherwise be feasible, its resource base will contribute positively to its adaptive capacity.

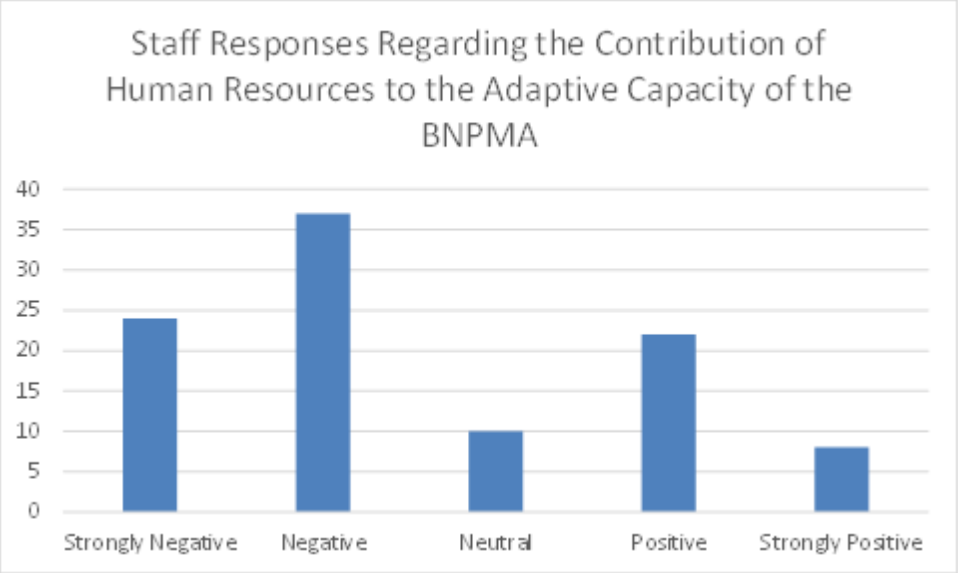

Figure 6.0.4 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's human resources to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

In the case of the BNPMA, questionnaire responses to those statements pertaining to human resources strongly suggest that personnel constraints within the BNPMA negatively impact upon the organisation's adaptive capacity. The majority of staff do not believe that the BNPMA has enough employees to effectively achieve its aims, with staff often working in positions for which they are not suitably trained whilst having to fill multiple roles. Hattisar staff, in particular, emphasised the failure of the organisation to identify and fill human resource gaps before they occur. This is perhaps an unsurprising complaint given that at the time of research the BNPMA was failing to meet requirements proscribed by law concerning the minimum number of staff required to care for domestic elephants. As the

veterinarian from Hattisar reported, '*By law, there should be three staff to care for each of our elephants, so we should have 51 staff to properly care for our 17 elephants. At the moment our existing manpower is only 30*,' (PPBNPH).

A further indication of the constraints placed upon the BNPMA by its lack of human resources comes from an examination of reported staff numbers. In the park's 2007 management plan the BNPMA list a total of 130 staff alongside a proposal to increase employment by a further 91 staff over the subsequent five years (DNPWC/GoN 2007). This table is reproduced verbatim five years later in the draft 2012 management plan, suggesting either that staff numbers and positions haven't changed at all over this period or that reporting of staff numbers is of questionable accuracy. The fact that the park's 2011/12 Annual Report indicates that staff numbers are actually 126 implies that the latter is the case whilst highlighting the severe lack of resources which has seen staff numbers decrease by four instead of the intended increase of almost 100 (DNPWC/GoN 2011). Personnel deficiencies within the organisation were starkly highlighted during the Game Scout meetings attended by the researcher when it became apparent that some guard posts within the park, such as at Khayarbhatti, were currently unmanned whilst others, such as Motipur, were occupied by a single Game Scout. When these issues were raised during the meeting the Chief Warden's stock response was simply, '*we have to manage with what we have*,' (TRAGSM1).

A further issue associated with this lack of manpower is the current imbalance of positions within the organisation. Despite the reported seven there are far fewer park rangers employed at present, as during the Maoist insurgency it was decreed that anyone who had worked in their government post for at least 14 years would automatically receive a promotion. Consequently whilst the number of Rangers within the BNPMA is less than officially reported in park documents, the number of Assistant Wardens is more than double the reported figure. Not only, therefore, are total staff numbers working to constrain the ability of the BNPMA to respond to new challenges, but the misallocation of staff within the organisation is also working to limit adaptive capacity. As a respondent from the focus group reported, '*we have only 28 Game Scout posts in the park and a total of 60 Game Scouts which is not enough*,' (R4GSFG).

This misallocation of staff, highlighted in the wider literature as impacting negatively on an organisation adaptive capacity (e.g. Jianhua et al. 2010), was further exemplified by an informal encounter during fieldwork between the researcher and an Assistant Warden from the BNPMA. Despite being posted to the BNPMA this individual had only spent five days in Bardiya during the first year of his posting, as a result of this overstaffing at the Assistant Warden grade. Instead this park employee had been conducting ad hoc research on National Parks in other areas of the country.

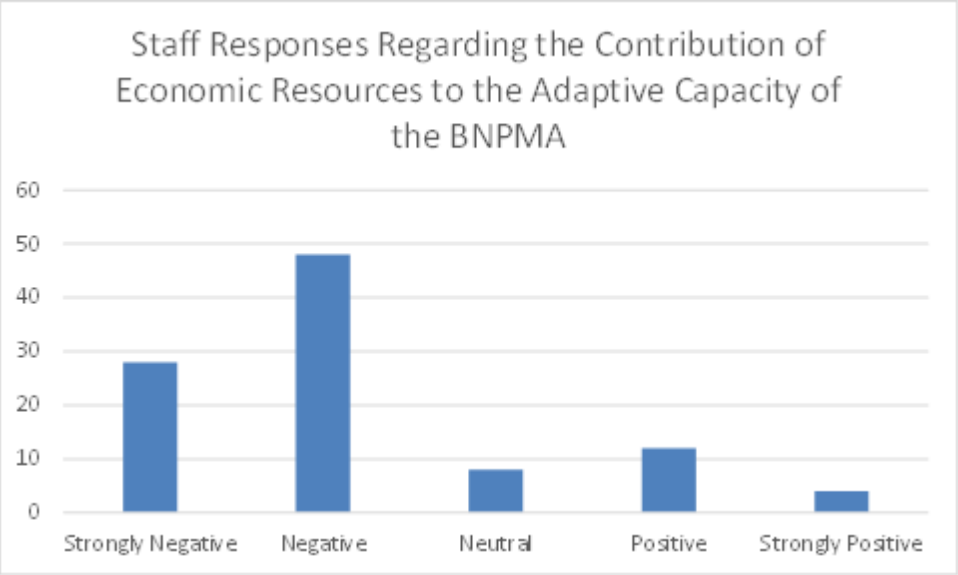

Figure 6.0.5 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's economic resources to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

Related to these HR constraints, staff from all departments of the organisation reported that the economic resources of the park represent an area which impacts negatively upon the organisation's adaptive capacity (Figure 6.5). Staff were found to be in overwhelming agreement that their organisation does not have sufficient financial resources to effectively meet its current aims or new challenges that may arise, consequently current activities have to be prioritised due to a lack of adequate financing. A senior member of park staff expounded upon this problem in relation to the park's grassland:

'We need to monitor and evaluate our progress but the problem is that we do not have as much money as we need and we are not able to manage perfectly the grassland. It should be monitored every year but we do not have enough money to manage this every year. It is in the five-year plan but we lack the finances to meet the targets laid out in the five-year plan,' (RKTBNPMA).

Another of the park's Assistant Wardens acquiesced:

'*Issues such as human resource constraints and lack of adequate financing are not issues specific to our organisation. We know how many staff we have and we know what our budget is so we work within these boundaries. Often we have to prioritise the most important activities and we can then take the time to try to source the additional budget needed to address the less urgent challenges through other organisations or donors*, (ABBNPMA).

Nevertheless the overwhelming negativity of Likert and interview responses indicate that financial constraints have an important role to play in constricting the BNPMA's adaptive capacity. Constraints not only in terms of imposing limits on the numbers of staff that can be employed and the range of conservation activities which can be implemented, but also in relation to the type and quantity of equipment available for park staff, particularly those based in the field. As one of the park's Game Scouts observed during the focus group, '*when we go patrolling for more than two or three days we don't have any tents or any proper equipment. If it rains you have to sleep outside all night and just wait for the rain to go*,' (R6FGBNPMA).

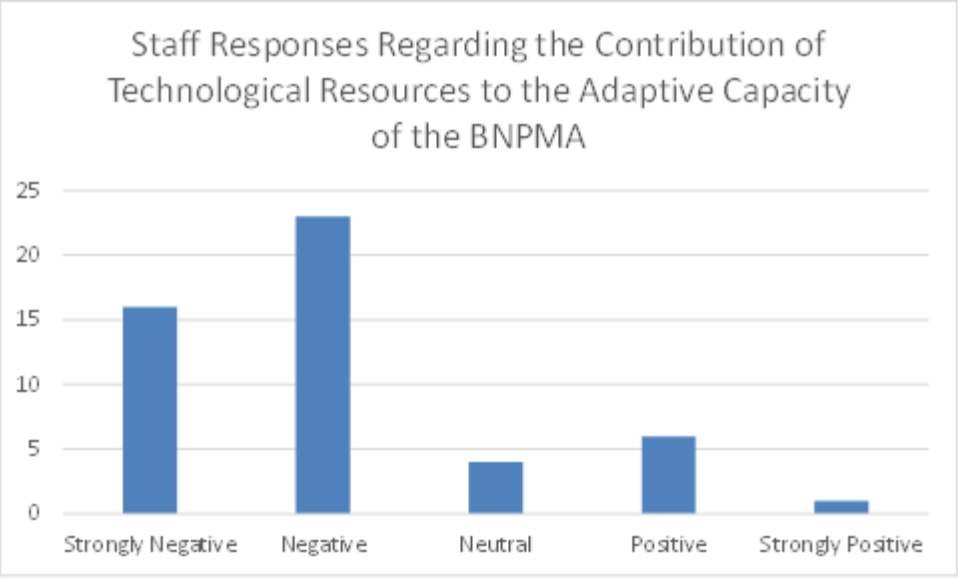

Figure 6.0.6 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's technological resources to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

The limited finances of the BNPMA also impact upon the technology available to park staff and, as Figure 6.6 illustrates, responses to Likert questions relating to the technological

context of the organisation painted a correspondingly bleak picture. Staff from all positions within the organisation reported that the technological context of the park has a negative impact on the organisation's adaptive capacity. Staff aired their opinion that at present they do not have access to the latest available technology, whilst contending that with better access to such resources they would be able to perform their roles more effectively. A further consequence of this limited access to technology was raised by numerous focus group respondents who highlighted the resultant low morale of staff who have to deal with this lack of appropriate equipment and technology on a day to day basis in pursuit of their duties.

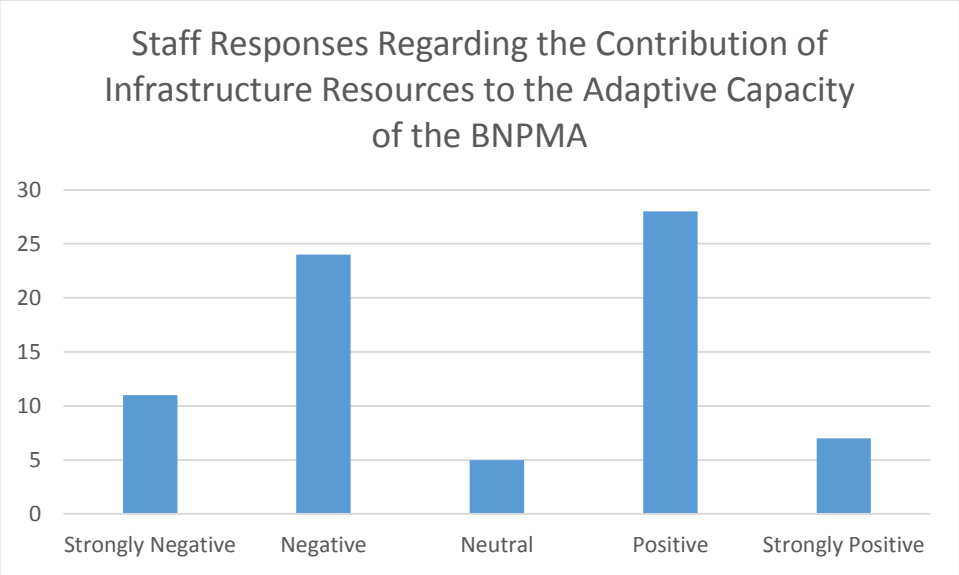

Figure 6.0.7 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's infrastructure resources to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

In contrast to the gloomy picture painted above, the BNPMA's infrastructure resources were found to make a positive contribution to the organisation's internal adaptive capacity. Staff who responded to the questionnaire indicated their belief that current levels of infrastructure within the park's core area allow the organisation to address its current aims whilst providing a means of dealing with new challenges. The network of trails created within the BNP, for example, '*acts as a physical fire break or 'fire line network' which helps to stop the spread of wildfires but also allows tourists to visit the park and, more importantly, allows Game Scouts to go on patrol*,' (PKWWF).

However this was by no means a unanimous position with respondents from Hattisar, in particular, bemoaning a lack of adequate park infrastructure and the difficulties that this creates for their department in achieving its aims when faced with new challenges.

Although this perspective could perhaps be a reflection of the specific resource challenges facing the Hattisar which, as mentioned above, is currently chronically understaffed and is struggling to ensure the delivery of adequate care to the park's domestic elephants, Game Scout focus group responses were strongly supportive of this alternative view.

6.2.3 Organisational Systems

The third key element of the BNPMA's internal adaptive capacity identified by this study comprises the structures, procedures, and systems that govern activities and routines within the organisation and which have the potential either to enable or constrain its ability to respond to its drivers of change. Where organisations have effective planning systems, clear internal policies, and effective monitoring and evaluation procedures in place, new and potential future challenges are quickly identified and appropriate measures taken to mitigate associated negative impacts, whilst enabling the exploitation of any beneficial opportunities that may arise (Tompkins et al. 2010, Wilby and Vaughan 2010). Conversely, where such systems are not in place, the organisation is effectively hamstrung in identifying and responding to new challenges (Berkhout 2012).

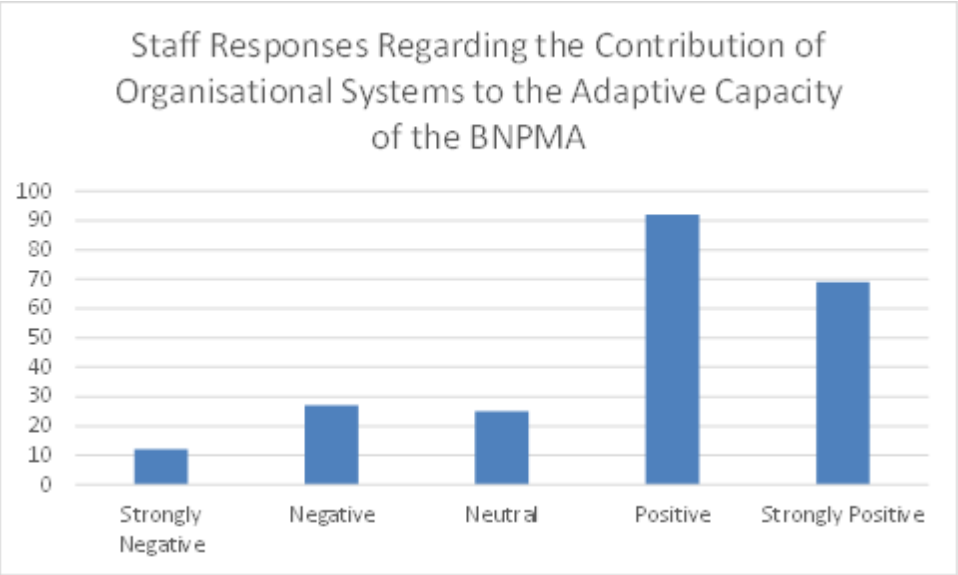

Figure 6.0.8 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's organisational systems to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

For the BNPMA, questionnaire responses illustrate the belief of staff that the systems in place within the park management authority contribute positively to the internal adaptive capacity of the organisation. As an interview respondent elucidated:

'*Effective planning and management interventions by the park certainly help us to deal with new challenges… Planning is the backbone of this organisation and if we plan badly then we will see bad results. In my opinion effective planning is the main key to our success. The planning process involves bringing together all of our staff and conservation partners to share our different knowledge and the latest information, and to make sure that we have feedback from all stakeholders ensuring the preparation of the plan. It is a very participatory and inclusive process,*' (ABBNPMA).

This quote corroborates the finding of the Likert questionnaire, that the organisational systems the BNPMA has in place enable effective planning for the future to be undertaken, complemented by thorough monitoring and evaluation strategies. Furthermore, as alluded to by the Assistant Warden, this has strong ties to the knowledge generation and sharing component of internal adaptive capacity, which is required to ensure that all staff are aware of current planning processes and priorities, the latest internal policies, and the outcomes of monitoring and evaluation exercises. Similarly strong consensus was found around the formulation and dissemination of internal policies, with 94% of questionnaire respondents from all departments of the belief that clear policies, targets and procedures exist within the BNPMA, with staff roles well defined and clear understandings of how an individual's work contributes to the overall goal of the organisation.

As with some of the components of adaptive capacity discussed previously, however, a degree of discord was identified between the experiences of those staff based at the elephant stables and those based in the field or at park headquarters. Hattisar staff were most frequently of the belief that senior managers do not set them clear targets or communicate these effectively to them. As the stable vet explained:

'At Hattisar we do not get properly involved in the park planning. We are given an overall budget for the whole of Hattisar and we have to decide how to spend it, but we can only spend it and act in line with plans drawn up by others. Although the Hattisar is an important part of the park management sometimes it feels as though we are in our own department,' (PPBNPH).

In terms of monitoring and evaluation there was very strong consensus amongst respondents that this component of the organisation's systems has a positive impact on

adaptive capacity. Staff believe that the BNPMA undertakes regular monitoring and evaluation activities and are of the opinion that the organisation has all of the information it requires to gauge the effectiveness of its current programmes. Perhaps unsurprisingly staff were reluctant to expound upon their own limitations and with over three-quarters of respondents claiming to continually assess their own performance and contribution to the organisations overall effectiveness.

As documented in the BNPMA's five year plans and further outlined in Chapter Four, park staff are engaged in regular monitoring of both the ecological and social outcomes of their activities. As one of the park's Assistant Wardens echoed, '*we are always constantly monitoring the park and its environment and we and our staff are always in the park so these changes quickly come to our attention*,' (ABBNPMA). The BNPMA's adaptive management approach, underpinned by a culture of monitoring and evaluating the effectiveness of interventions, documented in these plans and reflected in both Likert and semi-structured interview responses, appears to enable drivers of change to be quickly identified and the effectiveness of responses to be measured and modified as necessary. It also illuminates the relationship between the systems that exist within the BNPMA and the organisation's culture, which represents the final constituent quadrant of internal adaptive capacity identified by this research.

6.2.4 Organisational Culture

Organisational culture encompasses notions of clarity of vision, strength of leadership, flexibility and willingness to change, and perceived adaptive capacity, all important traits which may exert a significant influence on the ability of an organisation to respond to new challenges that it encounters (e.g. Wilby and Vaughan 2010, Baron et al. 2009, and Grothmann and Patt 2005 respectively). Where an organisation has strong visionary leadership which is open to new ideas, it has the strength required to shape and implement adaptive responses in the face of new drivers of change. Moreover it is able to remain flexible enough to exploit any opportunities created in the organisation's external environment, whilst simultaneously acting to counter any new threats originating from this arena.

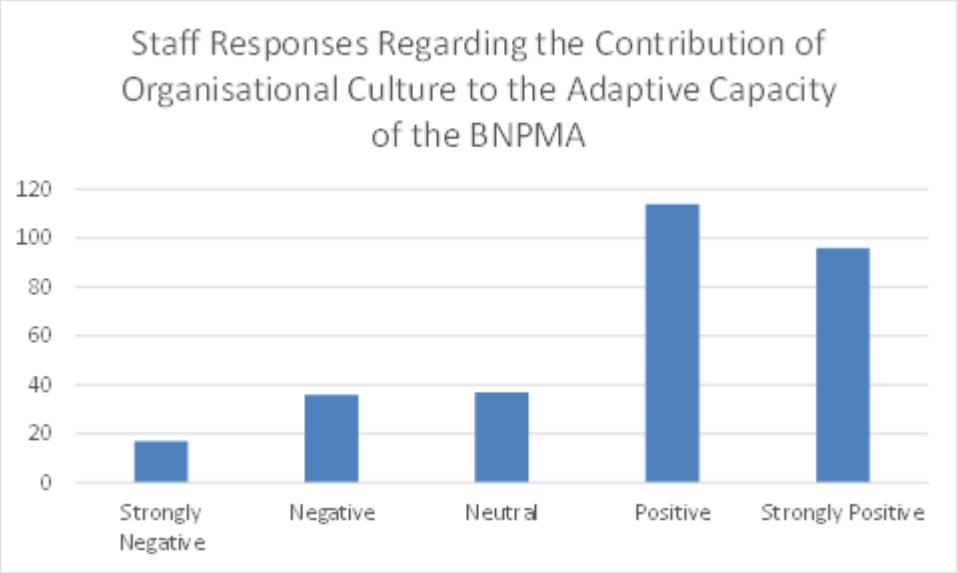

Figure 6.0.9 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's organisational systems to overall adaptive capacity. Original data is tabulated in full in Appendix 6.1.

Aggregate staff responses to the Likert-style questionnaire indicate a strong belief that the culture of the BNPMA impacts positively on its ability to address its drivers of change. Almost without exception staff believe that the strength of leadership and clarity of the organisation's vision and goals make a strong positive contribution to organisational adaptive capacity (82% and 98% of respondents respectively, see Appendix 6). Responses indicate concurrence that the BNPMA has a clear goal which is shared by all staff, and employees understand how their role contributes to this goal; information about any changes in the organisation's overall goal are said to be effectively communicated to all staff regardless of the department in which they work. Questionnaire results further indicate that staff believe that the organisation has strong leadership which takes decisive action when required and is willing to listen to alternate points of view. A Senior Game Scout affirmed the importance of the park leadership:

'*The Chief Warden has a very important role as he coordinates all of the different actors in and around the park including local communities, the army, their conservation partners and all of the other organisations here. The leadership from the Chief Warden is therefore vital to the success of conservation here*,' (JBKBNPMA).

Indeed a number of incidents witnessed by the researcher during the fieldwork period illustrated that in terms of leadership, the Chief Warden and his Assistants are held in awe by the majority of park staff and Buffer Zone residents. In one such case, following a meal

attended by a number of park staff for the Pasni[11] celebration of a conservation partner's daughter, one of the Assistant Wardens was variously described to the researcher as being 'a great man,' who is 'vital to the running of the park,' and 'has done great work in the park.' Similarly the head of one of the park's key conservation partners observed, '*if you talk to RKT then you get all of the information about the Bardiya, here he is more than bible*,' (RKNTNC). This veneration of senior park officials enables them to implement responses to new challenges even when they are unpopular amongst park staff, and in this way may act to augment the range of viable response options available to address drivers of change, positively enhancing the organisation's adaptive capacity.

Conversely, it is possible that this often uncritical acceptance of edicts and decisions laid down by senior staff may actually work to constrain the BNPMA's adaptive capacity. As Milliken and Wolfe Morrison (2003) argue, such subservience to senior staff is likely to result in a contagious culture of silence within the organisation, which may impact upon the effectiveness of organisational learning. Organisational learning is central to organisational performance and where such a culture of silence exists, opinions based on individual knowledge and learning are infrequently shared reducing the capacity for wider learning within the organisation and limiting action (Gambarotto and Cammozzo 2010). Studies have found that staff are more likely to air their opinions in organisations where an enabling climate exists which encourages them to share their views (Milliken and Wolfe Morrison 2003), where staff unquestioningly follow their superiors this may therefore be symptomatic of an unsupportive organisational environment and a debilitating climate of silence.

In this case, however, Likert responses indicate that being open to change is viewed positively within the BNPMA and that staff are encouraged to contribute their ideas and opinions regardless of their rank or position. Such traits will undoubtedly have a positive contribution to the organisation's internal adaptive capacity as this willingness to change practices, procedures and operations in the face of new challenges enables the BNPMA to remain flexible in rapidly changing environment within which it is operating. One of the park's Assistant Wardens highlighted the breadth and flexibility encompassed by their role:

[11] Nepal's traditional weaning ceremony where children receive solid food, in the form of rice, for the first time.

'*My role and duty, well my work is 24 hours. There is no fixed time for my work because of the nature of my job; my work is full time. According to our work we do administrative work, investigation of wildlife related crimes, patrolling the park, coordination with communities for effective biodiversity conservation, and to help to build the capacity of local communities to uplift their life and livelihoods. I also work with teachers and school kids for conservation education and with the army for joint patrolling in the park and capturing poachers. In our work for the park we do have individual sections of the office and in that way I am in charge of anti poaching activities, but the whole nature of my work is defined more broadly and we all have to cover all of these issues*,' (RKTBNPMA).

In contrast, Likert responses to certain questions demonstrated that this flexibility and culture of voice is not ubiquitous, and does not, for example, necessarily extend to the organisation's systems. Almost two-thirds of staff cited the view that attempts to change things within the BNPMA were met with resistance and many were of a belief that certain practices and procedure are so entrenched and established that they cannot be challenged, potentially fostering a culture of silence within the organisation. This apparent resistance to change within the BNPMA appears also to provide evidence of the pervasive culture of Chakari and Chaplusi which has been shown to exist in the Nepali public sector (Jamil and Dangal 2009). This unofficial system through which professional progression is determined by personal relationships is closely linked to the underlying causes of a culture of organisational silence (cited by Milliken and Wolfe Morrison 2003) which often arises where staff fear the consequences of speaking out to senior staff and employ silence strategically to ensure their relationships with those above them in the organisation's hierarchy is maintained. This analysis suggests that despite the apparent positive contribution of organisational culture to the BNPMA's internal adaptive capacity, this culture of listening and flexibility is, to a certain degree, superficial, with staff unwilling to push for change.

This complex and contrasting picture of the role of organisational culture in constraining and enabling the adaptive capacity of the BNPMA is completed by staff opinions on perceived adaptive capacity. Staff expressed a belief that cognitive barriers do not, as Kuruppu and Liverman (2011) suggest, result in staff feeling powerless to respond when faced with the enormity of new environmental challenges; rather they are used to effectively addressing their drivers of change whilst operating with a lack of resources, as

they have successfully dealt with such urgent and complex challenges in the past. On balance, responses to questions relating to perceived adaptive capacity indicate that these cognitive barriers do not constrain the organisations adaptive capacity with staff confident that their organisation is well placed to adapt to its drivers of change.

6.3 External Components of Adaptive Capacity

In conjunction with the internal components of adaptive capacity, discussed above, there are a number of factors which contribute to the external adaptive capacity of the BNPMA. External adaptive capacity can be defined as the aggregate conditions existing in an organisation's external environment that govern its ability to respond to change. As discussed in Chapter Two there is a growing body of literature that has examined the key components of external adaptive capacity, with determinants such as the wider resource, ecological, social, and institutional contexts frequently adduced as factors influencing an organisation's external adaptive capacity (e.g. IPCC 2001, Adger, Brown et al. 2003, Yohe and Tol 2002, Gupta et al. 2010).

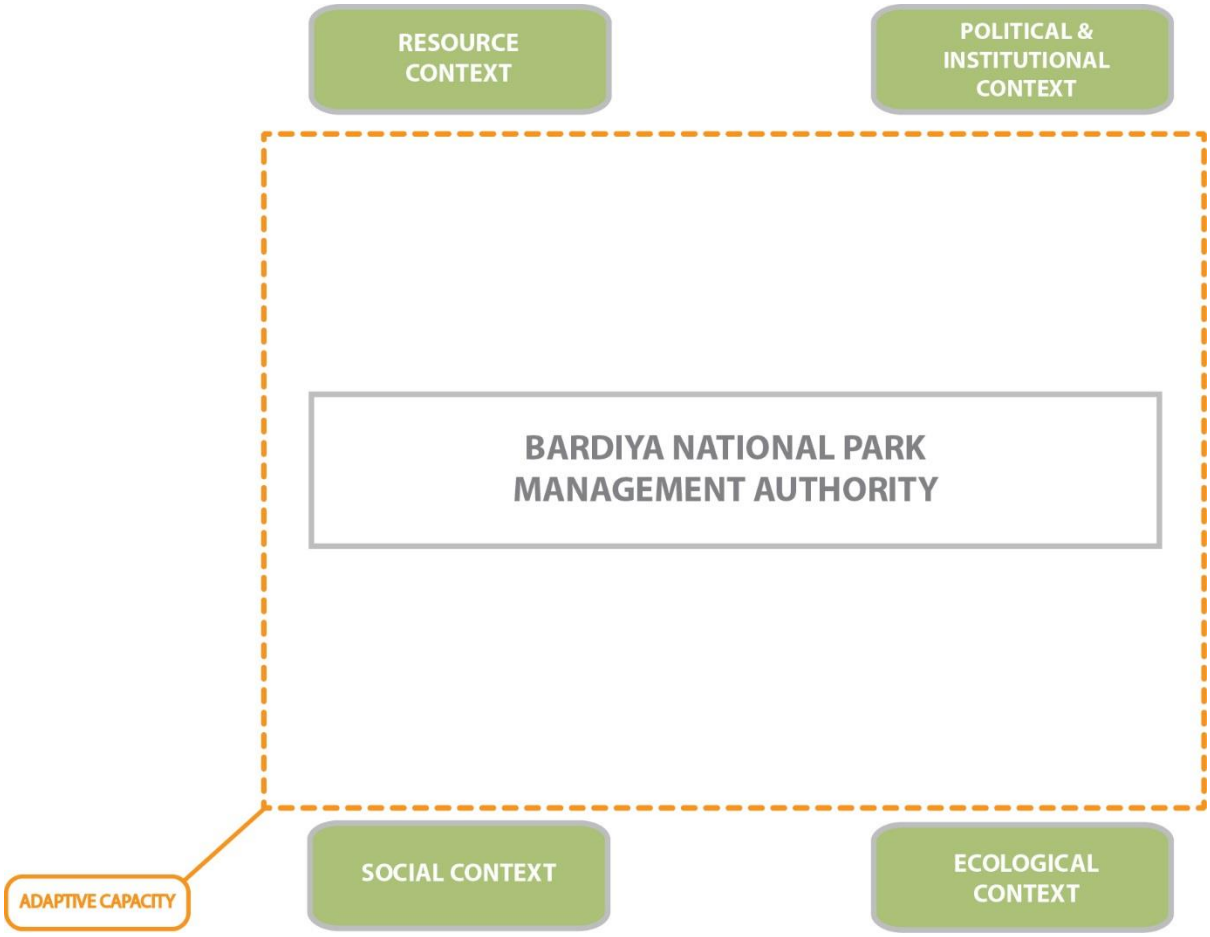

Figure 6.0.10 External components of adaptive capacity illustrating the relative contribution of the constituent components of external organisational adaptive capacity, to the adaptive capacity of the BNPMA. Examining aggregate responses to questions for each category, 'agree' (represented above by the light green sectors) was found to be the most frequent response for all four external components.

Figure 6.10 illustrates the headline Likert questionnaire results, suggesting that the wider resource, ecological, political and institutional, and social contexts all make, on balance, a positive contribution to the BNPMA's external adaptive capacity. For the most part semi-structured interview and focus group responses lend weight to these findings, however one notable exception was highlighted. Interview responses unequivocally demonstrated the negative influence of the wider political context on the organisation's adaptive capacity, and the constraining role played by the nature of the Nepali bureaucratic system and its associated institutions, a finding corroborated by focus group responses and meeting minutes.

In the following section of this chapter the role of each component of external adaptive capacity in influencing the ability of the BNPMA to respond to its drivers of change is examined in more detail. Subsequently these external components of adaptive capacity are

considered in conjunction with the internal constituents, previously discussed, to provide a more comprehensive account of the organisation's absolute adaptive capacity.

6.3.1 Social Context

Numerous authors (for example Moser et al. 2008, Dovers and Hezri 2010) have highlighted the importance of an organisation's social context in influencing its ability to adapt to new drivers of change. The social context of an organisation refers to the knowledge, experience, and expertise that exist within an organisation's environment, and the relationships through which this knowledge can be shared. Organisations are situated within a strong social context when external stakeholders are knowledgeable and have relevant experience of the challenges facing an organisation, and where strong social networks exist through which this information can be transferred (e.g. Yohe and Tol 2002). Under such circumstances the additional knowledge resources available to the organisation in question positively contributes to a robust ability to successfully respond to new challenges. Conversely, where this additional knowledge pool and robust social ties are lacking, an organisation is left in relative isolation. In such circumstances the ability of an organisation to respond successfully to new drivers of change is constrained by the limited pre-existing knowledge, experience and expertise residing within the organisation itself.

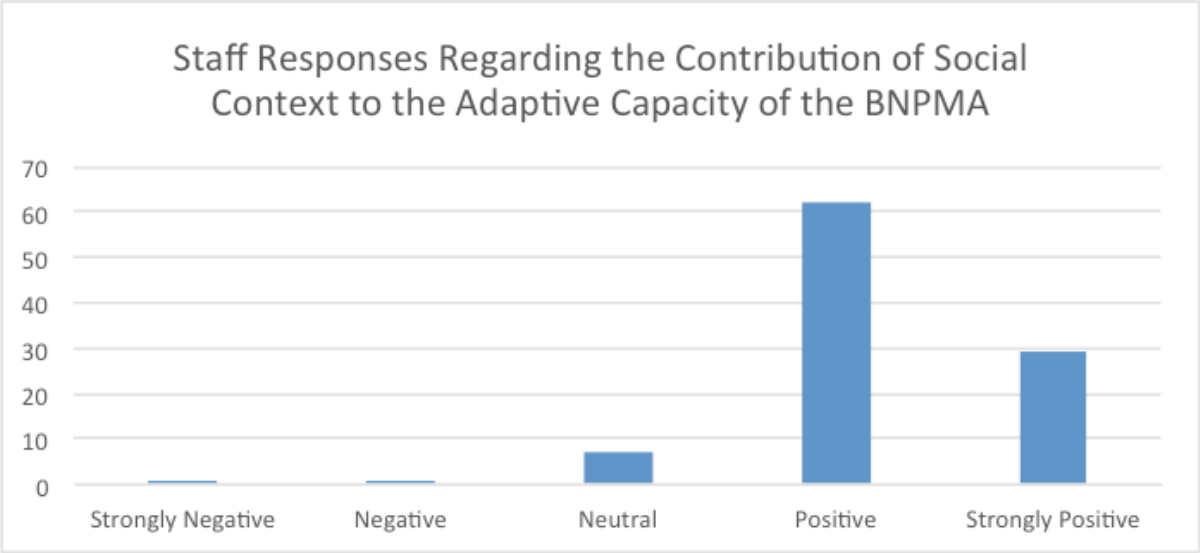

Figure 6.0.11 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's social context to overall adaptive capacity. Original data is tabulated in full in Appendix 6.2.

In the case of the BNPMA, questionnaire responses represent an overwhelming belief amongst staff that social context has a positive role to play in enabling the organisation to adapt to its drivers of change (see Figure 6.11). Respondents asserted with near absolute consensus, a belief that it is beneficial to work with other organisations as it allows their

organisation to achieve more than it could alone. Respondents reported that opinions of external stakeholders are regularly sought by the BNPMA and action taken based on their recommendations. Indeed when the organisation reviews its policies and approaches to conservation, decision-makers consult with other organisations working in their field and feedback received from these external stakeholders often influences the development of new practices. In terms of knowledge sharing it was unanimously agreed that informal channels and personal relationships form a key part of knowledge sharing between the BNPMA and the organisations operating in their external environment.

Semi-structured interviews conducted with park staff and stakeholders are strongly supportive of these findings and afford further insights into to the different scales and mechanisms through which such knowledge sharing occurs. As previously mentioned the DNPWC administer training to all field level staff either through their Training and HR Development Section in Kathmandu, or through locally based training sessions. Other means of national level knowledge exchange include the annual park warden's conference, which provides an excellent opportunity for senior staff from all of Nepal's protected areas to share their ideas and understandings of new issues and challenges that they are facing, as well as potential responses to them. More commonly, however, knowledge exchange occurs at the local level either through occasional topic-specific training sessions or, more regularly, on an informal interpersonal basis. As the local head of one of the park's key conservation partners observed:

'*In my opinion the best way to share knowledge and information is informally. This is the best way to discuss things, to share ideas, to develop proposals, to discuss innovative ideas, and more than just sharing ideas it allows us to find gaps in current operations and the sources of money to fill them*,' (PKWWF).

Indeed the park's senior staff hold informal meetings with representatives from their conservation partners every morning, providing a forum for the discussion of key issues, new challenges, and potential responses.

Despite this apparent unanimity of responses by park staff obtained through both interviews and Likert questionnaires, one clear example was found where this formal and informal knowledge sharing failed to enhance the capacity of the BNPMA to address its

drivers of change. Increasing climate variability and change, although a growing priority both at the national level and within the BNPMA's conservation partners (discussed in Chapter Four) currently receives limited attention at the park level. When pressed, interview respondents highlighted the limitations of the BNPMA's social context, and the knowledge sharing facilitated by it, in helping the organisation to address its climate-related drivers of change.

As one of the park's Game Scouts observed, '*where there are environmental changes I see them through my own eyes but I do not understand what is behind these problems because I have not had that sort of training. I have seen through my own eyes the grassland getting smaller and the river getting lower but I have no information about the causes*,' (KJBNPMA).

An employee from Hattisar highlighted the lack of available knowledge about these issues at the local level and the conjectural nature of that information which is available stating their belief that, '*there are climate change impacts at the local level and this is a fact but the only thing is that the rumour is said more than necessary, I agree with it to some extent but this is too much*,' (PPBNPH). When questioned as to why there was a lack of information on this specific topic respondents highlighted spatial differences in knowledge availability noting that, '*there are lots of seminars on this but only in Kathmandu, because they are not coming to the field where is the real village and countryside*,' (RBSNAGA). One of the Park's Chief Wardens succinctly summarised the situation:

'*We need a better knowledge and understanding of these issues, on what is this new challenge and what it means for us and how to deal with it. We don't have any idea or any opportunity to learn how to deal with it. But officials in Kathmandu visit other countries and get information and have seminars and training and they know, but the problem is that they do not share this knowledge with us but we are at the field level and if they don't help us how can we know? Only through self-study which is not easy because of all the time pressures*,' (RKTBNPMA).

What these quotes indicate, perhaps, is that whilst knowledge sharing between the BNPMA and its local conservation partners works well, enhancing the knowledge base of the organisation, knowledge sharing between the organisation and its partners across scales works less well. A confounding factor in this case may be the current focus in Nepal on

national level climate change programmes rather than local initiatives. Although this situation is beginning to change through programmes such as Hariyo Ban there is still a long way to go. The DNPWC, for example, does not currently have any employees specifically engaged in climate change work.

Climatic changes aside, Likert and interview responses indicate that the BNPMA's social context enhances the organisation's ability to effectively respond to the drivers of change outlined in the previous chapter. The effective sharing of knowledge and experience between the BNPMA and its external stakeholders, particularly at the local level, not only complements the positive contribution of internal knowledge generation and sharing to the organisation's adaptive capacity, but also works to mitigate the limitations associated with the organisation's human resource constraints. Further analysis of the role of knowledge generation, sharing and learning is provided in the following chapter of this thesis, whose focus is squarely on how processes of organisational learning enable the transformation of these components of adaptive capacity, into adaptive actions.

6.3.2 External Resources

In addition to the role of the BNPMA's external social context in mitigating the impact of the organisation's internal human resource constraints, the external infrastructure, technological and financial context of the park also have a role, in tandem with the internal resource constraints discussed above, in defining the organisation's adaptive capacity. Where the organisation is able to benefit from the external infrastructure, technological and financial context within which it operates, this has a positive impact on it adaptive capacity (e.g. Armenakis and Bedeian 1999, Dovers and Hezri 2010, Chhetri et al 2012). Furthermore it may, to some degree, be able to overcome the impact of related internal resource constraints on adaptive capacity.

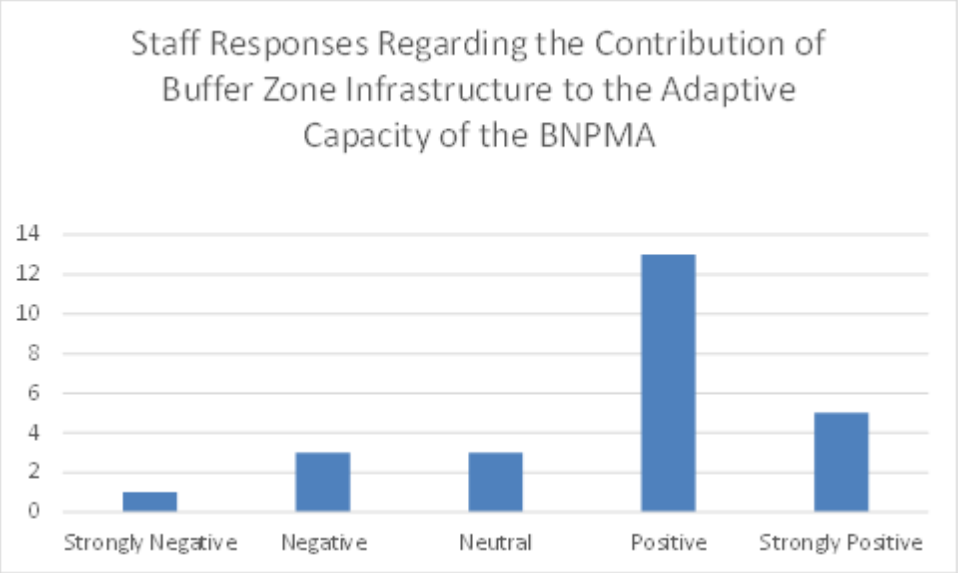

Figure 6.0.12 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's external infrastructure context to overall adaptive capacity. Original data is tabulated in full in Appendix 6.2.

In the case of the BNPMA, questionnaire responses convey a feeling amongst staff that the buffer zone infrastructure contributes positively towards the organisation's adaptive capacity. During semi-structured interviews, park staff reiterated this positive contribution highlighting the role of buffer zone organisations in improving roads, telephone systems and expanding electricity provision in and around the park. Such infrastructure improvements have been achieved as a result of the lobbying efforts of non-park personnel, and in recognition of the tourism potential of the area. The head of the Ecotourism Association recounted the process through which some such improvements have been achieved:

'We are one kind of leader, we are going sometimes to the communication office, sometimes to the electricity office, sometimes to the road department, and we are talking to them [about the need] *to make roads and we are supporting them also… Here electricity came in only because we have the tourism industry. There is the communication, all the systems we have, they are coming here because there is the tourism industry, and we are a big deal here… we go to them and say 'do','* (KBETA).

Each component of the organisation's infrastructure context was cited as providing a positive contribution to the BNPMA's adaptive capacity. Improved electricity and communications provision have facilitated swifter, enhanced, transfer of information amongst park staff based in different locations, and between park staff and buffer zone

stakeholders. This has enabled the timely identification and reporting of new challenges, even from the more geographically remote buffer zone settlements, thus elevating the adaptive capacity of the organisation. The improved road system within the park's buffer zone, including the construction of a tarmac road, has helped to improve the BNPMA's ability to patrol effectively whilst also enabling easier movement around the buffer zone to deal with new challenges, and acting as an enhanced fire break between the buffer zone and core park area. As the Chief Warden observed, '*during the rainy season the poachers just take the opportunity to poach the animal, even rhino and tiger. If we construct the all weather road, then we can just move throughout to patrol the park, throughout the year*,' (TRABNPMA).

As the IPCC (2007) note, adaptive capacity is also influenced by access to technology at all scales, since many potential adaptation strategies depend, either directly or indirectly, on the availability of and access to technology. Therefore, when addressing adaptive capacity it is important to examine the technological options available for adaptation, which may have a positive or negative impact upon it. Unlike the contribution of the BNPMA's internal technological resources which have a perceived negative influence, the organisation's external technological context was cited by key stakeholders as contributing positively to the adaptive capacity of the BNPMA.

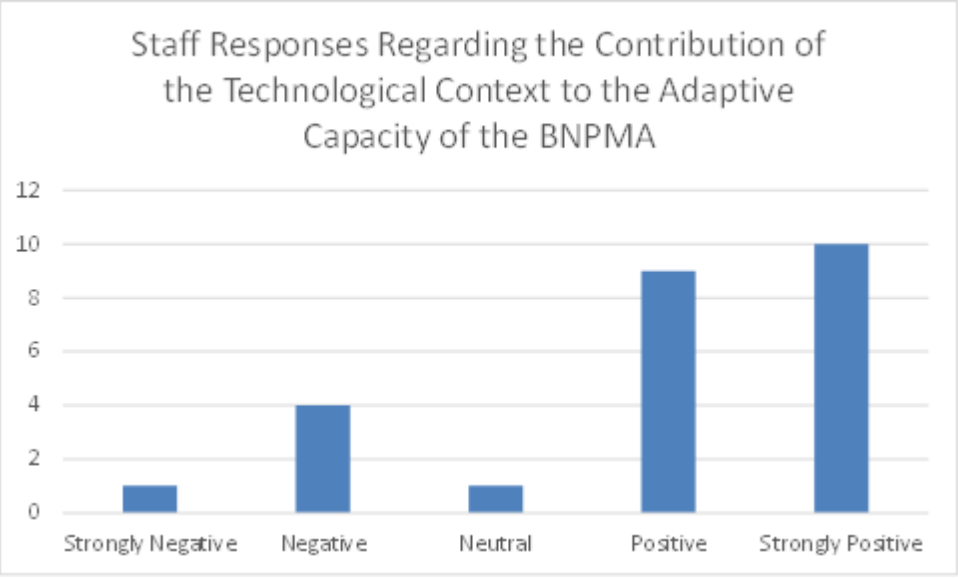

Figure 6.0.13 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's technological context to overall adaptive capacity. Original data is tabulated in full in Appendix 6.2.

Questionnaire respondents highlighted the positive role of increased access to new technologies such as new crop varieties and technologies in the buffer zone in significantly

reducing human pressures on park resources. Interview respondents lent further weight to this claim, documenting the process of wildlife monitoring, noting that for the monitoring of keystone species all of the technology and equipment required such as camera traps and GPS devices are provided by WWF Nepal. The head of another of the park's conservation partners reiterated this point whilst highlighting the links that exist between technology and other components of adaptive capacity including knowledge transfer and the importance of the organisation's social network, '*the front line staff, they need sometimes they need the latest technology, you know. Now they are using the GPS and we organised the GPS training for them, and sometimes for the camera trapping we organise how to use a camera trap,*' (RKNTNC).

In addition to this direct external support by their conservation partners, interview respondents documented supplementary facets of the technological context which indirectly benefit the BNPMA's organisational adaptive capacity by reducing current (and potential future) pressures on the park. The introduction of biogas generators in the name of the BNPMA by its conservation partners, for example, has reduced the reliance of buffer zone residents on fuelwood for cooking, in turn reducing the pressures of illegal resource extraction on the core area of the park, as well as improving the image of the park and public sentiment towards it.

Similarly the BNPMA's conservation partners have, in recent years, begun to encourage the diversification of crop production away from traditional varieties of crops towards species unpalatable to the park's large herbivores such as Mentha. The BNPMA's conservation partners have also funded the construction of a Mentha processing plant in the park's buffer zone, and the introduction of this new species of crop alongside the installation of the technology to processes it, has led to increased incomes for local farmers and a reduction in crops lost to the park's herbivores. In theory this action has not only enhanced local livelihoods and reduced pressures on park resources, but has also increased local support for the BNPMA's aims and activities, indirectly augmenting the organisation's adaptive capacity by enhancing its social context and freeing up personnel and financial resources.

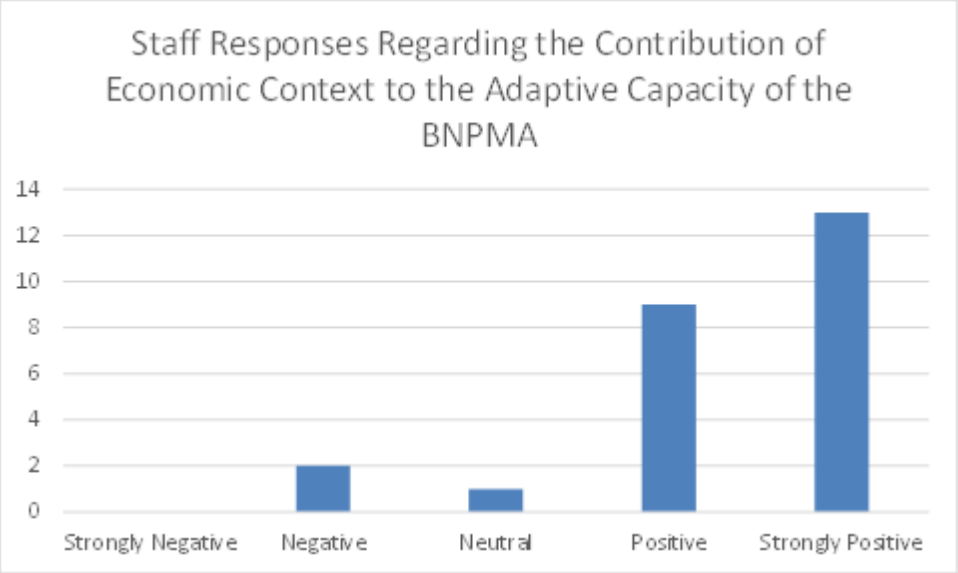

Figure 6.0.14 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's economic context to overall adaptive capacity. Original data is tabulated in full in Appendix 6.2.

As discussed in Section 6.2.2, the internal financial resources available to the BNPMA have an important influencing role in relation to the organisation's internal adaptive capacity. Similarly, the wider external economic context within which the BNPMA is operating also has a significant role to play. Unlike the BNPMA's internal financial resources which were found to have a negative impact upon the organisation's ability to respond to new challenges, staff responses to the Likert questionnaire indicate a belief that the external economic context of the organisation makes a strongly positive contribution to external adaptive capacity. Almost 90% of staff surveyed strongly agreed that financial contributions from NGOs have a vital role to play in making up the shortfall in park income, thus enabling the park to implement a greater breadth of conservation programmes than would otherwise be possible. Indeed, as reported in the BNPMA's annual reports and referred to in Chapter Four, between 2007 and 2012 annual financial contributions from the BNPMA's conservation partners account for up to 65% of the organisation's total budget.

Responses from a number of interview participants reiterated the positive contribution that such support has on organisational adaptive capacity whilst shedding more light on the important role of external organisations in providing financial resources to enable the park to address new challenges. An Assistant Warden from the BNPMA observed that, '*if any new challenges come along… we cannot request to the government to change our plans, or for additional funds, so we have to go to our partners for help*,' (ABBNPMA). The Chief Warden reiterated this point more succinctly, '*getting money from the government is very difficult; conservation partners they are very much practical*,' (TRABNPMA). As these quotes

illustrate the BNPMA's external financial environment has an extremely positive impact on the organisation's adaptive capacity by significantly bolstering the financial resources available for conservation programmes. They also allude to the more deleterious influence of the wider political and institutional context on the on the BNPMA's adaptive capacity.

6.3.3 Political and Institutional Context

In this context, institutions are defined following North (1990 p3) as, "the rules of the game," that is the formal and informal constraints that influence social or organisational behaviour and govern organisational structure (Pelling et al. 2008). Formal institutions are therefore represented in this case by legislation, work policies and official procedures. Informal institutions are less tangible, alluding to cultural norms, values, and prevailing practise including, in the case of government organisations, bureaucratic norms. An organisation's political context, on the other hand, is fundamentally concerned with decision-making processes and power from the local to the national arenas.

The political context of an organisation can influence its adaptive capacity through defining the range of realistic, appropriate and technically feasible response options available to address new drivers of change. Where an organisation's political context is characterised by political stability with equitable power over decision-making which is flexible, efficient and founded upon altruistic motivations, then it will impact positively on an organisation's adaptive capacity (e.g. Vincent 2007, Gupta et al. 2010, Runhaar et al. 2012). Where decision-making power is disproportionately in the hands of a single political group, where decision-making is inflexible and inefficient and based upon selfish motivations, political instability prevails and the opposite is likely to be true.

Within the political arena, institutions as formal and informal rules exert a strong influence on the capacity of an organisation to adapt to its drivers of change. In the face of new challenges institutions govern an organisation's decision-making ability at the local level, as well as defining the available range of potential solutions to a challenge and the actors who are able to implement these. Where the formal and informal institutions relevant to an organisation concentrate decision-making power in the hands of the few, where they are not inclusive, flexible or responsive to change, the organisation's ability to exploit the opportunities associated with climate change, or to successfully respond to the new challenges that it faces, will be severely constrained (Ford et al. 2011, Runhaar et al. 2012).

Where the relevant institutions are inclusive, display a willingness to change, and are characterised by flexibility in decision-making authority, they will contribute positively to adaptive capacity by facilitating negotiation and compromise, whilst encouraging expeditious and decisive action when new challenges arise (e.g. Yohe and Tol 2002, Adger et al. 2003).

As described in Chapter Four, the prevailing political landscape in Nepal is complex, existing in a state of flux since 1991 and the first Jana Andolan. Although recent years have witnessed the restoration of a degree of stability, the political context in Nepal remains characterised by corruption, bureaucracy, national level strikes, and impotence in decision-making. As a respondent from a Nepali based think tank observed, there has been significant political upheaval in Nepal since the 1980s and that is reflected in the structure and culture of current government departments; the political struggle and changes that have occurred have only been successful in deconstructing the status quo, nothing has yet been reconstructed (RKNPAAFA). During the researcher's time in the field, for example, four national level bandhs were held resulting in a complete shutdown of all government services and a total ban on travel within the country, preventing park staff effectively carrying out their duties.

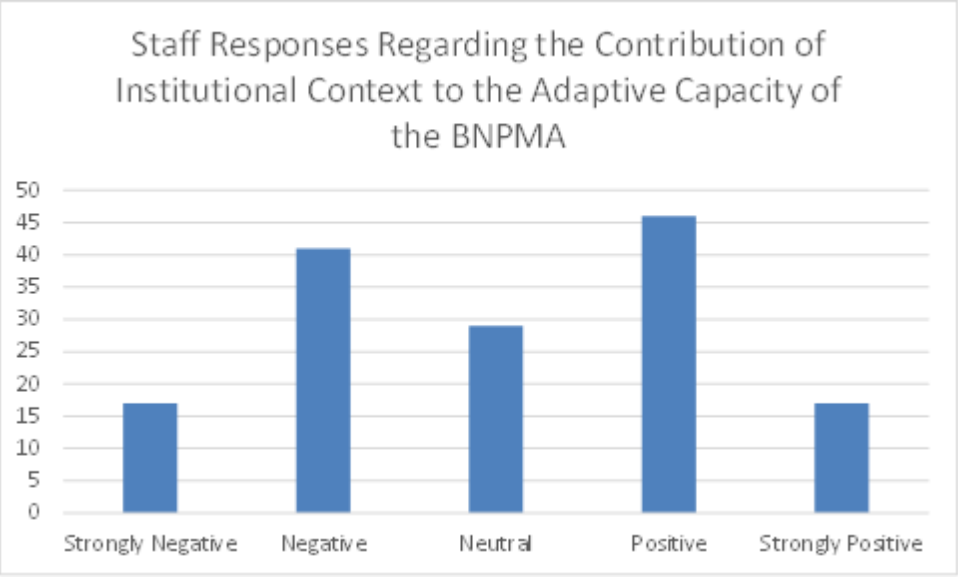

Figure 6.0.15 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's institutional context to overall adaptive capacity. Original data is tabulated in full in Appendix 6.2.

Against this volatile and unpredictable political backdrop the BNPMA's institutional environment has remained relatively constant; legislation pertaining to the management of the park has changed very little since the introduction of the National Parks and Wildlife

Act 1973. Indeed questionnaire and interview respondents identified this inertia in the organisation's institutional context as a key factor constraining the park's adaptive capacity. Almost three-quarters of questionnaire respondents were of the belief that the BNPMA's activities are constrained by the government rules and regulations which dictate how park management must be done; less than one in ten disagreed. Staff demonstrated less concord when asked about the ability of the BNPMA to resist rules which do not contribute to the running of the park and its capacity to lobby for changes in the rules and regulations governing park operations. Similarly, when asked whether government rules allowed enough flexibility to enable quick responses when new challenges arise, there was little consensus with only half of respondents believing that this was the case. However almost two-thirds of respondents believed that when faced with new challenges formal government rules and regulations limit the ability of the organisation to respond quickly and effectively; headquarters-based staff, who engage with these issues on a daily basis, strongly agreed.

Interview respondents demonstrated a more partisan view painting a more comprehensively negative picture of the role of the organisation's political and institutional context in enabling the BNPMA to adapt to its drivers of change. Respondents were unanimous in their belief that the wider political and institutional environment was having a deleterious effect on the adaptive capacity of their organisation, citing the influence of inflexible and bureaucratic institutions situated within an unstable political arena where decision-making power is concentrated in the hands of the few. Formal institutions were depicted as being inflexible and cumbersome, rending organisational systems unresponsive to new challenges.

The national level political context was cited as a key source fostering this inflexibility in formal institutions. At the time of fieldwork, parliament had been dissolved following the failure of the Constituent Assembly to ratify a new national constitution. At this time, legislative changes could not be made and no new laws enacted. Changes in policies and programmes could be made, however the absence of a national legislative body served to further concentrate decision-making power in the hands of a few high-level government officials, who were less accountable and therefore often less responsive to the needs and desires of staff at the local level. Furthermore, the process of developing new projects and

programmes was constrained by this prevailing political impasse. As the Joint Secretary of the MoFSC observed:

'*The current political situation has had a significant impact on our work here. We have not been able to implement our projects and programmes as we would have liked, and we need extra time to prepare in order to overcome the political problems which exist, as all projects and programmes have to be ratified by the government administration. So the current crisis is having severe negative impacts on programme implementation in terms of budget level, and the timing and quality of programmes. Let me give you an example. One of our programmes which was going to be implemented at the district level was meant to be ratified last August but we only received details of the full budget two weeks ago, so now we are really preparing to implement it in July but we are already eight months late! This has become a common problem for us; we haven't been able to design our programmes as and when we want because we are not sure of our budget. Also, because of the political situation, our budget has been reduced and we have a very limited overall budget and so it is not possible for us to introduce new programmes on time or to the extent that we would like*,' (KPA MoFSC).

Nepal's capricious political context and associated lack of flexibility in decision-making was also found to have an impact on formal institutions at the local level. The park-level implications of this were elucidated by the Chief Warden:

'*There are so many constraints and limitations, right, so that it is very difficult to formulate the new policies or guidelines because of the political turmoil in Nepal. So it is very difficult to change our guidelines, to change our policy, right, in time. So the local people are suffering from conservation because of the poor policies of the government,*' (TRABNPMA).

Moreover the country's prevailing political instability has resulted in inflexible rules pertaining to park management being formulated by a few increasingly powerful individuals based in the National Planning Commission. For example although the BNPMA's internal planning processes were opined as contributing positively to the organisation's adaptive capacity, the BNPMA's budget and associated programme of activities are strictly defined by their five-year plan. If a new challenge arises during this period, central government prescriptions prevent any flexibility in the organisation's budget or work plan.

In such instances, but for the intervention of the organisation's conservation partners, the BNPMA would be powerless to respond. As the Chief Warden summarised:

'*There is a lack of flexibility that hinders park management, adaptive management. It may be better for the scientific management but sometimes for quick reactions we need a quick response for the animals, a quick response to the environment. But we don't have any authority to go for a quick response*,' (TRABNPMA).

These quotes illustrate the links between the organisation's political and institutional context and the organisational culture and planning systems, discussed in Sections 6.2.3 and 6.2.4, which were found to have a broadly positive impact upon the organisation's adaptive capacity. Indeed the organisation's political and institutional context, outlined above, works to inhibit and constrain the BNPMA's adaptive capacity directly *and* through the influence that this has upon the ability of the organisation to realise its cultural aspirations. Whilst internally the organisation may be willing to change and striving to remain flexible, this matters little if there are forces in the organisation's external environment that prevent these ambitions from being realised. Similarly, despite the organisation's wish to retain a degree of flexibility within its budget and programme planning, the national level requirement to submit five-year plans that must be strictly adhered to, counteracts the positive impact of the organisation's internal systems on its adaptive capacity.

An additional facet of the BNPMA's formal institutions which exacerbates this negative contribution to its adaptive capacity, is the rate of turnover of Ministry staff who are often in post for a very short time. Indeed during the researcher's time in Kathmandu, the head of the MoFSC was in post for just two weeks before moving on to a more prestigious government department. The impact of this high churn rate is that on each new appointment, senior park staff must take the time to build a trusting working relationship with new government personnel and to brief them and bring them up to speed on the key issues pertinent to the running of the park and the challenges it is facing. As a focus group respondent observed:

'*The instability within the government, and frequent change in the cabinet means changes in the leadership of the Ministry, and changes in the Minister and the Secretary and the*

Director General, all these high figures. That leads to changes in the relationship between the officials at Kathmandu, and the officials down there as the park managers, because there are always, almost always, interpersonal relationships which are sometimes good, sometimes bad… For example, if the particular park manager has a good relation with the director here in Kathmandu then he or she would have invested more energy, resources, effort or whatever to better manage the park. If he or she doesn't have a good relationship with his boss at the capital, they tend to just spend the days [seeing out their posting],' (R2FGFA).

These frequent personnel changes at Ministry level result in the breakdown and renegotiation of relationships between park managers based in Bardiya, and DNPWC and Ministry staff based in Kathmandu. Not only does this raise the possibility of poor relationships between Ministry and BNPMA staff, it also results in reduced motivation for park staff, impeding the impact of the inspirational leadership required for robust adaptive capacity, further constraining the organisation's ability to respond to its new drivers of change.

Regular personnel changes are also a feature at the local level where they similarly work to the detriment of the organisation's adaptive capacity. Official Government policy decrees that all staff must be rotated between National Parks every two to two-and-a-half years, resulting in a very high turnover of staff. Not only does this prevent staff from developing a thorough knowledge of the specific context in which they are posted, it also reduces the likelihood of them developing a strong emotional investment in the park. This issue is of even greater detriment to the organisation's adaptive capacity when considered in conjunction with the organisation's oral culture. As the head of a key conservation partner elaborated:

'*We never write, that is our problem. You European people you write everything down, you have the habit of writing, you have a habit of reading. We don't have either habit of reading nor the habit of writing. That is why we are lacking behind. What happens if I have knowledge? Then my knowledge is transferred to my children of course, but orally, not written down*,' (RKNTNC).

The clear implication of this being that when staff members move on to take up a new position they take their knowledge and expertise with them, leaving only that which resides in the organisations systems and procedures.

The role of more informal institutions in constraining the BNPMA's adaptive capacity was also highlighted through semi-structured interviews. Cultural norms and values were found to impact negatively on the organisation's responsiveness to change, particularly as a result of the prevalent and pervasive unofficial incentive structure that exists within Nepali public sector organisations. Amongst interviewees there was a widespread belief that high-level officials have a tendency to base their decisions not upon sound evidence, but on non-technical factors stemming from what one interviewee euphemistically termed a 'different' incentive structure. Numerous interview respondents recounted tales of high-level conservation decisions being taken contrary to expert advice, or decisions being inexplicably reversed at a later date. The current lack of a national government and the growing concentration of decision-making power in the hands of a few high-level individuals encourages this problem and works to further undermine the BNPMA's external adaptive capacity.

Similarly, at the local level numerous respondents reported the absence of incentives for staff to be proactive or initiate new programmes, since (as discussed in Chapter Two and in Section 6.2.4) success within Nepali bureaucracies appears to be strongly dependent upon who you know rather than on personal achievement. Incidents recorded in the researcher's field diary further substantiate this idea, documenting numerous occasions in which day-to-day interactions with park staff were clouded by a perceived need for park staff to tow the hegemonic line. As one Focus Group respondent relayed, the incentive structure, '*should incentivise people's learning and knowledge generation and sharing, you know, but so as long as you can make your boss happy… you can ensure your better position*,' (R3FAFG).

In terms of the contribution of the local political context to the organisation's adaptive capacity, further related issues arise. As discussed in Chapter Four the National Parks and Wildlife Conservation Act (1973 p5) officially sanctions the park's Chief Warden to implement any activities and make any decisions deemed necessary to ensure the effective management of the park's core area and buffer zone. In practice, however, interview respondents revealed a number of instances in which this authority is unofficially

undermined. The prosecution of those engaged in illegal activities within the park's core area, for example, is not always straightforward. As one of the park's Assistant Wardens disclosed:

'*If we capture individuals engaged in illegal activities it is often difficult to successfully prosecute them and we sometimes face political pressure not to prosecute individuals and that is not good. And law and order is not good at the moment. Sometimes these groups attack our staff and it is difficult for us in these situations to do our job properly and to ensure the safety of our staff*,' (RKTBNPMA).

Similarly, in recent years a number of illegal settlements have sprung up in the park's buffer zone, predominantly populated by Kamaiya, Nepal's former bonded labourers freed under the Kamaiya Labour (Prohibition) Act 2001 (UN 2012). Political parties looking to garner public support have begun to issue land to these newly freed groups. Despite legislation which prevents the creation of new settlements within the park's Buffer Zone, park managers are powerless to prevent this trend, as captured in an exchange between the park's Chief Warden and a Senior Game Scout:

Senior Game Scout: *There is a huge problem of illegal settlement in Balauri* [buffer zone post at which respondent is stationed] *with approximately 150 houses illegally erected, and it is getting worse.*
Chief Warden: *They should be evicted and no new settlements allowed.*
SGS: *Where will they go?*
CW: *It's not up to us it's up to the government. Our job is to protect the park. I will meet with the District Forest officials and get them to visit the community and conduct an inspection to ascertain what can be done.* (GS Meeting)

A member of a Buffer Zone CFUG highlighted the extent of this problem:

'*From the temple to this village, 10, 12 years before it is all forest when you walk but now you see all villages when you walk from the temple to this village, through the forest from the market place here. It used to be a big forest just 14-15 years, 15 years before, it was a big forest. Now when you come you see on left hand side it is all houses. In the same way it is going more and more and more and it is the Sukumbasi* [Landless people]. *… There are*

some politics there backing them up, or there are some leaders, some bullshit leaders who say, 'ok, you go there and there,' and they have some power with the government and then they settle there… They settle, and if you fight they are more stronger,' (SPBCFUG).

A member of park staff exposed an additional, national level, dimension to this conflict:

'*Encroachment is another challenge, but a different kind of encroachment; encroachment by the Government. For example, those people working for the DNPWC and those officers working on issues of conservation and environment try to ensure that all Protected Areas are not encroached. At the same time, officers in the department of land reform and temporary government commissions such as the Proletariat Land Reform Commission give land and issue land certificates and land titles to landless individuals. So there is a real conflict between Government Departments some of which are trying to protect the Buffer Zone, whilst others are trying to make sure that people can settle there. This just increases the human pressures on the park*,' (MrNBNPMA).

The consequences of the resultant human pressures on park resources, combined with the inability of the BNPMA to resist these challenges imposed through their political context, include the expenditure of scarce financial and personnel resources in trying to address these challenges. In this way the BNPMA's political and institutional context severely restricts its adaptive capacity. The organisation's helplessness in the face of the challenges and constraints imposed upon it by its wider political and institutional environment at a range of scales, serves to severely constrain the capacity of the organisation to respond to its drivers of change.

6.3.5 Ecological Context

As discussed in Chapter Two of this thesis, a number of authors (for example Adger, Brown et al. 2003, Agrawal et al. 2008 and Moser et al. 2008) have identified the role of environmental context in defining adaptive capacity. Where the natural environment exists in close proximity to a critical threshold, beyond which it may not be able to adapt, it can be said to impact negatively upon the organisations adaptive capacity. In such circumstances, small changes in the organisation's environment can result in significant impacts in its ecological context. As Wilby and Vaughan (2011) summarise, the closer you get to such tipping points the more circumscribed your adaptation options become and the

more critical the need for anticipatory action. The consequences of such a regime shift, were it to occur, would be the imposition of further limits on the organisation's ability to successfully adapt to change. In this way, the interdependence of ecosystems and organisations results in the ecological context of an organisation impacting upon its adaptive capacity.

In instances where an organisation has a comprehensive knowledge of its ecological system, where that ecological system is stable and resistant to change, and where dependence upon the natural resources provided by the natural environment is low, the ecological context will impact positively on the organisation's ability to respond to new challenges (e.g. Agrawal 2008, Moser et al. 2008). This is particularly true in circumstances where the organisation's aims and objectives are inherently linked to the natural environment, and where – as in the case of the BNPMA - the organisation's drivers of change predominantly relate to wider environmental changes.

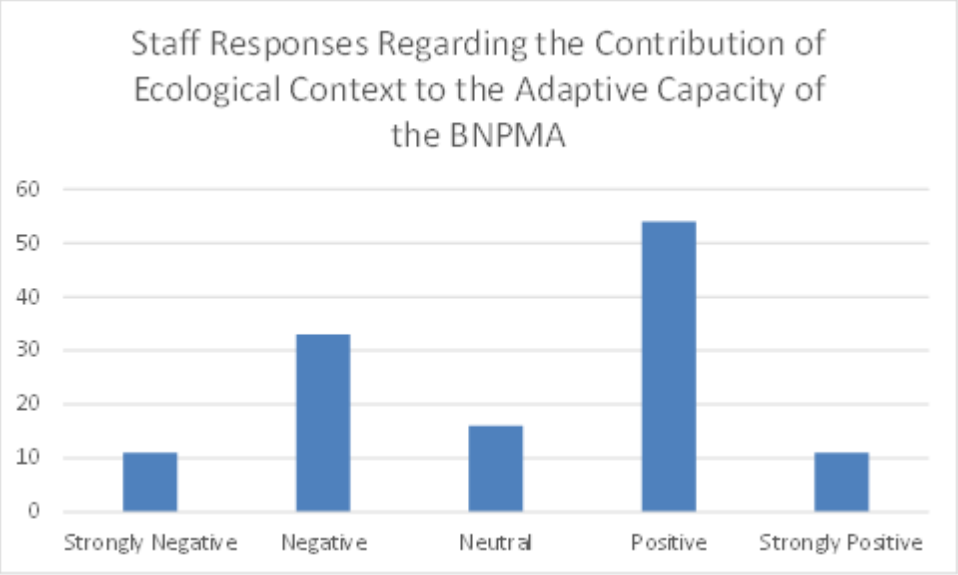

Figure 6.0.16 An illustration of aggregate staff responses to questions relating to the contribution of the BNPMA's ecological context to overall adaptive capacity. Original data is tabulated in full in Appendix 6.2.

The BNPMA's ecological context is dynamic and capricious and, as demonstrated in Chapter 5, is currently facing a multitude of environmental pressures. Despite this, questionnaire responses indicate a belief amongst staff that new challenges faced by the organisation have limited impact on the natural environment of the park, which is widely viewed as being resilient and resistant to change whilst contributing positively to the BNPMA's adaptive capacity. In contrast, staff believe that the natural environment of the buffer zone is extremely vulnerable to new challenges. This distinction made by park staff between the

natural environment of the park's core area and the buffer zone is an interesting one. Although the ecosystems present in both are broadly similar, the belief of staff that the core park area's environment is more able to resist change may stem from the protected nature of this area. Questionnaire responses indicate a belief amongst staff that that this strict protection instils the area with an ability to resist and respond to environmental changes, a trait seen as being absent from the buffer zone environment perhaps due to the greater human pressures experienced in this area. Alternatively it is possible that this apparent belief in the resilience of the park's ecosystems is a consequence of the latent imperative of staff to not to voice any opinions that may be construed as being disruptive by those above them in the organisation's hierarchy.

Interestingly, interview responses intimate a belief amongst staff that the ecological context of the park has but a limited role in defining the organisation's overall adaptive capacity. None of the interview respondents specifically referred to the role of the park's natural environment in enabling or constraining adaptive capacity. Indeed, this finding mirrors the coverage of this component in the wider literature, where the importance of ecological context in determining adaptive capacity is seldom discussed. Similarly, in focus group discussions and minutes from staff meetings attended, no indication was given by participants that the organisation's ecological context has a significant bearing on its adaptive capacity.

It would seem then that whilst park staff consider the ecological context of their organisation's environment to be broadly stable and to contribute positively to the organisation's adaptive capacity, they do not view this contribution as being significant in terms of the BNPMA's aggregate adaptive capacity. In the following section of this chapter the relative importance of these diverse components of adaptive capacity and the relationship between them are analysed in more detail, with findings situated within the context of the wider literature.

6.4 Discussion

Having identified and documented the key internal and external elements which together constitute the BNPMA's adaptive capacity, this section considers moves on to consider the implications of these findings. The first key issue raised by the results presented in this chapter relates to the effectiveness of Likert questionnaires as a tool for organisational

research. Numerous authors (e.g. Burns 2000, Bertram 2007) advocate the use of this method in organisational research, emphasising its utility in uncovering information relating to staff attitudes, opinions and belief about their organisation. In this case however, disagreement were found on a number of occasions between Likert responses and the results obtained by the methods used to triangulate these results. This raises questions regarding the value of this research tool in the context of public sector organisations in developing countries.

Quite apart from the practical difficulties experienced in administering these questionnaires (discussed in 3.4.2) disagreements were found between Likert and interview responses in relation to organisational culture and the wider political and institutional context. Even where disagreements were less distinct, such as in relation to internal resources, the complimentary analysis of interview and focus group data, along with field observations, was often required to uncover the nuances of the situation. This apparent discord between results, along with the apparent limitations associated with Likert responses, may be a result of respondent concern regarding confidentiality, in concert with the wider cultural climate that exists within the BNPMA.

Although the researcher went to great lengths to ensure participants were fully aware that their responses would be anonymous (see Section 3.5) it is conceivable that staff may have remained reluctant to respond frankly due to concerns that this may not be the case. A consequence of this would likely be a tendency of respondents to be less critical of the organisation than they might otherwise be. This situation may have been exacerbated by the absence of a culture of writing within the organisation which could feed staff concerns regarding anonymity. The wider culture of silence within the organisation identified by this research, in conjunction with the prevailing atmosphere of Chakari and Chaplusi, would further reduce the likelihood of staff responding in any way that could be deemed critical of the BNPMA or its senior staff. Indeed it is notable that the two sections of the questionnaire where there was the greatest disparity between the results of each research method, had the potential to portray the culture of the organisation and the wider political arena in a negative light, and may therefore have been deemed more controversial by respondents.

These limitations are perhaps peculiar to the administration of Likert questionnaires in the context of the BNPMA or, more likely, to Nepali bureaucracies in general and feasibly more widely, to public sector organisations throughout the developing world. Despite this, the use of Likert questionnaires in this research was not without merit. Responses did shed light on a number of perhaps less controversial components of adaptive capacity, including the resource constraints facing the BNPMA, its internal systems and social context. Furthermore, the questionnaire was useful in elucidating a number of disparities that exist between different sections of the organisation, particularly between those staff based in park headquarters and those stationed at Hattisar. On balance, then, the judicious use of Likert responses in this case has provided a broad overview of internal and external components of adaptive capacity, as well as highlighting disagreements between departments within the organisation. Indeed the limitations of this method with respect to the more controversial aspects of the BNPMA and its operations, whilst limiting in some respects also had some unanticipated benefits through the attention that it draws to the cultural environment that exists within the organisation and the complex political and institutional context within which it operates.

More broadly, the analysis presented in the previous two sections of this chapter has demonstrated that the adaptive capacity of the BNPMA is dependent upon a multitude of internal and external factors operating at a range of scales, largely corresponding to those factors identified in Chapter Two. Importantly, and less frequently discussed in the wider literature, it has also highlighted the interdependence of these components and the relationships between them, which help to define their relative contribution to organisational adaptive capacity. Similarly some determinants have been shown to be more distinctly multi-scalar than others, operating to influence components of the organisation's adaptive capacity over a range of scales.

Financial resources, for example, are of primary importance in determining the BNPMA's adaptive capacity. The finances available to the BNPMA are influenced by national government and local stakeholder contributions and in turn influence a wide range of other determinants of organisational adaptive capacity. The BNPMA's financial context impacts upon the quality and extent of the technological, infrastructure and human resources available to the organisation, the provision of training and, importantly, the scope and extent of conservation initiatives that can be designed and implemented. Semi-structured

interview responses in particular, highlighted the importance of this component, a finding corroborated by minutes taken at internal meetings attended by the researcher and backed by Likert responses.

A related key component found to impact negatively upon the organisation's adaptive capacity, was the extent of the human resources available to the organisation. Not only is the BNPMA chronically understaffed, employees are having to work in multiple positions for which they are not suitably trained and a clear imbalance exists in relation to the allocation of staff. However the importance of human resources in determining an organisation's ability to adapt to its drivers of change runs further, through its influence upon the process of knowledge generation and sharing within the organisation, the quality of organisational planning systems, monitoring and evaluation strategies, and even upon the wider organisational culture itself. One of the park's Game Scouts highlighted some of the practical implications of these human resource limitations:

'*I am stationed at the Bas Pani post near the highest peak in Surketmalla which is at 1445m. There is also another hill in the area which is as high as 1571m. In these places life is very difficult; it is very difficult for the communities living there. People need grass and firewood and they have to climb uphill for three hours to collect it and then walk back for three hours. Although this is illegal it is almost impossible for us to arrest them giving the climbing and at least six hour patrols that are needed to catch them*,' (R3GSFG).

Closely linked to the BNPMA's human resource capacity is the important role of the organisation's social context in determining its adaptive capacity, highlighted through interview and questionnaire responses. The social context of the organisation from the national to the local level, impacts not only on the knowledge, information, and training available to staff, but also the extent and quality of personnel available for park protection. Indeed the influence of the organisation's external social context can extend to almost every aspect of the organisation through directed support to, for example, develop monitoring and evaluation systems or through the provision of assistance in planning processes. Interview respondents most frequently cited components of the organisation's social context as the key positive influence on the organisation's adaptive capacity, as did respondents in both the game scout meetings and focus group, a finding also reflected in Likert responses. A clear example of this was provided by a member of park headquarters

who documented the role of the recently formed Community Based Anti-Poaching Control Unit (CBAPCU):

'*Another initiative which has helped to address the issue of a lack of human resources to cover the buffer zone, and also issues to do with poaching, is the creation of the CBAPCU which is made up exclusively of young volunteers who spend their time protecting the park from poachers. The CBAPCU also allows us to be more responsive than we would otherwise be. Before, the public would let the army know if they believe there to be illegal activity taking place and it would take them some time to respond as they would have to gather together a unit, get issued with weapons and so on. This group of young anti poachers can respond immediately as there are members in every community, so they can reach the scene immediately and ensure the protection of their community*,' (MrNBNP).

In this way the influence of the social context of the BNPMA on organisational adaptive capacity extends widely, alleviating, to some degree, the financial and human resource constraints facing the organisation.

The political and institutional context of the BNPMA was also found to be an important multi-scalar determinant of the BNPMA's adaptive capacity. Semi-structured interview discussions with senior park staff and with Ministry staff based in Kathmandu highlighted the important constraining role that the political and institutional context has upon the BNPMA's adaptive capacity, not only directly but also through its influence on organisational systems and flexibility, conservation priorities and financial resources. As the Chief Warden observed in relation to the constraints placed upon the BNPMA by the quinquennial planning cycle imposed at the national level:

'*We generally prepare the five year plan which is approved by the government and that is a binding material. We have to work under that plan… If any incident happens during that time then we call for our conservation partners, and make a request to them and they will provide the support… In one case a wild elephant entered a village and killed the people, destroyed the houses and we need additional effort to just control that elephant. We need manpower, we need vehicle, we need fuel, we need logistic support from the persons we involve to control the elephant right. So at that time we had additional costs. It was not*

included in the regular budget. So that during that period we request to the conservation partners,' (TRABNPMA).

There are a number of additional factors adjudged to have a more limited role in determining the BNPMA's adaptive capacity. Perceived adaptive capacity, for example, was rarely mentioned by interview or focus group respondents and was not expressed as being important issue in meetings attended by the researcher. In a similar vein the organisation's ecological context was not cited by interview respondents as a key determinant of adaptive capacity, nor did Likert responses demonstrate significant consensus around this point. In the case of the BNPMA's technological context, the lack of influence of this component of adaptive capacity on the other identified determinants at any scale, implies a more circumscribed but nevertheless important role in defining the BNPMA's adaptive capacity.

My conceptual framework, whilst useful for documenting the diverse components of the BNPMA's adaptive capacity and summarising the direction of their overall impact, requires development in order to effectively illustrate these linkages. Neither does it depict the absolute importance of these different constituents; the quantification of the relative importance of distinct components of adaptive capacity remains a complex but stimulating area for future research. Based on the links between these different components and the scales over which they operate, on the complimentary and cautious use of Likert responses, semi-structured interviews, focus groups and meeting transcripts it is, however, possible to intimate broad conclusions in respect of their relative importance in determining the BNPMA's adaptive capacity. To improve the capacity of the organisation to effectively respond to its drivers of change, scarce resources should, where possible, be targeted at the most influential components of adaptive capacity, whilst ensuring attention is paid to cultivating and maintaining those which are currently impacting positively on the adaptive capacity of the BNPMA.

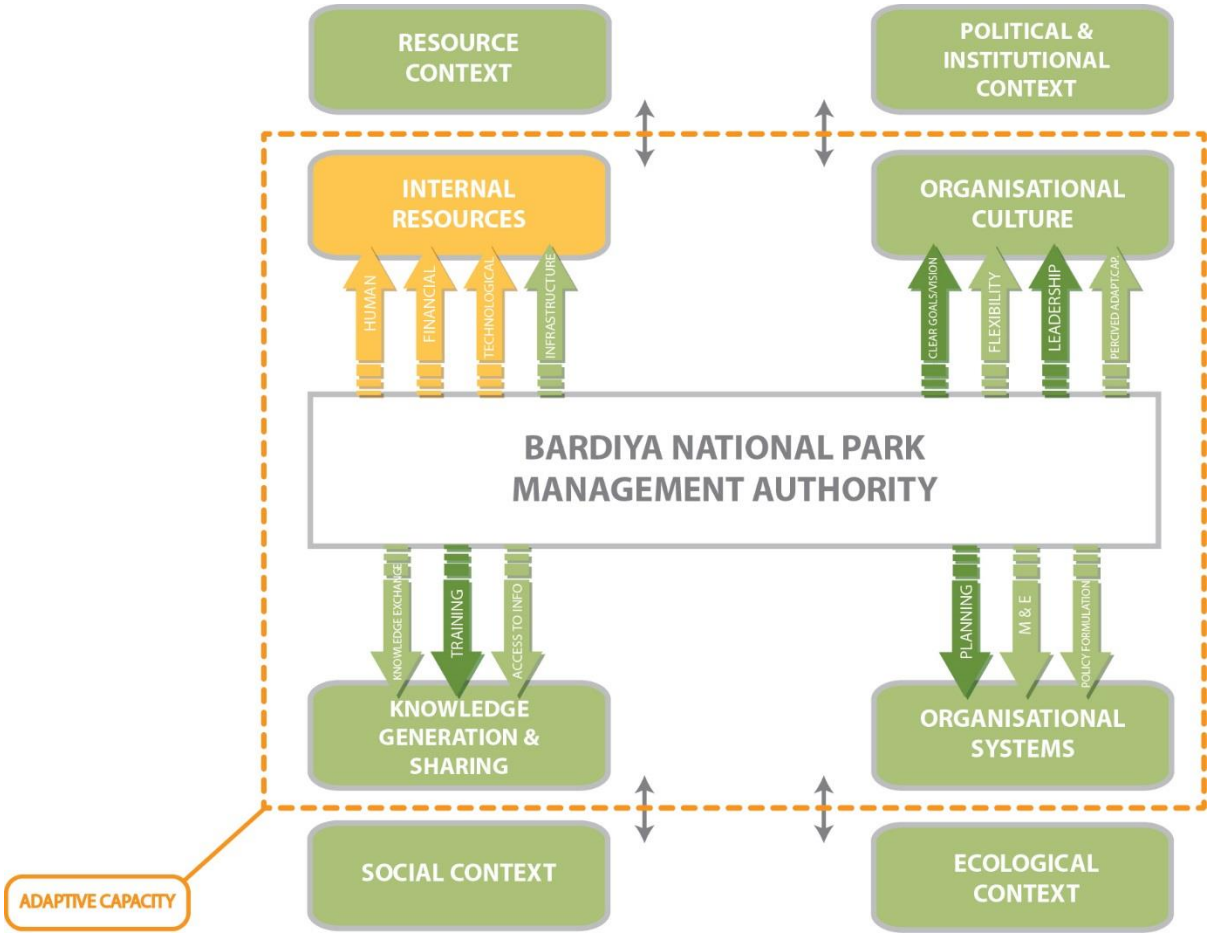

Figure 6.17 An illustration of the relative contribution of the constituent components of internal and external organisational adaptive capacity, to the adaptive capacity of the BNPMA, based upon Likert questionnaire responses. For questions where Likert responses were most frequently 'strongly agree' a value of +2 was assigned, shown in the diagram above as dark green and representing a strong positive contribution to internal adaptive capacity. 'Strongly disagree' was not found to be the most frequent response for any component of adaptive capacity. Where 'agree' was the most frequent response, a value of +1, represented by the light green sectors, was assigned; where it was 'disagree' a value of -1 was assigned represented above as orange. It is important to note that, given the dynamic nature of adaptive capacity, Figure 6.17 necessarily only provides a representation of the organisation's adaptive capacity at a single point in time. What the diagram does do, however, is provide a clearly structured and easily interpreted representation of the key components of the BNPMA's adaptive capacity, their relative contribution of each component to overall adaptive capacity, and an indication of which internal and external components are most closely linked.

6.5 Conclusion

This chapter has built upon the preceding analysis of the BNPMA's drivers of change to examine the factors that enable and constrain the capacity of the organisation to respond to them. Results from Likert questionnaires have been presented and analysed in conjunction with semi-structured interview and focus group responses, meeting transcripts, and official documents, to examine the interplay and contribution of each of these components to the organisation's overall adaptive capacity.

In broad terms the findings presented in this chapter fit within, and are largely supportive of, the growing body of literature on the components of adaptive capacity. Organisational systems, culture, internal resources and the process of knowledge generation and sharing were all found to be important determinants of internal adaptive capacity. The organisation's external resource base and social, institutional, political, and ecological contexts were all found to be significant elements governing the organisation's external capacity to respond to its drivers of change.

Likert questionnaires have been shown to be a useful method to provide a simple, clear overview of the contribution of different elements to overall adaptive capacity, despite limitations with regard to facilitating a more detailed and nuanced understanding of the organisation and it external environment. The complimentary use of other diverse research methods has helped to overcome these limitations, uncovering important links and interactions between the diverse dimensions of organisational adaptive capacity. These relationships were found to be of paramount importance in determining the relative contribution of each component to aggregate adaptive capacity, demonstrating the importance of considering the interplay and influence of internal and external factors over multiple scales.

This chapter has presented an analysis of the factors which govern the ability of the BNPMA to respond to its drivers of change, outlined in the preceding chapter; how this capacity is translated into action is the subject of the final analytical chapter of this thesis.

Chapter 7 – Organisational Learning

7.1 Introduction

Having examined the BNPMA's drivers of change and the internal and external components of adaptive capacity that determine the organisation's ability to adapt to these new challenges, the final analytical chapter of this thesis presents an analysis of how this capacity is translated into action through the process of learning. To that end, this chapter employs a number of pertinent examples to elucidate the processes through which the BNMPA is able to mobilise its adaptive capacity to respond to its key drivers of change. These examples of the organisation's responses to new challenges, facilitate an examination of the type of learning taking place within the organisation, how that learning occurs, and how this enables adaptive capacity to be translated into adaptive management interventions; that is, how the BNPMA is able to operationalize its adaptive capacity. In doing so, this chapter addresses the third key question of this research; how learning takes place within the BNPMA and the extent to which the organisation's observed activities, routines and procedures support the organisational learning schema discussed in the wider literature and presented in Chapter Two of this thesis.

The first section revisits key debates in the organisational learning literature, highlighting contested areas within the subject and current research gaps. Subsequently data from semi-structured interviews, focus groups, official park documents and fieldwork observations are used to examine the process of organisational learning in response to a perceived lack of watering holes within the core area of the park. This case presents evidence of both single- and double-loop learning, elucidating the different circumstances in which they are appropriate and the diverse means through which they are achieved. In contrast, the second example, based upon interview and focus group data along with field observations, examines the BNPMA's lack of response to the drying of the Geruwa branch of the Karnali River, shedding light on the circumstances in which a learning disability results in the failure of the organisation to translate its adaptive capacity into a proactive response. The third and final learning example considers the challenge of the increasingly rapid succession of grasslands to forest. Evidence of both single- and double-loop learning is presented, and the complementarity of these learning loops emphasised.

The forms of learning taking place within the BNPMA highlighted through these examples, and the processes through which they occur, as well as the implications of this for wider

organisational learning and adaptive capacity theory are then considered in the discussion section of this chapter. The chapter concludes with a consideration of the implications of these findings, highlighting potentially fruitful areas for future research.

7.2 Organisational Learning

The concept of organisational learning and its component ideas is neither a straightforward nor a clearly defined one. As discussed in detail in Chapter Two, in this thesis organisational learning is defined following Storbjörk (2010) as a deliberative process that may be rationally planned, and/or the result of continuous experimentation and re-evaluation. Organisations successfully learn where valid learning occurs leading to actions that have positive outcomes in relation to the organisation's pursuit of its goals. However as Tosey et al. (2011) acknowledge, the organisational learning domain remains a field characterised by conceptual confusion centred around debates concerning who or what is learning, the level at which learning takes place, and the processes through which learning occurs.

In terms of the who or what, initially learning was understood to occur at the individual level, with organisational learning simply representing the sum of this individual learning (Easterby-Smith et al. 2000, Fabricus and Cundill 2014). The rationale underpinning this conceptualisation of learning was that human characteristics should not be attributed to inanimate organisations. In response to this position, a growing body of scholarship has countered that organisations can in fact learn, through the knowledge stored in their values, norms, systems, structures and procedures. Furthermore, it can be argued that the internal organisational structures and systems within which this knowledge resides, can impact upon the process of learning itself (Easterby-Smith 2000).

This debate around the appropriate unit or level of analysis at which to examine organisational learning has largely been resolved through the broad acceptance of the existence of multiple levels of learning which are understood as being distinct but complimentary. What becomes important, then, is the selection of the appropriate unit of analysis through which to examine organisational learning, and the consideration of the links that exist between different learning levels. To that end, the focus of this chapter is on learning at the organisational level of aggregation, since the phenomena of greatest concern in this case are the overall responses of the BNPMA to its diverse drivers of change. Consideration is also given to the links that exist between learning at the

organisational level and the thoughts and actions of individuals within the BNPMA, as well as the wider learning that occurs in the organisation's external environment.

A second key area of uncertainty with regard to organisational learning is the process through which learning takes place. Since the seminal work of Argyris and Schon (1974), scholars have commonly understood organisational learning as taking one of two forms, termed by the authors single- and double-loop learning. More recently a growing number of authors have conceptualised a third level of learning, frequently termed triple-loop learning (for example Pelling et al. 2008, Pahl-Wostl 2009). However a lack of consensus exists around exactly what is meant by this distinct level of learning, as well as its relationship to the single and double learning loops.

The greatest accord exists around the idea of single-loop learning which is widely understood to be learning that leads to incremental improvements in existing practices (Pahl-Wostl 2009). As such single-loop learning involves the implementation of new actions or strategies by an organisation, to resolve specific problems and improve outcomes based on an ongoing process of monitoring and evaluation. Consequently whilst single-loop learning addresses the outcomes of new challenges it fails to address their root cause.

Double-loop learning concerns change beyond business as usual and involves the modification of an organisation's norms, policies, routines and core values upon which day-to-day actions and routines are founded (Hatch 1997, Tosey et al. 2011). As with single-loop learning there is broad consensus regarding the definition of this term; the debate is less concerned with exactly what constitutes double-loop learning than with its relationship to single-loop learning, an argument considered in detail in Chapter Two. The conceptualisation of Double-loop learning used in this chapter posits it as being complimentary to single-loop learning, arguing that double-loop learning is not necessarily superior to single-loop learning, rather that each has its own value. Double-loop learning may be particularly relevant during times of rapid change, whereas single-loop learning may be of greater import where smaller corrective actions are required to improve performance, and where wholesale upheaval and reformulation of an organisation's processes and protocols would not only be unnecessary but also counterproductive. Furthermore, as the examples of organisational learning presented in the subsequent

sections of this chapter demonstrate, the boundaries between double- and single-loop learning are not as clear-cut as their definitions would suggest.

By far the most contentious and ill-defined process through which organisations are said to learn is commonly termed triple-loop learning (for example Armitage et al. 2008, Pahl-Wostl 2009, Löf 2010). The concept of triple-loop learning is often mistakenly credited to Argyris and Schon who describe a third type of productive organisational learning, which they term deutero-learning (Argyris and Schon 1996). This is clearly defined by the authors as, "enquiry through which an organisation enhances its capacity for single- and double-loop learning," (ibid. p20). Deutero-learning as conceptualised by these authors is therefore primarily concerned with learning about learning. More recently, a number of authors (for example Löf 2010, Storbjörk 2010) have muddied the water around this concept, referring to triple-loop learning which is defined as a transformational process through which an organisation reconsiders its values and beliefs. Some (for example Löf 2010) argue that this third learning loop is a prerequisite for an organisation to evolve to a higher level of adaptive capacity. The clear implication of this relatively recent conceptualisation of triple-loop learning is that this type of learning is more desirable than and superior to single- and double-loop learning since it involves a greater degree of (transformative) organisational change.

This interpretation of a third loop of organisational learning is appealing in terms of order, form and aesthetics but is, I argue, less helpful in terms of analysis as it feeds back into misconceptions regarding the primacy of double-loop learning over single-loop learning; it implies an increase in importance and effectiveness as an organisation 'travels along' learning loops (Pahl-Wostl 2009). I argue, following Tosey et al. (2011), that a third type of learning can be identified, concerned with finding out how best to facilitate learning within an organisation, whilst identifying and addressing the factors that may inhibit learning. In other words this third form of learning, analogous to Argyris and Schon's duetero-learning, is learning achieved through the analysis of the processes of single- and double-loop learning; it requires an organisation to reflect upon them. In this conceptualisation deutero-learning does not transcend single- and double-loop learning and, unlike contemporary conceptualisations of triple-loop learning, it does not require an organisation to reject its principles and values and reformulate its underlying purpose. Were the latter to be the case a conservation organisation would be unlikely to attain the rarefied heights

of third-order learning since to do so might involve a rejection of the fundamental conservation values and moral imperatives which underpin it.

The muddled ideas and nebulous concepts surrounding the process of learning, discussed above, derive at least in part from the dearth of empirical studies which have been undertaken to examine learning loops with reference to real life cases. The examples from the BNPMA provided in the following sections of this chapter may provide a useful contribution to addressing this shortcoming. As the following sections demonstrate, in the case of the BNPMA productive organisational learning is of paramount importance if the park management authority is to successfully employ an adaptive management approach to conservation. Organisational learning is a vital component of adaptive management since adaptive management is concerned with improving knowledge to improve organisational performance, whilst minimising the risks associated with operating whilst in possession of imperfect knowledge (Keith et al. 2011). As a decision-making approach, adaptive management has been developed to deal with such uncertainty and it therefore has the concept of learning at its core. With increasing climate variability and change uncertainties surrounding decision-making are amplified, ensuring the need for robust decision-making is more pressing than ever. Learning is therefore a central concept to adaptive management approaches, and whilst the original understanding of learning in adaptive management was of an iterative process based on the results of monitoring and evaluation (perhaps analogous with single-loop learning) I argue that understandings of learning within a process of adaptive management should be reconceptualised in order to incorporate the concepts of double- loop and deutero-learning.

As with the process of learning itself, there are very few studies that examine the practical application of an adaptive management approach (Keith et al. 2011, Fabricus and Cundill 2014). The examples and analysis presented in the following sections of this chapter include the case of the lack of waterholes within the park, the drying of the Geruwa branch of the Karnali, and the increasingly rapid succession of grasslands to forest. These examples not only demonstrate that the BNPMA is a learning organisation and the processes through which this learning occurs, but also illustrate the implementation of adaptive management approaches by the organisation, in response to its drivers of change.

7.2.1 Lack of Watering Holes for Animals

As demonstrated in Chapter Five, during the dry winter months and hot summer season water scarcity is a growing problem within the BNP, particularly within the Churia Bhabar, the lowland plains and the Lamkauli Phanta (Adhikari et al. 2009). Within the park some natural waterholes exist as ox-bow lakes along the floodplains of the Karnali and Babai rivers, and, during the wet season torrential rain creates streams and ponds in the foothills of the Churia, providing further temporary sources of water for wildlife. In recent years, however, reduced water availability stemming at least in part from falling river levels and reduced rainfall, has become more common, impacting upon the quantity and extent of these natural waterholes within the park. The importance of water to the park's fauna is not limited to its role in sustaining life as, for example, the park's rhino population need the mud found on the banks of the waterholes in which to wallow, whilst tiger, elephant, swamp deer and sambar deer need water in which to bathe, to cool themselves in the hot dry summer months. Where water is scarce wildlife is forced to travel in search of new sources, where these are limited wildlife populations become concentrated in the areas where surface water endures. Consequently, where insufficiently numerous waterholes exist, the resultant higher concentrations of the park's fauna leads to conflicts within and between species, resulting from the increased competition over increasingly scarce water and food resources.

According to interview respondents this issue first came to the attention of park staff through, to return to Daft and Weick's (1984) typology, the active process of discovering using internal personal data sources. Between 1986 and 2003 87 rhinoceros were translocated to Bardiya from Chitwan National Park (TAL 2011). Park field staff, in conducting monitoring activities relating to the introduction of these animals, observed that none of the translocated rhino were inhabiting the banks of the Karnali River. Instead, the newly introduced rhino were only found alongside the park's natural ponds. As one of the BNPMA's Assistant Wardens expands:

'*We knew that rhino needed places to muddy wallow and that the Karnali is too cold for this. We then found that the density of animals around the waterholes was too high and there was conflict between them so we constructed additional ponds in the park to address this problem*, (RKTBNPMA).

As this quote intimates, increasing incidents of conflict between the park's large mammals around existing watering holes provided a further indication of the lack of adequate water resources available for the park's mega fauna. Having been alerted to this challenge through its formal monitoring and evaluation systems, the senior planning staff of the BNPMA elected to take action to address this problem as it was deemed to pose a significant challenge to the BNPMA's attainment of its overarching aim. More specifically it was believed that this lack of water would compromise the organisation's ability to meet the commitments outlined in its 2007-12 Management Plan. These specific pledges include a commitment to increasing the park's tiger population from 40 to 45 breeding adults, its rhino population from 30 to 35 breeding adults, stabilising the elephant population at 60, and ensuring that herbivore and waterfowl populations remain stable, over the period covered by the plan (DNPWC/GoN 2007).

A lack of water availability within the park clearly imposed limits on the ability of the BNPMA to achieve these aims. Indeed it created additional threats to the organisation's successful pursuit of these aims since higher densities of mega fauna around increasingly scarce and isolated waterholes provide enhanced opportunities for poachers to locate and kill the park's protected animals. Equally water scarcity within the park's core area may force animals to stray outside the park's boundary in search of water, increasing the likelihood that they will come in to contact with domestic animals and livestock. Where this occurs the result is an enhanced threat of disease transfer from livestock to wild animals, and vice versa, further threatening the BNPMA's ability to achieve its stated goals. As the Head of the Hariyo Ban Programme observed:

'*The whole waterhole thing I think is a big issue. If they are going to continue to intervene artificially and they can do that, then that is good because otherwise there could be a risk of wildlife actually moving out of the park if there is not enough water and increasing human-wildlife conflict. One thing that you don't hear very much about is disease transmission between wildlife and livestock. I mean what diseases are tigers vulnerable to that domestic cats for example might have. Or er you know cattle and ungulates like deer… If climate change pushes wildlife more into contact with livestock, for example, and with people, then there could be a risk of disease transmission going either way, any of three ways*,' (JOWWF).

The BNPMA's response to this multifaceted threat was determined by the interplay of the organisation's components of adaptive capacity, discussed in the preceding chapter of this thesis. In this case the organisation's formal and informal internal knowledge sharing systems, along with the BNPMA's social context, appear to have played a particularly vital role in facilitating the formulation of the organisation's response. The park's Chief Warden provided a more detailed account of how these facets of adaptive capacity enabled the BNPMA to respond to this challenge:

'*We take the partners. We take RK and PK* [heads of partner organisations] *to the waterhole site, and the grassland management site. Even we discuss at the site, how to manage the waterhole… because we have different backgrounds, right. I am a conservation biologist and RK is a forester, and PK is another, a good researcher, right. So then we just discuss all these things, and RKT and AB and PS [senior park staff], they have a very ground level truth knowledge because they work at the ground level, right. They have a truth knowledge, and we share our knowledge. I will know the scientific ideas, I share the scientific background to our staffs and they will say me the realities on the ground, and we discuss each others and we make a decision*,' (TRABNPMA).

This quote not only outlines the process through which the organisation formulated its initial response to the lack of waterholes within the core area of the park, it also emphasises the role of informal knowledge sharing, both within the organisation and between park staff and their conservation partners, as well as the organisation's social context in enabling effective responses to new drivers of change.

Conversely, as highlighted in Chapter Six, the organisation's institutional context and planning processes strictly limit the activities of the BNPMA to those defined through its five-year plan. When new challenges such as the lack of waterholes are recognised, the park is therefore unable to allocate funds from their existing budget to address these challenges. In this case, the financial resource context of the park enables the organisation to address this new challenge through the direct provision of funds, a process notable for its simplicity and outlined by the Chief Warden, '*whenever we feel that we need the waterholes, we just prepare the proposals and submit to the WWF and request to the NTNC and they will source the money*,' (TRABNPMA). Indeed the assistance of the BNPMA's conservation partners extends beyond the simple provision of additional advice and

finance. As the local head of the NTNC observed, '*we also support them* [the BNPMA] *with monitoring, evaluation, and also you know with the decision-making, planning, and also we provide financial support with the help of donors*,' (RKNTNC).

The result of this process of collaborative decision-making (a key part of an adaptive management approach) has been the construction of 19 new waterholes in the park's sal forests, on the lowland plains and on the Lamkauli Phanta. These waterholes were financed by WWF, the NTNC and by the UNDP-coordinated, and now defunct, Western Terai Landscape Complex Project, which also provided assistance with their construction. The locations of the new waterholes were, as one interview respondent reported, selected in a sense by the park's fauna themselves:

'*To decide the location of waterholes we generally searched the areas where the water deterioration capacity is high. And then find out the areas, and in those areas the animals also naturally make the waterholes, the shallow waterholes, the small waterholes. The animals also dig out, that is the nature of the animals. So we select that point and make a, we just extended the* [animal's] *waterholes*,' (TRABNPMA).

In terms of the outcomes of this intervention by the park's management authority, initial monitoring of their impact suggested that the newly constructed waterholes were successfully arresting the rise in issues associated with the growing water scarcity within the core area of the park. As an Assistant Warden from the park detailed:

'To start with there were some natural waterholes which had large concentrations of large species and prey species around them. When the new waterholes were constructed the pressures from this high concentration of animals decreased. We found out through the monitoring of the wetlands where and in which season animals are and what they use the waterholes for – either drinking or wallowing. Monitoring was done throughout the park with the support of the NTNC and of WWF and this still continues to this day,' (RKTBNPMA).

This quote alludes to the fact that despite the apparent success of this initial intervention, BNPMA staff did not rest on their laurels and progress has subsequently been monitored and evaluated on an ongoing basis to ensure the continued effectiveness of the intervention. This continuing regular monitoring of progress as part of the BNPMA's

internal planning procedures is primarily to ensure that the waterholes are adequately maintained, and also to ensure that any additional problems that may come to light are quickly identified. As the senior staff member continued:

'*The construction of these ponds began around 15 years ago and they are still regularly monitored as part of national park procedures. This is partly to ensure that we maintain the required width and size of the waterholes to stop them silting up and becoming smaller, and so that we can see the pressure of wildlife in the area and if this is too high*,' (RKTBNPMA).

This ongoing learning process through which waterholes were first introduced, and which now results in the regular monitoring of their performance and incremental improvements to maintain the organisation's effective pursuit of its goals is indicative of single-loop learning. The BNPMA has identified and addressed a negative outcome by making simple modifications to their existing strategy, whilst leaving their theory-in-use unchanged. This is reflected in the BNPMA's 2007-12 draft Management Plan which outlines the organisation's intention, founded upon the results of its monitoring programme, to construct three additional waterholes in the eastern section of the park, over the planning period (GoN 2007). Furthermore this process of single-loop learning is symptomatic of an adaptive management approach since the identification of this new challenge has resulted in a response from the organisation, formulated in conjunction with its conservation partners, which, through ongoing monitoring and evaluation processes, has led to improved knowledge and enhanced organisational performance as evidenced, for example, by an increase in tiger numbers from 32 to as many as 55, since this initial intervention (DNPWC/GoN 2012, WWF Nepal 2013).

In 2009, against this background of adaptive management founded upon single-loop learning, three senior park staff undertook a more comprehensive long-term study of the relationship between the park's waterholes and the abundance and distribute of fauna within the BNP (Adhikari et al. 2009). This more in depth evaluation of the success of the BNPMA's intervention in constructing additional waterholes examined their surface area and depth, and the range and abundance of species present at each location. The study found that during the hot dry summer months five of the 19 waterholes had completely dried up yet contained evidence that they were still being visited by animals, suggesting

that despite the BNPMA's intervention water scarcity remained a challenge, particularly during the summer season (Adhikari et al. 2009).

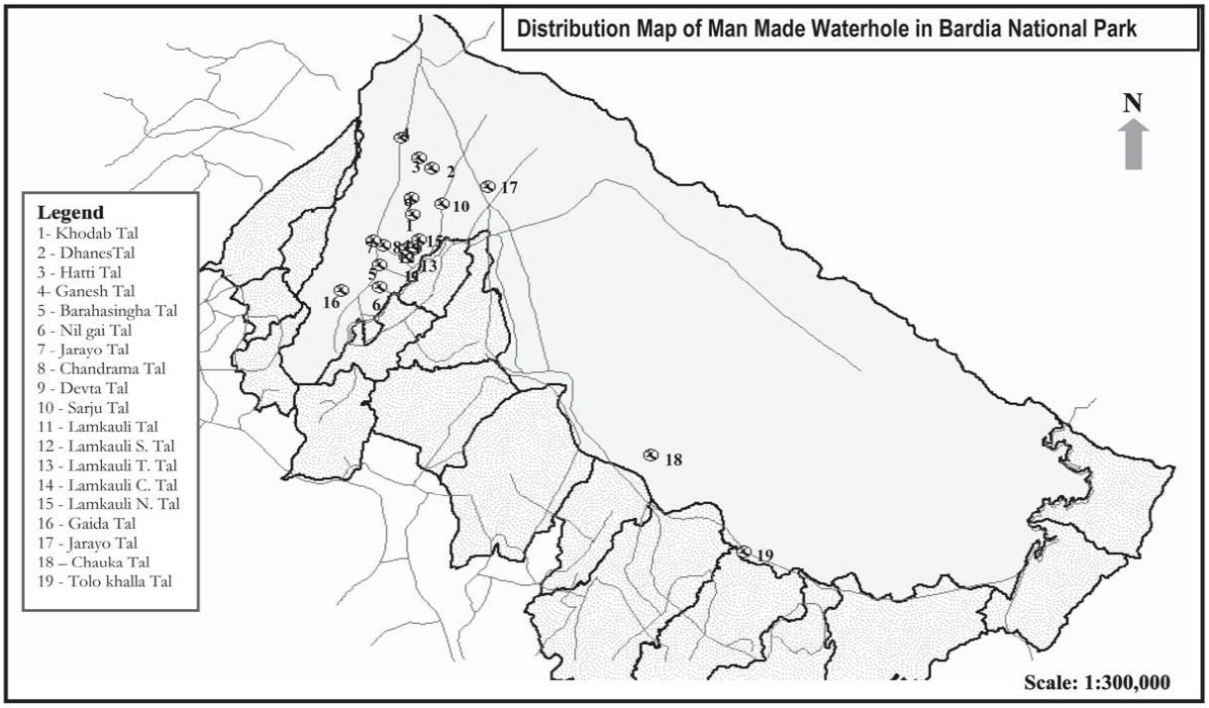

Figure 7.1 Location of waterholes in Bardiya taken from Adhikari et al. (2009 p54).

The results of this study demonstrate that despite the ongoing modification of their response to this challenge founded upon the organisation's monitoring and evaluation processes, for example the resultant construction of an additional seven waterholes between 2007 and 2012 (DNPWC/GoN 2012), additional action was needed to comprehensively address this driver of change. As a consequence of this study the senior managers of the BNPMA re-evaluated their response to the problem, acknowledging the need to improve waterholes that were found to be dry in the summer season, to further develop monitoring of these interventions and to improve the protection of wildlife around waterholes since, without such measures the construction of additional waterholes was deemed to be counterproductive (Adhikari et al. 2009).

As a direct result of this study the BNPMA's senior managers developed a number of new wetland management initiatives that have since been reified in the park's 2012-17 Management Plan which echoes the study's findings noting that, "some waterholes are dried up in the hot summer season so proper site selection and maintenance is necessary to have water throughout the year," (DNPWC/GoN 2012 p13). Specifically in this document the BNPMA commit to creating an inventory of wetlands within the park and to undertake

more comprehensive monitoring of their condition, the presence and abundance of wildlife around them, and any apparent threats to their success (ibid). In addition to this enhanced monitoring process and the regular assessment and maintenance of the park's waterholes, this plan makes allowance for the construction of a further 10 waterholes. Most importantly, perhaps, it also commits to the provision of wetland management training for park staff in addition to education and awareness raising activities for buffer zone residents (ibid).

This new strategy clearly indicates a departure from the initial single-loop learning response to this driver of change founded upon the cumulative construction of additional waterholes, towards a more holistic and far reaching response which addresses not only the outcomes of this new challenge but also its root causes. Indeed this example demonstrates the process of learning within the BNPMA very effectively, illustrating how the organisation has developed from doing the same but better (single-loop learning) to changing beyond business as usual through the modification of the organisation's norms, policies and routines upon which day-to-day actions are founded (double-loop learning). In other words the BNPMA has, in response to this ongoing challenge, undertaken learning that has resulted in a change in the organisation's theory-in-use.

Indeed it could be argued that this example even contains evidence of deutero-learning as conceptualised by this paper since the BNPMA's most recent strategy for addressing this challenge, documented in the draft of their latest management plan, outlines modifications to their monitoring and evaluation processes through which they learn. It could be argued, then, that these changes result from the organisation reflecting upon the monitoring and evaluation systems through which it learns and that this is a clear example of deutero-learning; that is the BNPMA learning about how it learns.

7.2.2 River Channel Drying

Closely related to, but distinct from, the issue of waterholes discussed above, is the challenge posed by the drying of the Geruwa branch of the Karnali River, introduced in Chapter Five. This relatively recent challenge first came to the attention of park staff approximately three years ago and its importance, as one interview respondent summarised, stems from the fact that:

'*The Karnali flood plain is where the majority of the biodiversity are concentrated in this park because of water availability on the flood plain. So if it dries out then the beauty and the significance of the BNP also dries out. So it is a very big issue for, not only for BNP, but also for national and international level*, (SKTNTNC).

Specifically the drying of the Geruwa branch of the Karnali will jeopardise the floodplain ecosystems which, as the BNP's Management Plan (DNPWC/GoN 2012) acknowledges, is a designated biodiversity hotspot as well as being one of the most promising areas for park tourism. Indeed the 100 square kilometres of the Karnali flood plain provide prime habitat for numerous endangered aquatic wildlife and bird species including the Gangetic dolphin (*Platanista gangetica*), the ghadiyal crocodile (*Gavialis gangeticus*), and the golden mahaseer (*Tor putitora*). The severity of this challenge was acknowledged by a member of park staff based in the organisation's headquarters who observed:

'*One important challenge is that the main stream of the Karnali river is now running very very low and most of the water now flows in the channel away from the park. This has had serious impacts on the park biodiversity and wildlife in this area and the whole habitat is at risk if the situation doesn't change soon. There are already no more dolphins in this branch of the river and there are now very few rhinos in the area as well*,' (MrNBNPMA).

Such interview responses were common with respondents clear in their recognition of the importance of this challenge as the preeminent threat to the BNPMA's ability to successfully achieve its aims. They also serve to highlight the important implications of this issue not just at the local scale but also across a range of scales. As discussed in Chapter Five the identification of this driver of change by park staff occurred through a range of channels neatly summarised by one of the BNPMA's Assistant Wardens:

'*This is a fairly new challenge that was first noticed only two or three years ago, and it really came to our attention through the observations of local people and through the observations of park staff. This information was fed back to us informally up the chain of responsibility in the park and through official meetings with communities, but also informally through personal contacts and informal meetings. As I said the locals used to get water for irrigation from the river and now it is blocked so they tell us their problems and then we respond*,' (RKTBNPMA).

According to Daft and Weick's (1984) classification the range of mechanisms through which this driver of change was identified include the active process of discovering using internal personal data sources, and conditioned viewing using external personal data sources. The implications of the drying of the Geruwa branch of the Karnali, outlined above, were quickly recognised by Senior Park Staff and the need to respond to the consequent threats to the integrity of the park's most important ecosystems, acknowledged.

The formulation of the BNPMA's response to this new threat is still in its infancy, involving numerous stakeholders over a variety of scales. A key issue obstructing the formulation of an effective response is the lack of knowledge around the root causes of this driver of change. Most frequently interview respondents cited stone extraction from the western branch of the Karnali as the underlying cause of the Geruwa drying, an opinion exemplified by a member of one of the BNPMA's key conservation partners:

'*One of the main causes is the extraction of gravel and sand from the riverbed of the western branch of the river. Where the river flows inside the buffer zone the park can manage and limit this extraction of gravel and sand but those areas where it flows outside the park don't fall under the same rules*,' (PKWWF).

However such opinions were by no means unanimous. Other stakeholders placed the blame firmly at the feet of upstream activities such as irrigation, '*because there is an irrigation channel that the World Bank have funded… that is coming off upstream from there*,' (JOWWF). Still others, '*believe it is mainly a natural process*,' (JBKBNPMA), whilst some claim, '*this is one clear cut instance of the climate change*,' (NCTBZUC). Given this lack of consensus and the wide range of potential causes proffered as explanations for the falling river levels in the Geruwa, the process through which the BNPMA experiments and searches for solutions in this case is an understandably convoluted one.

The current response to this challenge was initiated by the BNPMA in conjunction with their conservation partners and buffer zone stakeholders. As a representative of one of the BNPMA's conservation partners documented:

'*Information on this challenge was gathered by the park and other partners including WWF and all of us have reported this back through our respective channels. Just three months back we had a park-conservation partner-BZMC meeting to discuss our concerns. This meeting and these concerns were minuted and the minutes then submitted to the DNPWC. Last week the Secretary of the Department of Forests was here and the Chief Warden presented to him about these risks. The Secretary of Department of Forests has agreed to send a field team to assess the problems and… this team will draw up their final report and will share it with their conservation partners through a report and presentation. This is likely to take about one or two months*,' (PKWWF).

Despite this clear response and confident claim, over one year later the report from this process is yet to be published (pers. comm. TRA 1.7.14). Stakeholders appear to be no closer to definitively identifying the cause or causes of this problem, or potential solutions; a process of learning has not been initiated. In this case respondents identified a number of barriers which are likely to have contributed to this apparent inertia. The most frequently cited reason for the lack of action in response to this driver of change, was the scale of the issue and the associated political and institutional complications that this brings. In many senses this is a transboundary problem since the river transcends the park's margins, district boundaries and even national borders. It is therefore beyond the capacity of the park to deal with these issues alone. As a member of park staff with over 30 years service observed:

'*The park* [BNPMA] *can only focus on its own area and section of the river, and a challenge like this is a national and international level issue so it is beyond the capacity and power of the park to deal with this. Solutions to such problems need to be government led because the river stretches from the Himalayas across the border to India and this challenge is beyond the scope of the park. I am sure that this issue has been raised at the department and although they have sat down for a few meetings no action has been taken, partly because of the current political situation at the national level which is very unstable*,' (JBKBNPMA).

As these quotes intimate, having been raised as an issue by the BNPMA and subsequently by the DNPWC, decision-making pertaining to this driver of change becomes embroiled in the pervasive political morass which prevails at the national level (considered in detail in

Chapter Six). The issue is further complicated by the fact that, under the National Park and Wildlife Conservation Act (GoN 1973), the BNPMA is not allowed to dredge the Geruwa branch of the river to divert water towards the core area of the park, since the use of machinery within this area and the associated extraction of resources is forbidden under this legislation. Similarly, the BNPMA have no power over the activities conducted in the western branch of the Karnali which lies outside the park's boundaries which falls within the jurisdiction of the Department of Forests, nor do they have any power over those engaged in extractive activities upstream. As one of the BNPMA's Wardens elaborated:

'*Well we are trying to open the source of the water, to remove the stones and gravel and to dig a canal, but we cannot use heavy equipment in the park without permission from high level government so we cannot remove the stones and gravels easily. We now have the idea to use local people to help us to remove the stones because they know that the low water level is impacting upon them and on their crops*,' (RKTBNPMA).

This quote demonstrates the limitations within which the organisation is operating and also highlights the continuing positive role of the BNPMA's social context which is continuing to provide potential solutions to new drivers of organisational change in the face of apparently insurmountable political and institutional barriers. Despite the lack of action to address this issue to date, the park and its conservation partners are continuing to monitor river levels even in the absence of any substantive response or support from central government.

A focus group respondent from a national forestry think tank expanded upon these national level barriers to learning, observing that, '*a very important barrier is the link between overall knowledge and research and its relation with the policy decision*,' (R3FAFG). This respondent proceeded to document the case of another of the Terai's National Parks in which decision-making at the national level was similarly dependent, '*not upon the relationship between the park management and ecology*,' but on other political interests and the whims of Ministers operating under, '*different incentive structures*,' (R3FAFG). As a consequence of such issues which are, for the most part, beyond the direct control of the organisation, the BNPMA is similarly hamstrung in this instance, unable to implement its own adaptive management responses to this challenge and therefore unable to initiate a process of either single- or double-loop learning. Whereas in the case of the

waterholes the BNPMA was able to implement a range of learning processes to improve their performance, in this instance external factors centred around the organisation's political and institutional context are creating, to borrow Senge's (2006) term, a learning disability within the organisation, preventing the effective mobilisation of its adaptive capacity to address this problem.

7.2.3 Grassland Conversion to Forests

Closely linked to the issue of growing water scarcity in and around the core area of the BNP, is the issue of the increasingly rapid conversion of grasslands to forests. Highlighted as a key challenge facing the park by over 80% of respondents from the BNPMA and their conservation partners, interviewees highlighted the important role of fluvial disturbance in grassland persistence. First coming to the attention of the organisation approximately 15 years ago, the gravity of this issue was highlighted by one of the BNPMA's Assistant Wardens who observed that:

'*The key challenge within the park is related to the grasslands and riverine forest where changes in climate have led to rapid succession of the ecosystems to forested land. Given the scarcity of the water in the park at the moment and the likelihood of increased droughts in the future this is the main future challenge of the park*,' (ABBNPMA).

Whilst the exact cause of this increasingly rapid succession of grasslands to forests is perhaps more contentious than the above quote implies (see discussion in Chapter 5.2.4), the importance of this phenomenon as a driver of change was echoed by the park's wider stakeholders. As a respondent from one of the BNPMA's conservation partners observed, '*in the park the grasslands are now being encroached by the forest. This used to be naturally managed but now the park has to put more and more effort into maintaining the grassland, and keeping it grassland, to prevent it from returning to forest*,' (SGNTNC).

The increasing rate of conversion of grasslands into forest first came to the attention of the BNPMA through the regular patrolling conducted by the organisation's Game Scouts, as well as through field visits undertaken by senior park staff; to continue with Daft and Weick's (1984) typology, though the active process of discovering through internal personal sources. As a senior member of park staff observed, '*we are always constantly monitoring the park and its environment and we and our staff are always in the park so these changes*

quickly come to our attention,' (ABBNPMA). However as with the case of the waterholes there is a second, more passive channel, through which this challenge came to the attention of the park authorities, a process succinctly summarised by a second Assistant Warden, '*the issue was noticed when, for example, the density of spotted deer was particularly high in the area outside the park. When we started to manage the grassland more intensively and increase the area of grassland there became many less problems with spotted deer outside the park*,' (RKTBNPMA).

In this instance the identification of this driver of change resulted, at least in part, from a process of conditioned viewing through external personal means, as park staff and local residents reported increased sightings of park fauna within the buffer zone, and associated incidents of human-wildlife conflict, to staff at park headquarters.

The BNP's grasslands play an important role in maintaining the park's biodiversity, supporting a high ungulate biomass, particularly of chital (*Axis axis*), and also a number of endangered species including the hispid hare (*Caprolagus hispidus*), the pygmy hog (*Sus salvanius*), and the Bengal florican (*Eupodotis bengalensis*) all of which reside in the *Imperata cylindrica* dominated grasslands. The conservation of these habitats is also vital to ensure the maintenance of sufficient numbers of prey species for the park's big carnivores including the Royal Bengal Tiger (*Panthera tigris).* In addition to this ecological importance, the park's grasslands also have a high social and economic significance, providing valuable natural resources for local villagers who are permitted to enter the park for three days each year to harvest grasses primarily for thatch and fodder.

Consequently, the rapid succession of grasslands to forest poses a significant threat to the organisation's multifaceted overarching goal of safeguarding the biodiversity of the BNP whilst improving public support and enhancing ecotourism (DNPWC/GoN 2007 p22). More specifically the Park Management Authority recognised that the disappearance of the park's grassland would hinder the organisation's ability to meet its targets for improved tiger and rhino populations, which in turn would likely impact upon the tourism potential of the park. Similarly, the sustainable management of the park's grasslands forms an important component of the organisation's strategy to ensure the attainment of one of its key aims, that "harmony between the BNP and its buffer zone is attained through park and people cooperation and collaboration in biodiversity conservation and community

development," (DNPWC/GoN 2007 p76). The organisation therefore recognised this issue as being an important driver of change to which it must respond. As a local stakeholder elucidated:

'*This is big issue and I am sure that this will create big problem one day. We have rhinoceros and they need always water, and they need lots of big grassland and we have lots of elephants… I have seen 20 years before what the grassland was, and I see today what the grassland is become. I see with my own eyes what the big differences coming to the habitats*,' (SPBCFUG).

In 1995, around the time that this threat was first identified, the BNPMA was approached by a group of UK-based researchers to collaborate in a Darwin Initiative funded project examining the management of tall grasslands for biodiversity conservation and sustainable utilisation (Peet et al. 1997a). Having recognised the threats to the effective conservation of the core park area posed by the rapid succession of grasslands, and in response to this driver of change, the DNPWC and BNPMA consented to allow these external researchers to work in conjunction with park staff, to assess potential responses and search for appropriate solutions (pers. comm. Professor Watkinson).

Before this external intervention the management and maintenance of the park's grasslands had been characterised by two distinct phases. Prior to the establishment of the protected area locals used a combination of manual harvesting and uncontrolled fire to meet their resource needs and regenerate the grasslands (Brown 1997). Following the area's gazettement as a Wildlife Reserve in 1976 the traditional practices were continued under the park management authority on a more restricted basis, with initially seven and subsequently fifteen days allocated to local residents for grass collection from the core park area (Bhatta 1999). This approach was complimented by controlled burning in the park's phantas and the manual uprooting of trees, bushes and unpalatable species (ibid). The underlying rationale for employing cutting and burning as the primary grassland management tool was that in doing so succession from shorter swards to taller grasslands and ultimately to forests was prevented, whilst also enabling the regeneration of the grasslands to the benefit of ungulate and human populations. However as Peet et al. (1999) observe, the scientific basis for the justification of this approach was limited at best,

founded more upon traditional Tharu practices and anecdotal information that systematically generated evidence.

The research conducted by Peet et al. (1999) between 1995 and 1997 involved a randomised block experiment comprising four different treatments: cutting, burning, cutting and burning, and no intervention. Continual monitoring was undertaken by park staff with in depth analysis of plots carried out pre-treatment, 11 months post treatment and 11 months later. The results of this study were disseminated to park staff in a number of ways. In March 1999 the BNP hosted a workshop entitled 'Grassland Ecology and Management in Protected Area of Nepal,' convened by the DNPWC, ICIMOD and WWF (pers. comm. Professor Watkinson). This forum enabled the research team to verbally communicate their findings to the organisation's staff, as well as facilitating their input into the development of future research and management strategies for the grasslands of the Nepali Terai. The team also produced a scientific and management report outlining their key management recommendations and the scientific basis underpinning them, submitted to both the BNPMA and the DNPWC. In addition to this, numerous project progress reports were submitted directly to the DNPWC (pers. comm. Professor Watkinson).

Most importantly, in terms of these recommendations this study found there to be limited successional consequences of leaving *Imperata cylindrica* dominated grasslands unmanaged for two to three years, indeed doing so was found to result in increased dominance of the species when compared to managed plots (Peet et al. 1997a). The key implications of these findings therefore, was that rotational patch management on a biennial or triennial basis could result in more favourable outcomes for biodiversity than traditional management practices, by simultaneously providing habitats for those species such as the hispid hare that require cover, and those ungulates that benefit from the cutting and burning of grassland. Such an approach would have the additional benefit of creating financial savings for the BNPMA. As a member park staff who contributed to this process summarised:

"*Dr Nick Peet was the first person to research in the grasslands here and it was he who suggested so many treatments and policies. We worked with him and developed some methods to maintain the grassland. He was the first to give us some recommendation about grassland management and we are still following the same method today. We conducted a*

workshop and some trainings with specialists here to look at the possible methods and responses, and we are following the same methods of management today. Dr Peet was here by agreement with the Government of Nepal, and when he had finished he gave us his report and we discussed it with our staff and conservation partners and applied it," (RKTBNPMA).

This learning process through which the organisation has modified its grassland management policies, aims, and routines can be conceptualised as a process of double-loop learning. The organisation has, in response to this challenge and on the basis of this new knowledge, modified the values of its theory-in-use. It has examined and reframed its strategies, processes and assumptions associated with business-as-usual grassland management, moving away from traditional ad hoc management practices, towards more scientific methods.

In this case the BNPMA has, through both active and passive means, become aware of the increased rate of grassland succession and recognised it as a challenge to which it must respond. The organisation's response has been enabled by its social context and the additional human resources and technical expertise that this provides, in tandem with the organisation's strong leadership, clarity of vision, and openness to change. A process of double-loop learning which has seen the BNPMA transform its grassland management practices from ad hoc management actions based upon traditional practices and anecdotal evidence, to a technical scientific approach involving the ongoing measurement and monitoring of outcomes from a range of management practices, has enabled this capacity to be transformed into adaptive actions which have seen the organisation develop an adaptive management system of rotational patch management in response to this challenge.

Since this initial and substantial response to this new driver of change further modifications to the parks approach to grassland management have been made within the organisation's new theory-in-use, building upon this initial research. As one of the BNPMA's Assistant Wardens summarised:

"*We have set up a number of different demonstration plots around the park headquarters, close to the natural grassland of the park. We are regularly monitoring these different test*

plots to see what will happen to the grassland when it is managed in different ways. One plot, for example, is left alone with no intervention, another is grazed using domestic cattle, and another is left to be grazed by the park wildlife. We monitor these plots every 15 days, counting the number and types of species in each plot, to see which management method will have the most beneficial outcome for the grasslands and the wildlife that it supports," (ABBNPMA).

The above quote intimates that since the formulation of the organisation's initial response to this challenge, its internal planning and monitoring and evaluation systems, along with the organisation's culture and knowledge sharing networks, have facilitated an ongoing learning process analogous to a process of single-loop learning. Since the implementation of a rotational patch management approach to grassland management the BNPMA has, for example, gradually reduced the number of days on which local residents are permitted to extract grasses from the park, from ten days per year at the time of the initial intervention (Bhatta 1999) to the current three day allowance (as observed during fieldwork and recorded in the researcher's field diary), demonstrating the ongoing incremental improvements that are made to existing practices through the process of adaptive management. In addition, as the preceding quote implies, the park management authority has begun to experiment with new and different management techniques in the test plots to examine the impacts of, for example, the potential use of domestic livestock grazing in grassland management. In contrast to the earlier process of double-loop-learning, none of these activities have resulted in a change to the organisation's theory-in-use.

Despite this broadly positive process outlined above, several interview respondents highlighted the role of a number of components of adaptive capacity which have worked to limit the effectiveness of these otherwise positive responses. In the previous chapter the role of the organisations internal resource constraints in limiting the BNPMA's capacity to respond to new drivers of change was discussed, and this was found to be an important factor in this case. A senior member of park staff provided a more circumspect view of the ongoing management of the park's grasslands:

"*Now we monitor and evaluate our progress but the problem is that we do not have as much money as we need and we are not able to manage perfectly the grassland. It should be monitored every year but we do not have enough money to manage this every year. It is*

in the five year plan but we lack the finances to meet the targets laid out in the 5 year plan," (RKTBNPMA).

This quote hints at the frustrations that exist for park staff whose best intentions in responding to their organisation's drivers of change are limited in practice by the resource constraints facing their organisation. Despite this the organisation's response to this challenge appears to have been broadly successful, involving both single- and double-loop learning, with the former occurring before the latter. The implications of this for the concept of learning loops are examined in more detail in the discussion section of this chapter which follows.

7.3 Discussion

Each of the examples of organisational learning within the BNPMA, discussed above, provide a contribution towards the clarifications which are currently lacking in the field of organisational learning theory. In this section the specific implications of these examples in relation to understandings of learning loops and adaptive capacity are considered in more detail.

The first key finding, implied in the examples discussed above, is that single- and double-loop learning are distinct (but not that distinct) and complimentary. What is meant by this is that the first and third examples demonstrate that it is possible to identify at least two distinct types of learning processes within the BNPMA, and that these broadly fit within the classifications of learning defined in the wider literature. Where they differ is that definitions of single- and double-loop learning in the wider literature are clear and concise whereas in their physical incarnations these distinctions are inevitably less clear cut. Double-loop learning is commonly defined as involving the modification of the organisation's norms, policies and routines, and whilst learning that fits within this typology was identified in both the case of the waterholes and with the grasslands, the predominantly incremental improvements illustrated in the case of the waterholes could also be said to involve the modification of the organisation's policies and routines through, for example, the introduction of waterholes where before there were none. Similarly wider literature also claims that single-loop learning addresses the outcomes of problems whereas double-loop learning addresses the root causes. I argue that this is not necessarily the case since in the examples provided, learning which fits the criteria for double-loop

learning has been shown to take place despite the fact that the root cause of the problem has yet to be definitively determined.

Linked to this notion of single- and double-loop learning being distinct but complimentary is the rejection of the widely held conceptualisation of double-loop learning as a successive loop, superior to and more desirable than single-loop learning. In the first example outlined above the process of learning within the BNPMA does indeed fit within the schema. Ongoing monitoring and modification of practices lead to incremental adaptive improvements in management strategies enabling the organisation to maintain its level of performance in the face of new challenges, without altering the organisation's theory-in-use. Ultimately, however, a more all-pervasive process of double-loop learning that modifies the organisation's theory-in-use is required, to transform the organisation's activities and ensure that improved performance in light of increasing aridity within the park can be sustained. The mobilisation of this process of double-loop learning does not mean that single-loop learning is no longer important. Under this new regime incremental improvement in the organisation's approach to dealing with increased aridity remains important to ensure the ongoing effectiveness of their response.

The case of grassland succession further exemplifies this point. In this instance double-loop learning is shown to have occurred in response to a new challenge, before the process of single-loop learning has taken place. The BNPMA introduced, through a process of double-loop learning, an entirely new theory-in-use in the form of a grassland management approach centred on new organisational norms, policies and routines governing day-to-day actions and activities. Subsequently this new approach has been developed and incrementally improved upon through a process of single-loop learning which has enabled the organisation's approach to be tweaked, tinkered with and improved, to meet the organisation's increasing ambitious conservation aims within the framing of its new theory-in-use. As both cases demonstrate, the order in which single- and double-loop learning occur is not as prescriptive as the wider literature suggests.

One implication of this analysis is that neither single- nor double-loop learning is inherently superior to the other; rather they should be viewed as being equally important, more appropriately applied to certain circumstances than others. In both of the cases discussed above, single-loop learning has occurred where threats to the organisation's ability to

attain its goals are strongly countered by existing organisational policies, systems and procedures, and modest incremental changes in park management practices allow the BNPMA to continue to successfully pursue its aims. In such instances double-loop learning would not only be unnecessary, it could work to the detriment of the organisation by usurping perfectly workable existing policies and procedures, replacing them with untried approaches which may ultimately prove to be less effective.

Similarly, when faced with new challenges for which the organisation does not have effective systems and procedures in place, or where existing systems have not been developed to effectively cope with such a magnitude of disturbance, double-loop learning will be more appropriate. This was shown to be true in the case of grassland management where traditional management procedures in conjunction with the natural process of fluvial action, were no longer sufficient to maintain key grassland habitats and a more far-reaching scientific approach was needed, attained through the process of double-loop learning. The effectiveness of this new approach could then be maintained through an ongoing process of single-loop learning.

In terms of triple-loop learning the examples discussed in this chapter have, perhaps, less to say. The findings of this study with respect to single- and double-loop learning in relation to the desirability and effectiveness of one form of learning over another do, however, have relevance for the concept of triple-loop learning. This chapter has shown that some authors have erroneously given primacy to double- over single-loop learning, and it would therefore seem likely that similar misconceptions may have been made in relation to triple-loop learning. Furthermore, the one example outlined above in which it could be argued that a third type of learning has been identified, the case of the waterholes, would appear to support Argyris and Schon's (1974) original conceptualisation of deutero-learning as the third form of organisational learning. Deutero-learning, should not therefore be considered superior to single- and double-loop learning, rather it should be understood as encompassing them both, involving an organisation learning about the means through which it generates and disseminates knowledge and working to improve these. In the case of the waterholes this process of deutero-learning involved the BNPMA evaluating and reformulating its monitoring and evaluating processes themselves as well as introducing new channels for knowledge generation and exchange both within their organisation and between them and local stakeholders.

The immediate outcomes of deutero-learning in this case have been improved monitoring and evaluation systems and therefore enhanced single-loop learning processes and more effective adaptive management. It is also likely to have resulted in increased capacity for double-loop learning within the organisation and more transformative change by increasing the knowledge and understanding that exists within the organisation of the range of potential responses to new challenges at their disposal. In doing so this further demonstrates the complementarity and importance of this third form of learning to the processes of single- and double- loop learning, as opposed to its primacy over them.

At the same time, it is clear that the process of learning, be it single-loop, double-loop or deutero-, is central to the mobilisation of adaptive capacity in response to new drivers of change, and to adaptive management approaches in conservation. Whilst the wider literature tends to conceptualise a simple process analogous to single-loop learning as a key component of adaptive management approaches, the examples outlined above demonstrate that the same may be true of double-loop and even deutero -learning. Consequently components of an organisation's adaptive capacity can exert a significant influence upon the organisation's ability to learn. This can occur in a positive way, for example in cases where the organisations which operate in the BNPMA's social context provide additional expertise and resources fostering learning and helping to address a new driver of change, such as in the case of the waterholes. However, components of an organisation's adaptive capacity have also been shown to impede the ability of the organisation to learn. Although an extremely recent challenge, it appears that this is how events are unfolding in the case of the river channel drying where the BNPMA's institutional and political context have an important influence on the learning processes within the organisation, working to constrain the BNPMA's adaptive capacity whilst preventing any learning, be it single-loop, double-loop, or deutero-, from taking place.

Although the focus of each of the three cases documented above has been at the organisational level of aggregation they are not without implication for other learning levels and the relationships between them. In the first example learning at the individual level resulting from the ongoing monitoring and evaluation of the park's core area, as well as the specific waterholes study undertaken by senior staff, has spread throughout the organisation through both informal knowledge sharing and formal meetings. Organisational

learning has also occurred in this case as this new knowledge has become embedded within the new policies, practices and procedures resulting from it. Similarly in relation to the succession of grasslands to forest, learning at the individual level initially through the study undertaken by external researchers and subsequently through an ongoing process of experimentation, monitoring, and evaluation, knowledge has been transferred amongst the staff of the organisation, ultimately becoming embedded within the organisation itself through the consequent changes to its structures, procedures, and activities. In contrast in the case of the drying river, no evidence was found of learning having yet taken place, as evidenced in part by the wide range of causal factors cited by respondents as being at the root of this challenge.

These finding would suggest that whilst organisational and individual learning are distinct, in terms of new learning, learning at the organisational level of aggregation results from the new actions taken by its staff on the basis of new knowledge; that is, individual learning leads to organisational learning. Similarly, it would appear to indicate that single-loop learning is, at the very least, more closely associated with learning at the individual level of aggregation, whereas double-loop learning is more closely linked to learning at the organisational level of aggregation through the institutionalisation of individual learning in the organisation's processes and procedures. What is certain is that the distinction and interactions between learning at these different levels of aggregation remains an important area for future research.

7.4 Conclusions

As this chapter has demonstrated the process of organisational learning is central to understanding the response of organisations to their drivers of change, including climate variability and change, as it is through this process of learning that an organisation's adaptive capacity is transformed into action. Despite the importance of the process of learning to organisational adaptation, this remains a field characterised by conceptual ambiguity and confusion.

In this chapter I have used data from semi-structured interviews, focus group discussions, field observations and internal park documents to examine the form and function of the learning processes at work within the BNPMA, as well as the implications of this for organisational learning theory. Through an examination of the organisation's response to a

number of its key drivers of change, originally highlighted in Chapter Five of this thesis, this chapter has demonstrated that in some circumstances the BNPMA may be characterised as a learning organisation yet in others it may not; the nuances of the organisation's position are case dependent, influenced by the diverse components of the organisation's adaptive capacity.

Through an examination of the example of the park's waterholes and the case of the dwindling grasslands, I have clarified the distinction between single- and double-loop learning and have demonstrated that neither one is fundamentally more desirable than the other nor does one necessarily supersede the other. Rather these case studies have shown that single- and double-loop learning are both key processes through which an organisation's adaptive capacity can be translated into action and therefore are key components of an adaptive management approach. Where incremental improvements to business as usual activities are sufficient to ensure the successful pursuit of an organisation's goals single-loop learning forms the cornerstone of a successful adaptive management approach; where more transformative change is required double-loop learning comes to the fore.

The example of waterhole construction in the core area of the park also appears to lend weight to the existence of a third type of learning more closely aligned to Argyris and Schön's (1974) original conceptualisation of deutero-learning than to contemporary claims of a third, fundamentally superior, learning loop. Understandings of deutero- or triple-loop learning would undoubtedly benefit from further investigation focused on real world cases of organisational learning in practice. More in depth analysis of this third form of learning is beyond the scope of this chapter, limited as it is by the data the researcher was practicably able to gather in the field. Similarly the focus of this chapter has been at the organisational level of aggregation and there remains a need for more work to be done which considers learning at the individual level of aggregation, learning in the organisation's external environment and how these levels of learning interact. What this chapter has demonstrated, to this end, is that single-loop learning may be more closely associated with individual learning whereas double-loop learning, which involves the institutionalisation of learning within the organisation's processes and procedures, is more closely aligned with learning at the organisational level of aggregation.

Finally, the case of the drying river has demonstrated that just because the BNPMA is, in some instances, a learning organisation, it does not necessarily follow that the organisation will learn in all circumstances in response to all of its discrete drivers of change. In this instance the transboundary nature of the challenge in conjunction with wider political and institutional impediments associated with the organisation's external environment have inhibited the learning process, preventing affective action being taken. This example may shed some light upon the lack of focus, at present, on a second important transboundary issue, climate change, which is not being explicitly dealt with by the organisation despite the fact that its impacts may already be being felt within the park and its environs. A lack of technical knowledge and understanding of the issue at the local level stemming from the lack of knowledge exchange between experts and senior managers at the national level and field based staff, prevent effective learning on this issue from occurring. I argue that there is urgent need, as with the case of grassland management in the park, for future research which can provide the new knowledge and skills directly to the BNPMA and its staff in order to precipitate the transformative action, through a process of double-loop learning, that is needed to ensure the future long term protection of the park and its biodiversity in the context of increasing climate variability and change.

Chapter 8 – Conclusions

8.1 Introduction

That the Earth's climate is changing is unequivocal (IPCC 2013) and numerous studies have begun to demonstrate the social, economic and environmental impacts of these changes (IPCC 2014b). As a consequence of this increasing climate variability and change, and in light of the current inertia surrounding emissions reductions and global mitigation efforts, organisations in all sectors need to improve their understandings of the barriers to effective adaptation, and the process through which effective adaptation can be achieved. Although a growing body of literature has examined the components of adaptive capacity in relation to communities, regions, institutions and specific sectors (e.g. IPCC 2001, Yohe and Tol 2002, Gupta et al. 2010, Wilby and Vaughan 2010, Runhaar et al. 2012) limited attention has been paid to date to the specific capacity constraints facing organisations, an omission with significant consequences for knowledge of how best to design and implement future adaptation initiatives (Conway 2011). Furthermore, whilst the impacts of climate change are likely to be experienced soonest and most severely in vulnerable developing countries (Adger et al. 2003), little work has yet been done to examine adaptation in organisations in the developing world.

Despite the reciprocal and mutually reinforcing relationship that links climate change and conservation outcomes, discussed in Chapter Two (e.g. Rockström et al. 2009, Mawdsley et al. 2011, SCBD 2014), adaptation in conservation organisations remains an unexplored topic. How conservation policy and practice can be adapted to deal with the issue of increasing climate variability and change and how this issue can be mainstreamed into all conservation planning and actions is a key complimentary and contemporary area of conservation research (Heller and Zavaleta 2009, Sutherland et al. 2009). This gap is echoed in the calls of adaptation scholars who have highlighted the need for adaptation research that focuses on adaptation policy and decision-making (Moser et al. 2008, Conway 2011).

Addressing these broad yet significant research gaps is the motivation behind and focus of this study. To that end this thesis has examined how the BNPMA in Nepal is able to adapt to pressures in its external environment, including increasing climate variability and change, and has focused on the factors driving organisational change, the components of adaptive capacity which enable and restrict organisational responses, and the learning processes through which this capacity can be mobilised and action taken. This concluding

chapter begins by returning to the key research questions upon which this thesis is founded, documenting how the evidence obtained and subsequent analysis has addressed the problems at the heart of this research. The methodological limitations of this study are then considered. The penultimate section of this chapter considers the broader theoretical contribution of this study to understandings of organisational change and learning, adaptive capacity, and adaptive management approaches to conservation. Finally, the specific contribution of this work to the future management of the park is highlighted, and the wider policy implications examined, in relation to Nepal and beyond.

8.2 Findings in Relation to Key Research Questions

In order to analyse organisational adaptation to climate change in the BNPMA, a mixed-methods case study approach has been employed, founded upon a modernist ontological and critical realist epistemological perspective. Approaching the research in this way has involved conceptualising the organisation as distinct from, and positioned within, its external environment. This has enabled focus to remain trained on the BNPMA itself, whilst acknowledging the importance and influence of those factors acting and interacting in the organisation's external environment, over a range of scales, in driving change. Moreover the use of multiple methods, facilitated by this framing, has allowed findings to be triangulated between methods, strengthening the validity of findings and associated claims to knowledge.

8.2.1 What are the BNPMA's Key Drivers of Change?

In Chapter Five analysis focused on identifying the BNPMA's key drivers of change, and examining the means through which the organisation intrudes into its external environment and gathers data on these diverse drivers. Data collected from hydro-climatic stations around the park were obtained through the DoHM and analysed using the MK and Seasonal MK Tests, in order to highlight the presence of precipitation, temperature and river discharge trends in and around the BNP. In conjunction with these data, survey responses were collected and analysed to uncover perceptions of climate change amongst local residents. Semi-structured interviews conducted with key stakeholders and a focus group meeting held with a selection of the park's Game Scouts were employed to shed more light on the drivers of change facing the BNPMA and, further, to identify the diverse means through which the BNPMA becomes aware of these drivers, recognising them as challenges to which the organisation must respond.

The results presented, highlight the importance of both environmental and anthropogenic factors in driving change within the BNPMA, providing some insights as to their relative importance and the links between them. Analysis of climate data revealed trends of increasing mean monthly maximum temperatures over the recent past, alongside warmer winters, findings corroborated by survey responses concerning local perceptions of change. Statistical analysis also provided evidence of reduced annual and monthly precipitation, combined with increasingly intense rainfall events and a delayed monsoon season. The impacts and significance of these changes were elucidated by interview respondents, almost three quarters of whom identified environmental change as a key driver of organisational change. Within this category climate change was most frequently cited as an important driver of change followed by, in order of diminishing importance, water availability, the conversion of grasslands to forests, the spread of invasive species, and changing fire regimes.

A number of anthropogenic drivers of change were also identified and shown to play an important role in precipitating change within the BNPMA. Approximately half of interview respondents cited international conservation and climate change agendas as an important driver of change facing the BNPMA whilst 44% and 46% of respondents highlighted the role of park-people conflict and human-wildlife conflict respectively. These findings were substantiated by data obtained through the Game Scout focus group and observations made by the researcher during interactions with park staff. Examining these data in relation to Daft and Weik's (1984) Model of Organisational Interpretation Modes enabled the complex and important links between these environmental and anthropogenic drivers to be emphasised, eroding the conceptual distinction between these apparently discrete categories of drivers of change.

Interview and focus group responses also illuminate the diverse means through which the BNPMA becomes aware of these drivers, recognising them as challenges to which they must respond. These mechanisms of problem identification and interpretation were found to broadly align with those first proposed in the seminal work of Daft and Weik (1984). The analysis presented in this chapter also accentuated the value of clear channels of communication, not only between park staff but also between staff and their wider

stakeholders, in identifying these drivers of change and conveying information about them throughout the organisation to key decision-makers.

8.2.2 What are the Main Factors that Facilitate and Constrain the Adaptive Capacity of the BNPMA?

In Chapter Six the principal factors facilitating and constraining the adaptive capacity of the BNPMA were examined. Likert questionnaires were administered in order to garner staff opinions regarding the key factors working to facilitate and constrain the ability of the BNPMA to respond to its drivers of change. Responses obtained were grouped together based on their relevance to different facets of the organisation and its external environment, and scores were aggregated to enable the basic quantification of the strength of staff opinions relating to each component of adaptive capacity. Data obtained from interview and focus group responses were then examined alongside field observations, to corroborate Likert findings and to derive more nuanced information regarding the relative contribution of these components to organisational adaptive capacity, and the relationships between them.

Results of the Likert questionnaires indicate a belief amongst park staff that the organisation's clear vision, strong leadership, staff training and planning processes make the most positive contribution to the ability of their organisation to successfully respond to new drivers of change. Perhaps unsurprisingly, given the developing country context, internal resource constraints were perceived by staff to exert the most negative influence upon overall adaptive capacity. Interview responses emphasised the importance of the relationships between the identified constituents of adaptive capacity, both amongst and between those categorised as internal and external. The organisation's financial resources, for example, were shown to be of primary importance in determining overall adaptive capacity given the influence that this component exerts upon the technological, infrastructure and human resource capacity of the BNPMA, as well as defining the scope of activities in which it is able to engage. Others, such as the social context of the BNPMA, were shown to be important because of their influence across scales; others still, such as the organisation's technological context, were shown to be of lesser importance in determining organisational adaptive capacity, given their bounded influence on other identified components.

The results and analysis presented in this chapter provide an important insight into staff perceptions of the adaptive capacity of the BNPMA. Interestingly, examining Likert responses by department rather than as a single aggregated unit highlighted distinct differences in the experiences of staff from different sections of the organisation. This issue was most apparent in relation to questionnaire responses received from Hattisar staff, particularly concerning issues of knowledge sharing, organisational planning, and the availability of human and infrastructure resources. The sense of isolation alluded to by Hattisar staff in their responses, emphasises the dangers of over simplification when conducting studies focused at the organisational level of aggregation; it is vital to ensure that any generalisations are not achieved at the expense of transparency, accuracy, and precision.

8.2.3 To What Degree Does the Organisational Learning Schema Fit with the Observed Activities, Routines and Procedures of the BNPMA?

In Chapter Seven consideration turned to the degree to which the organisational learning schema, central to the conceptual framework of this study, was reflective of the observed activities, routines and procedures of the BNPMA. Data from interview and focus group responses, field observations, and official park documents were drawn upon to examine the form and function of the learning processes at work in the BNPMA, and the relationships between them. Three examples: the lack of water availability within the park, the drying of the Geruwa branch of the Karnali, and the succession of grassland to forest, were used to illustrate and elucidate the processes through which the BNMPA mobilises its adaptive capacity in response to its drivers of change.

In the case of the park's waterholes, the BNPMA was shown to be engaged in productive organisational learning. An initial process of single-loop learning resulted in the construction of additional waterholes for the park's fauna, however when ongoing monitoring found this response to be inadequate, a process of double-loop learning was instigated, resulting in the more comprehensive adjustment of the organisation's policies and routines. Evidence of a third form of learning was also presented, apparent in the modification of the BNPMA's monitoring and evaluation processes; the means through which learning occurs. In the example of the conversion of grassland to forest, productive organisational learning was also shown to occur. In this instance more pervasive institutionalised changes occurred resulting from a process of double-loop learning.

Subsequently the organisation was found to be engaged in an ongoing process of single-loop learning through which ongoing incremental improvements to grassland management strategies were made. However, as in the case of the drying river, learning was not always found to occur; rather it was revealed to be dependent upon the interplay of the organisation's components of adaptive capacity.

In line with the findings of other authors (e.g. Allen et al. 2011, Fabricus and Cundill 2014) learning was found to be a central element of adaptive management approaches to conservation in Bardiya. Furthermore, the utility of adaptive management approaches to conservation in enabling effective action to be taken in the face of uncertainty was demonstrated. In this case, whilst all types of learning were shown to have a role to play in adaptive management approaches, the degree to which learning, and therefore adaptive management takes place was found to be influenced, and in the case of the Geruwa River entirely constrained, by the diverse range of components of the organisation's adaptive capacity.

8.3 Limitations

Although every care has been taken to ensure that the methodology employed in this research is rigorous and the findings robust and defensible, a number of limitations which may have affected the quality of this research were identified. Firstly, as discussed earlier in this thesis, a number of factors were identified prior to fieldwork, such as the limited sample size for the semi-structured interviews, and the group effects which can influence responses received in focus groups. The influence of these limitations was mitigated through strategies such as clearly outlining the rules of the focus group prior to commencement, and ensuring that all participants had an opportunity to air their opinions, but they could not be entirely avoided. Some such limitations identified prior to the commencement of fieldwork were harder to avoid and may have impacted more significantly on this study, including the constraints and influence exerted by the necessity of employing a translator. Whilst such issues may have impacted negatively upon the quality of this research the use of multiple methods to triangulate findings has undoubtedly helped to reduce their impact, if not negated them entirely.

Linked to this assemblage of confounding factors were a number of additional limitations that became apparent during the course of research and analysis, rather than *a priori*. Chief

amongst these were concerns relating to the applicability of Likert questionnaires in the context of the BNPMA. Although the researcher was acutely aware of the need for self-reflexivity and the importance of addressing considerations of positionality, the apparent reluctance of park staff to engage openly with the more sensitive topics of the questionnaire, such as those pertaining to the culture and political context of their organisation, was an issue that only became apparent *post hoc*.

During the process of data analysis it became clear that a number of Likert responses were in disagreement with the results obtained through other methods of data collection. Although some authors (e.g. Thompson and Phua 2005) have argued that Likert responses may be influenced by a social desirability bias, others argue that the impact of such factors has been exaggerated (Spector 1987, Moorman and Podsakoff 1992). In order to be methodologically sensitive to the possible influence of such a bias on the validity of questionnaire responses, it was imperative that care be taken over question formulation and that the confidentiality of respondents was ensured (Randall and Fernandes 1991, Spector 1994). Anonymous respondents have been shown to exhibit a lower social desirability bias (Joinson 1999) and, despite the assurances of anonymity given to questionnaire participants, it is possible that in administering the Likert questionnaire, improved respondent comprehension of its purpose and content was achieved at the expense of increased bias. A possible implication of this finding is that Likert questionnaires, although commonly advocated as a useful tool in organisational research (e.g. Bryman 2005) may be of more limited utility in the context of public sector bureaucracies in developing countries.

As a consequence of this perceived limitation, less emphasis has been placed upon the Likert responses than was originally anticipated. However, these results have remained a useful source when analysed judiciously in conjunction with other data sources, further demonstrating the value of methodological pluralism and the benefits of triangulating findings. Despite apparent limitations, Likert responses enabled a range of interdependent internal and external components of adaptive capacity to be identified, broadly corresponding to those cited in the wider literature (e.g. IPCC 2001, Adger, Brown et al. 2003, Gupta et al. 2010, Runhaar et al. 2012). Quantifying the relative importance of the identified determinants of adaptive capacity, however, although possible in theory, was

found to be beyond the scope of this study; this remains an interesting area for future research.

8.4 Theoretical Contribution

The findings outlined above, although based on the specific circumstances in Bardiya should not be viewed in isolation as they are founded in the wider body of organisational change, adaptation and conservation literature and therefore speak to it, and to the theoretical and conceptual debates therein. In particular the results of this study provide a number of insights relevant to the identified gaps and debates in the organisational change and learning, adaptation, and adaptive management literature, whilst highlighting potentially productive avenues of future scholarship.

The findings of this study, for example, demonstrate the utility of Daft and Weick's (1984) model of organisational interpretation modes, despite the implicit focus of the original conceptualisation on private sector actors. The scanning characteristics through which organisations are said to acquire data concerning their external environment, and the distinct modes through which this information is interpreted and given meaning, provided a useful framing though which to analyse the activities observed within the BNPMA. Where the results of this study take this further, is through demonstrating that organisations do not necessarily operate statically within this framework, rather that the process through which data is gathered and interpreted is more complex, dependent, to a degree, upon the nature of the driver of change itself.

In Chapter Five, for example, the BNPMA was shown to view its environment as being simultaneously analysable, as in the case of the identification of grassland succession, and unanalysable, in relation to the lack of watering holes for the park's fauna. Such findings suggest that organisations have more transient assumptions concerning the nature of their external environment, than the static categories put forward by Daft and Weik. An implication of this is that organisations should not be neatly divided into those, on the one hand, that question their environment and analyse the data obtained, and those that, on the other, operate in a more ad hoc improvisational manner. The reality is more fluid and complex.

Similarly, the outcomes of this study imply that the degree to which an organisation interacts with its external environment should not be viewed as a simple binary position within this static framework. The reality appears to be a more fluid case-dependent situation which may involve both active intrusion into the external environment, as in the case of active field experiments to gather data on invasive species, and the passive receipt of information from that arena, as in the case of the Geruwa River drying, brought to the attention of the BNPMA by local residents. In these circumstances the question then becomes how does interpretation take place? How is the value of information received through these different modes evaluated and the data given meaning to precipitate action? In the case of the BNPMA it would appear that the answers to these questions lie in the daily discussions and interactions that take place between senior park staff and the local heads of the BNPMA's conservation partners. Ultimately, however, decision-making power rests solely in the hands of the Chief Warden. Whether this is more broadly representative of the situations in other organisational contexts is an interesting area for future research, which may ultimately identify a greater number of more fluid modes of organisational interpretation than those originally outlined by Daft and Weick (1984).

In terms of the components of adaptive capacity that can be brought to bear on an organisation's drivers of change, the findings from this study are broadly supportive of those documented in the wider literature. Organisational systems, culture, internal resources and the process of knowledge generation and sharing were found to represent important constituents of internal organisational adaptive capacity, whilst the organisation's external resource context and wider social, institutional, political, and ecological settings were also shown to play an important role in determining overall adaptive capacity.

The results of this study also provide some additional insights to the importance of the relationships that exist between these components. Whilst a quantification of the relative importance of these components of adaptive capacity was beyond the scope of this study, what it has achieved, is to highlight the significant role of the interdependencies between these elements in influencing the overall adaptive capacity of an organisation. The financial resources of the BNPMA, for example, are an interesting case in point. The availability of internal finances influences the technological, infrastructure and human resources available to the BNPMA, the level of training provided and the extent and scope of

activities conducted by the organisation. At the same time this component of adaptive capacity is strongly linked to the organisation's resource context which represents a key external source of financing, and the wider social context through which these additional funds are often accessed.

At present the importance of these relationships is rarely acknowledged in the wider literature and it therefore represents a potentially fruitful area for future research. Indeed it seems likely that the exact relationships between the building blocks of adaptive capacity will vary between organisations operating in diverse industries and sectors, in distinct locations. Improving our knowledge of how to assess the relative importance of the constituents of adaptive capacity may enable organisations to prioritise areas for the receipt of scarce funds whilst maximising the impact of such interventions on overall adaptive capacity. Such outcomes would be particularly valuable in the context of developing countries where resources are scarce and vulnerability to the impacts of climate change is disproportionately high. In the BNPMA, for instance, this study has highlighted the importance of the social context of the organisation in overcoming the limitations imposed by other determinants of adaptive capacity including the availability of internal human, financial, and technological resources. In the case of poaching, for example, outreach work with local stakeholders has resulted in the establishment of numerous CBAPCU groups. The result has been a significant increase in the BNPMA's capacity to prevent poaching within the park's core area and buffer zone, overcoming the internal resource constraints that had previously impeded action whilst simultaneously improving park-people relations.

The results of this study have also helped to provide important clarifications regarding the tacit disagreements which endure in organisational learning theory. The examples of the lack of watering holes within the park, and the increasingly rapid succession of grasslands to forest, support the widely accepted notion of single- and double-loop learning as distinct learning modes (e.g. Argyris and Shön 1996). At the same time these findings indicate that this distinction is not as clear cut in practice as is often portrayed in theory (e.g. Armitage et al. 2008, Pahl-Wostl 2009). This is particularly true of claims that double-loop learning addresses the root causes of a problem whilst single-loop does not (e.g. Hatch 1997), and the assertion that only double-loop learning can involve the modification of policies and routines (Tosey et al. 2011).

The results and analysis presented in Chapter Seven also demonstrate that single- and double- loop learning should be conceptualised as being complimentary. Whilst some scholars have begun to imply (e.g. Shultz and Lundholm 2010) or even explicitly claim (e.g. Storjbork 2010) that double-loop learning is a successive and superior loop more desirable to organisations than single-loop learning, this study has demonstrated that both forms of learning are important. Single-loop leaning is of greatest benefit where existing policies and procedures have rendered the organisation well placed to deal with a new driver of change; double-loop learning is needed to catalyse and inform the creation of these new policies, systems and procedures where they are not yet in place. This is important since the lack of clarity around the distinction between these two types of learning in the wider literature exacerbates confusion surrounding questions of who or what is learning. The results of this study suggest not only that individual learning may lead to organisational learning but also, interestingly, that single-loop learning may be more closely associated with individual learning and double-loop learning with learning at the organisational level of aggregation. Whilst these findings appear to shed some light on the relationship between levels of analysis in organisational learning, more work is needed in this area to expand the evidence base.

No evidence was found of triple-loop learning in the contemporary sense of the term (e.g. Pahl-Wostl 2009, Löf 2010, Storbjörk 2010), although a third type of learning was intimated in the case of the water holes. Deutero-learning, analogous to Argyris and Shön's conceptualisation of the term (1996, drawing on the work of Bateson 1972), was implied through the modification of the organisation's monitoring and evaluation processes, complimenting both single- and double-loop learning by enhancing the overall capacity of the organisation to learn. Such results echo the findings of Tosey et al. 2011; more empirical research examining organisational learning in practice is needed, in order to assess the degree to which such findings derived from the case of the BNPMA, are representative of organisational learning more generally.

In relation to theoretical conclusions of relevance to the adaptation in conservation literature, learning, be it single- double- or deutero-, has been shown to be fundamental to adaptive management through the mobilisation of organisational adaptive capacity into action. Conceptualisations of adaptive management approaches in the wider conservation

literature (e.g. Allen et al. 2011) emphasise the important role of learning within this process, but frequently characterise this component as no more than a simple process of monitoring, evaluation and feedback. This study intimates a more complex role of learning within adaptive management approaches, incorporating single- double- and even duetero-learning.

An important implication of this finding is that conservation organisations with scarce resources, who wish to engage in adaptive management approaches, will likely benefit from a focus on developing robust and diverse formal learning and knowledge sharing systems including monitoring and evaluation procedures and experimentation. In addition, in line with the findings of Pelling et al. (2008) strong informal processes and systems are needed drawing on the knowledge and experiences of the organisation's wider stakeholders, to mobilise the organisation's latent adaptive capacity to successfully address its drivers of change. In other words, for effective adaptive management to occur, most organisations will likely benefit, as has the BNPMA in the case of the provision of waterholes, from the initiation of a process of deutero-learning: learning how to learn. Conversely the example of the drying of the Geruwa River, in which learning did not take place, suggests that where political and institutional constraints exist, and where the scale of an issue transcends the decision-making power of a single organisation, the ability of that organisation to develop robust adaptive management responses may be compromised.

8.5 Policy Implications

In addition to the theoretical conclusions and future research directions outlined above relating to the wider literature on organisational change and learning, adaptation, and adaptive management, there are a number of substantive conclusions of this study which speak both to park management, and to those involved in adaptation and conservation planning, policy making and practice more generally.

At the local scale this research project has made a practical contribution to the future management of the park in a number of ways. As highlighted in Chapter 6 due to resource constraints, the capacity of the BNPMA to provide formal training sessions to all of its staff is limited. An important component of this is the current paucity of information on, and knowledge of, the relevance and potential implications of climate change at the park level.

Interview respondents from within all sections of the organisations from field staff (e.g. KJBNPMA), to those at park headquarters (RKTBNPMA), to those based in the elephant stables (PPBNPH), identified this limited knowledge and understanding of climate change issues in Bardiya, recognising its roots in the novelty of the issue and the constraints that restrict knowledge sharing between the organisation and its partners across scales, emphasised in Chapter 6.

This research has helped to address this knowledge gap, in the first instance through the provision of a training session on climate change and conservation held during fieldwork at park headquarters. Staff from various sectors of the organisation attended and the session outlined key climate change terminology, the relevance of climate change to conservation practice, and the importance of ensuring that climate change considerations are included in park management. In addition, the researcher committed to providing park staff and managers with a number of summary papers synthesising the key findings of this research of relevance to the future management of the park.

Following this training session, senior park staff discussed the possibility of including an enhanced section on climate change in the forthcoming five-year park management plan. Based on the initial findings of this research, and on the wider body of Nepal-focused research on climate change, the researcher authored and shared with park managers a climate change section for the management plan (Appendix 7).

This climate change chapter for the management plan outlines the latest climate change projections for Nepal in relation to temperature, precipitation, seasonality and the frequency of extreme events. It highlights the relevance of climate change to protected areas, the challenges faced and potential response options, and presents an assessment of the potential role of current park management practices in enabling the BNPMA to address climate change issues. In conclusion it outlines a number of initial practical steps available to the organisation towards mainstreaming climate change considerations in future park management. Although this management plan is still to be finalised (pers. comm. TRA 1.7.14) senior park staff expressed their commitment to ensuring the inclusion, for the first time, of this climate change chapter in the management plan.

The results of this study also have less immediate implications for the management of the BNP in practice. Building upon these awareness-raising activities, this thesis has highlighted the importance of monitoring the local environment in facilitating effective park management. This includes the need to ensure the ongoing analysis of local climate data and establishing channels through which local perceptions of change can be fed back to park managers. More specifically it has highlighted the urgent need, over the coming months, to ensure that park management strategies and activities reflect the need to focus on water management issues within the core park area, particularly in relation to the Geruwa River.

This work has also identified a number of key constraints to the successful management of the park, such as its political and institutional context, towards which park managers should turn their immediate focus, whilst emphasising the need to ensure that such challenges are not addressed in isolation. The findings of this study have also provided evidence of the operational benefits of adopting a learning-based adaptive management approach to the management of the BNP, and the importance of strengthening and formalising internal monitoring and evaluation systems to that end.

In relation to wider policy implications this study has also made an important contribution. It has shown that some components of the BNPMA's adaptive capacity have a more important role in determining the overall ability of the organisation to adapt, than others. The role of financial resources in governing organisational adaptive capacity, for example, discussed above and in Chapter Five, was highlighted by interview respondents as being of particular importance as a consequence of the influence of this element on other components of adaptive capacity. Similarly the social context of the BNPMA was highlighted though interview responses and Likert questionnaires, as providing a particularly important contribution to the adaptive capacity through its ability to redress a number of human, financial and technological resource constraints within the organisation.

Equally, others constituents of adaptive capacity including the political and institutional context of the BNPMA were shown, in Chapter Six, to have been of particular significance because of their influence across multiple scales. Political uncertainty at the national level, resulting from the dissolution of parliament, for example, has played a key role in fostering the institutional inertia which has resulted in a lack of responsiveness in national level

legislation, and significant delays in the implementation of new projects and programmes. At the same time, the growing concentration of decision-making power in the hands of a small number of political elites has reduced flexibility in decision-making at the park level. This has had additional impacts at the local level where politicians have become less accountable to the needs of local people, creating an environment in which patronage and corruption can blossom.

These findings, and in particular the links identified between these distinct components, suggest that in the short-term adaptive capacity may be most efficiently enhanced through a recognition of, and focus on, those components evaluated as having the greatest influence, be that positive or negative. This is particularly relevant, as in the case of the BNPMA, where a number of key elements are acting as bottlenecks, constraining the overall adaptive capacity of the organisation. The limitations imposed upon the BNPMA by the wider political and institutional context in responding to the challenge of the Geruwa River, for example, represents an interesting case in point. In this instance, the political and institutional blockages imposed by a lack of flexibility in the rules governing the extraction of stones from within the park, is forestalling the initiation of an adaptive management response. In working to enhance the ability of organisations to respond to their drivers of change it is therefore important for policy makers to assess the relative importance of these distinct components of adaptive capacity, which will vary across space and time, in order that scarce resources can be targeted, in the first instance, at the most influential factors governing the ability of an organisation to respond to its drivers of change.

A further key finding of this study, of relevance to all organisations but of particular concern in the context of developing countries, is that capacity constraints will likely limit the degree to which an organisation is able to adequately address all of its drivers of change. Consequently the process through which an organisation's drivers are prioritised for action becomes a key point of interest. In the case of conservation organisations in developing countries, an additional layer of complexity may be added to this process through the influence of international conservation and development organisations who intervene to help address this capacity shortfall, often through the provision of financial and technical assistance. In doing so decision-making power pertaining to the selection of which drivers to address, often at the expense of others, may be removed from the hands

of the organisation in question and placed at the feet of donors and the internationally driven agendas upon which they are commonly focused.

As a result, the drivers perceived to be of greatest immediate importance by senior managers at the local level may not be the most extensively or frequently funded activities, particularly where such actions don't fit with the priorities and policies of donor organisations or the wider international community. Nepal's commitment under the St. Petersburg Declaration to double tiger numbers by 2022, for example has, as documented in Chapter Five, raised concerns in some quarters that such targets could result in local level programmes that prioritise international conservation agendas over local livelihood needs.

The significance of building strong relationships at the individual and organisational levels, to aid negotiation and prevent conflict in such circumstances, and the importance of knowledge sharing including the recognition of the value of local knowledge for prioritising an organisation's distinct drivers of change, is therefore clear. This study has demonstrated the complex interdependencies that exist between an organisation's drivers of change. Conservation organisations operating in developing countries must acknowledge this complexity and the associated trade-offs, and should ensure that their priorities and activities, at the local level, are informed as much by the organisations that they intend to assist, as by the international agendas which frequently shape the form of these interventions. If not, there is potential for the misallocation of funds towards at best non-priority activities, and at worst activities that may impact negatively on other drivers of change.

That an organisation's diverse drivers of change are so deeply entwined does not necessarily result in the negative impacts implied by this idea of trade-offs; the reverse may be equally true. This should provide further motivation for park managers, partner organisations and policy makers to focus on identifying the links and complementarities that exist between these anthropogenic and environmental drivers, since action taken to address one driver of change may impact positively on another. In the case of the BPNMA, the construction of a solar-powered electric fence to address issues of human-wildlife conflict presents a pertinent illustration of this. Not only has this intervention contributed to a reduction in incidents of human-wildlife conflict and the associated livelihood impacts

of this, it has served to improve relationships and foster cooperation between park staff and local communities. Such mutually beneficial outcomes, where identified, should be prioritised as areas for intervention.

At the same time, action taken to address an organisation's drivers of change must consider implications and impacts over a range of scales since, as Chapter Five has shown, such drivers originate from and operate over multiple scales. Donors and conservation organisations in Nepal could potentially improve their impact by widening their vision and working to address the current political and institutional blockages which exist at the national level, and which currently work to limit adaptive capacity at the local level. In a similar vein, the country's national parks, and the organisations tasked with managing them, could perhaps benefit from focusing more of their scarce resources on lobbying efforts, to increase their voice and exert a greater influence on their political and institutional environment which is working to severely constrain organisational adaptive capacity at the local level.

Finally, to return to the specific case of Bardiya, in the short-term it may not be possible to overcome the barriers to adaptation imposed by the wider political and institutional environment expeditiously enough to adequately address its increasingly compelling environmental drivers of change. In light of this it may behove the BNPMA to take advantage of the fortuitous window of opportunity that has arisen as a result of the Chief Warden's recent promotion to Deputy Director General of the DNPWC. Given the former warden's close emotional and personal ties to Bardiya, and his current knowledge of the unique drivers threating the effective conservation of the park, this would appear to represent a promising opportunity for senior park staff to lobby for the legislative and political changes required to enhance the organisation's adaptive capacity, with a high powered ally advocating on their behalf. This is particularly true in the case of the Geruwa River where swift action is needed to avert potentially calamitous consequences for the parks fauna and flora. Successfully addressing the political and institutional barriers that have been shown to play an important role in influencing the adaptive capacity of the BNPMA, would undoubtedly improve the potential future effectiveness of adaptation interventions in and around the Bardiya National Park.

References

Adams, W. Mulligan, M. (2003) Decolonising Nature: strategies for nature conservation in a post-colonial era. Earthscan Publications Ltd: London.

Adams, W. (2004) Against Extinction: the story of conservation. Earthscan: London.

Adams, W. (2009) Conservation. In: Gregory, D. Johnston, R. Pratt, G. Watts, M. Whatmore, S. (eds.) The Dictionary of Human Geography. Wiley-Blackwell: Oxford: 107-8.

Adams, C. McNicholas, P. (2007) Making a difference: sustainability reporting, accountability and organisational change. Accounting, Auditing & Accountability Journal, 20(3): 382-402.

Adger, W. Huq, S. Brown, K. Conway, D. Hulme, M. (2003) Adaptation to Climate Change in the Developing World. Progress in Development Studies, 3(3): 179-195.

Adger, W. Brown, K. Fairbrass, J. Paavola, J. Rosendo, S. Seyfang, G. (2003) Governance for Sustainability: towards a 'thick analysis' of environmental decision-making. Environment and Planning A, 35: 1095-1110.

Adger, W. (2006) Vulnerability. Global Environmental Change, 16: 268-281.

Adhikari , T. Thapa, RK. Karki, JB. (2009) Status of Wetlands Conservation in Bardia National Park. The Initiation, 3: 49-56.

Adhikari, T. (2012) Bardiya National Park Briefing. Unpublished presentation slides.

Agrawal, A. McSweeny, C. Perrin, N. (2008) Local Institutions and Climate Change Adaptation. The Social Dimensions of Climate Change, 113: 1-8.

Allen, C. Fontaine, J. Pope, K. Garmestani, A. (2011) Adaptive Management for a Turbulent Future. Journal of Environmental Management, 92(1): 339-45.

Allen, C. Gunderson, L. (2011) Pathology and Failure in the Design and Implementation of Adaptive Management. Journal of Environmental Management 92: 1379-1384.

Allendorf, T. Smith, J. Anderson, D. (2007) Residents' Perceptions of Royal Bardia National Park, Nepal. Landscape and Urban Planning, 83(1-2): 33-40.

Alix-Garcia, J. Shapiro, E. and Sims, K. (2012) Forest Conservation and Slippage: evidence from Mexico's national payments for ecosystem services program. Land Economics, 88 (4): 613–638.

Andam, K. Ferraro, P. Sims, K. Healy, A. Holland. M. (2010) Protected Areas Reduced Poverty in Costa Rica and Thailand. Proceedings of the National Academy of Sciences of the United States of America, 107(22): 9996 -10001.

Anfara, V. (2008) Theoretical Frameworks. In: Given, L. (ed.) The SAGE Encyclopaedia of Qualitative Research Methods. SAGE Publications: London: 869-873.

Anonymous. (2013) Congress Largest Party in FPTP Polls. Kathmandu Post 24/11/13, http://www.ekantipur.com/the-kathmandu-post/2013/11/23/top-story/congress-largest-party-in-fptp-polls/256100.html (accessed 18/12/14).

Aragón, A. Macedo, J. (2010) A Systematic Theories of Change Approach for Purposeful Capacity Development. IDS Bulletin, 41(3): 87-99.

Argyris, C. and Schön, D. (1978) Organisational Learning: a theory of action perspective. Addison-Wesley: London.

Argyris, C. Schön, D. (1996) Organisational Learning II: theory method and practice. Addison-Wesley Publishing Company: Wokingham.

Armenakis, A. Bedeian, A. (1999) Organisational Change: a review of research and theory in the 1990s. Journal of Management, 25(3): 293-315.

Armitage, D. Marschke, M. Plummer, R. (2008) Adaptive Comanagement and the Paradox of Learning. Global Environmental Change, 18: 86-98.

Arnell, N. (2010), Adapting to Climate Change: an evolving research programme. Climatic Change, 100: 107-111.

Arriagada, R. Ferraro, P. Sills, E. Pattanayak, S. and Cordero, S. (2012) Do Payments for Environmental Services Affect Forest Cover? A farm level evaluation from Costa Rica. Land Economics, 88(2): 382–99.

Bam, S. Bhandari, S. Prakash, G. Pokhrel, R. Basnet, D. (2013) Climate Change Perception: a case study of Bardiya National Park (BNP), Thakurdwara, Bardiya, Nepal. Bioscience Discovery, 4(2): 133-138.

Baral, N. Heinen, J. (2006) The Maoist People's War and Conservation in Nepal. Politics and the Life Sciences, 24(1-2): 2-11.

Baron, G. Gunderson, L. Allen, C. Fleishman, E. McKenzie, D. Meyerson, L. Oropeza, J. Stephenson, N. (2009) Options for National Parks and Reserves for Adapting to Climate Change. Environmental Management, 44: 1033-1042.

Bass, S. Steele, P. (2006) Managing the Environment for Development and to Sustain Pro-poor Growth. IDS Bulletin, 37(3): 7-16.

Bateson (1972) Steps to an Ecology of Mind: collected essays in anthropology, psychiatry, evolution, and epistemology. Intertext: Aylesbury.

Béné, C. (2013) Towards a Quantifiable Measure of Resilience. IDS Working Paper, 434: 1-27.

Béné, C. Newsham, A. Davies, M. Ulrichs, M. Godfrey-Wood, R. (2014) Review Article: resilience, poverty and development. Journal of International Development, 26: 598-623.

Berkhout, F. Hertin, J. Gann, D. (2004) Learning to Adapt: organisational adaptation to climate change impacts. Tyndall Centre for Climate Change Research Working Paper, 47: 1-21.

Berkhout, F. (2012), Adaptation to Climate Change by Organisations. WIREs Climate Change, 3: 91-106.

Bertram, D. (2007) Likert Scales are the Meaning of Life. CPSC681 – Topic Report http://poincare.matf.bg.ac.rs/~kristina/topic-dane-likert.pdf (accessed 8/10/14).

Bhatt, N. (2003) Kings as Wardens and Wardens as Kings: post-Rana ties between Nepali royalty and National Park staff. Conservation and Society, 1(2): 247-268.

Bhatta, S. (1999) Status Paper of the Royal Bardiya National Park. Grassland Ecology and Management in Protected Areas of Nepal, 2: 122-127.

Bhatta, B. Karna, A. Prakesh Dev, O. Springate-Baginski, O. (2007) Chapter Six Participatory Forest Management in the Nepalese Tarai: policy, practice and impacts. In: Springate-Baginski, O. Blaikie, P. (eds.) Forests, People and Power: the political ecology of reform in South Asia. Earthscan: London: 177-221.

Bhattarai, DK. (2012) CA Goes Sans Statute; govt plans fresh elections. Kathmandu Post 28/05/2012, http://www.ekantipur.com/the-kathmandu-post/2012/05/27/top-story/ca-goes-sans-statute-govt-plans-fresh-elections/235347.html (accessed 18/12/2014).

Bhattarai, DK. (2014) Congress, UML Close Deal. The Kathmandu Post 10/2/2014, http://www.ekantipur.com/the-kathmandu-post/2014/02/09/top-story/congress-uml-close-deal/259092.html (accessed 23/10/2014).

Boone, H. Boone, D. (2012) Analyzing Likert Data. Journal of Extension, 50(2): 1-5 http://www.joe.org/joe/2012april/tt2.php (accessed 28/8/2013).

Botcheva, L. White, C. Huffman, L. (2002) Learning Cultures and Outcomes Measurement Practices in Community Agencies. The American Journal of Evaluation, 23(4): 421-434.

Boyd, E. (2012) Chapter Eleven Adapting to Global Climate Change: evaluating resilience in two networked public institutions. In: Boyd, E. Folke, C. (eds.) Adapting Institutions: governance, complexity and socio-ecological resilience. Cambridge University Press: Cambridge: 240-263.

Boyd, E. Folke, C. (2012) Adapting Institutions, Adaptive Governance and Complexity: an introduction. In: Boyd, E. Folke, C. (eds.) Adapting Institutions: governance, complexity and socio-ecological resilience. Cambridge University Press: Cambridge: 1-8.

Boyd, E. Osbahr, H. (2010) Responses to Climate Change: exploring organisational learning across internationally networked organisations for development. Environmental Education Research, 16(5-6): 629-43.

Brockington, D. Schmidt-Soltau, K. (2004) The Social and Environmental Impacts of Wilderness and Development. Oryx 38(2): 140-2.

Brown, K. (1997) Plain Tales from the Grasslands: extraction, value and utilization of biomass in Royal Bardia National Park, Nepal. Biodiversity and Conservation, 6: 59-74.

Brown, P. Nelson, R. Jacobs, B. Kokic, P. Tracey, J. Ahmed, M. DeVoil, P. (2010) Enabling Natural Resource Managers to Self-Assess their Adaptive Capacity. Agricultural Systems, 103: 562-568.

Brugha, R. Varvasovszky, Z. (2000) Stakeholder Analysis: a review. Health Policy and Planning, 15(3): 239-46.

Bruner, A. Gullison, R. Rice, R. da Fonseca, G. (2001) Effectiveness of Parks in Protecting Tropical Biodiversity. Science, 291: 125-8.

Bryman, A. (2004) Social Research Methods. Oxford University Press: Oxford.

Bryman, A. (2005) Research Methods and Organization Studies. Routledge: Abingdon.

Bryman, A. (2008) Social Research Methods. Oxford University Press: Oxford.

Bunton, D. (2005) The Structure of PhD Conclusion Chapters. Journal of English for Academic Purposes, 4(3): 207–224.

Burns, R. (2000) Introduction to Research Methods. Sage Publications: London.

Burn, D. Elnur, M. (2002) Detection of Hydrological Trends and Variability. Journal of Hydrology, 255: 107-122.

Chan, K. Pringle, R. Ranganathan, J. Boggs, C. Chan, Y. Ehrlich, P. Haff, P. Heller, N. Al-Khafaji, K. Macmynowski, D. (2007) When Agendas Collide: human welfare and biological conservation. Conservation Biology, 21(1): 59-68.

Chandler, R. Scott, E. (2011) Statistical Methods for Trend Analysis in the Environmental Sciences. John Wiley and Sons: Oxford.

Chapin III, F. Lovecraft, A. Zavaleta, E. Nelson, J. Robards, M. Kofinas, G. Trainor, S. Peterson, G. Huntington, H. Naylor, R. (2006) Policy Strategies to Address Sustainability of Alaskan Boreal Forests in Response to a Directionally Changing Climate. Proceedings of the National Academy of Sciences of the United States of America, 103(45): 16637-16643.

Chaudhary, RP. (2000) Forest Conservation and Environmental Management in Nepal: a review, Biodiversity and Conservation, 9: 1235-60.

Chazdon, R. Peres, C. Dent, D. Sheil, D. Lugo, A. Lamb, D. Stork, N. Miller, S. (2009) The Potential for Species Conservation in Tropical Secondary Forests. Conservation Biology, 23(6): 1406-1417.

Chhetri, N. Chaudhary, P. Tiwari, P. Yadaw, R. (2012) Institutional and technological innovation: understanding agricultural adaptation to climate change in Nepal. Applied Geography, 33: 142-150.

Christensen, JH., K. Krishna Kumar, E. Aldrian, S.-I. An, I.F.A. Cavalcanti, M. de Castro, W. Dong, P. Goswami, A. Hall, J.K. Kanyanga, A. Kitoh, J. Kossin, N.-C. Lau, J. Renwick, D.B. Stephenson, S.-P. Xie and T. Zhou, 2013: Climate Phenomena and their Relevance for Future Regional Climate Change. In Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA pp1217-1308.

Coffey, A. Atkinson, P. (1996) Making Sense of Qualitative Data: Complimentary Research Strategies. Sage Publications: London.

Conroy, M. Runge, M. Nichols, J. Stodda, K. Cooper, R. (2011) Conservation in the Face of Climate Change: the roles of alternative models, monitoring and adaptation in confronting and reducing uncertainty. Biological Conservation, 144: 1204-1213.

Conway, D. (2011), Adapting Climate Research for Development in Africa. WIREs Climate Change, 2: 428-450.

Crona, B. Bodin, Ö. (2012). Chapter Two Knowledge, Social Networks and Leadership: setting the stage for the development of adaptive institutions. In: Boyd, E. Folke, C. (eds.) Adapting Institutions: governance, complexity and socio-ecological resilience. Cambridge University Press: Cambridge: 11-36.

Cundill, G. Cumming, G. Biggs, D. Fabricus, C. (2011) Soft Systems Thinking and Social Learning for Adaptive Management. Conservation biology, 26(1): 13-20.

Cutter, S. Barnes, L. Berry, M. Burton, C. Evans, E. Tate, E. Webb, J. (2008) A Place Based Model for Understanding Community Resilience to Natural Disasters Global Environmental Change, 18: 598-606.

Dacin, M. Goodstein, J. Scott, W. (2002) Institutional Theory and Institutional Change: introduction to the special research forum. The Academy of Management Journal, 45(1): 43-56.

Daft, R. Weick, K. (1984) Toward a Model of Organisations as Interpretation Systems. The Academy of Management Review, 9(2): 284-295.

Desai, B. Oli, K. Yang Y. Chettri, N. Sharma, E. (2010) Implementation of the Convention on Biological Diversity: a retrospective analysis in the Hindu Kush-Himalayan countries (preprint). ICIMOD: Kathmandu.

DNPWC/GoN. (2007) Bardia National Park: management plan 2007-2012. Department of National Parks and Wildlife Conservation, Government of Nepal: Kathmandu.

DNPWC/GoN. (2011) Bardia National Park Annual Report 2011/12. Department of National Parks and Wildlife Conservation, Government of Nepal: Kathmandu.

DNPWC/GoN. (2012) Bardia National Park: Draft Management Plan 2012-2017. Department of National Parks and Wildlife Conservation, Government of Nepal: Kathmandu.

DNPWC/GoN. (2013) Bardia National Park Annual Report 2012-13. Department of National Parks and Wildlife Conservation, Government of Nepal: Kathmandu.

Dinerstein, E. (1979) An Ecological Survey of the Karnali-Bardia Wildlife Reserve Nepal Part II: habitat/animal interactions. Biological Conservation, 16: 265-300.

Dovers, S. Hezri, A. (2010) Institutions and Policy Processes: the means to the ends of adaptation. WIREs Climate Change, 1: 212-231.

Drápela, K. Drápelová, I. (2011) Application of Mann-Kendall Test and the Sen's Slope Estimates for Trend Detection in Deposition Data from Bílý Kříž (Beskydy Mts., the Czech Republic) 1997–2010. Beskydy, 4(2): 133–146.

Dudley, N. (2008) Guidelines for Applying Protected Area Management Categories. IUCN, Gland: Switzerland: 1-86.

Eakin, H. Patt, A. (2011) Are Adaptation Studies Effective and what can Enhance their Practical Impact? WIRES Climate Change, 2: 141-153.

Eakin, H. Tompkins, E. (2012) Private Actors and Public Adaptation to Climate Change. Climate Science and Policy. http://www.climatescienceandpolicy.eu/2012/06/private-actors-and-public-adaptation-to-climate-change/ (accessed 12/07/12).

Easterby-Smith, M. Crossan, M. Nicolini, D. (2000) Organizational Learning: debates past, present and future. Journal of Management Studies, 37(6): 783-796.

Fabricus, C. Cundill, G. (2014) Learning in Adaptive Management: insights from published practice. Ecology and Society, 19(1): 22-36.

Folke, C. (2006) Resilience: the emergence of a perspective for social-ecological systems analyses. Global Environmental Change, 16: 253-67.

Ford, J. Berrang-Ford, L. Paterson, J. (2011) A Systematic Review of Observed Climate Change Adaptation in Developed Nations: a letter. Climatic Change, 106: 327-336.

Forest People, 2010, Nepal's Failure to Comply with the Recommendations Issued by UN Special Procedures and Treaty Bodies Concerning the Ongoing Exclusion of Indigenous Peoples' Representatives from the Making of Nepal's New Constitution: a request for follow up by the UN special rapporteur on the situation of human rights and fundamental freedoms of indigenous peoples. www.forestpeoples.org/sites/fpp/files/publication/2010/08/nepalunsprapporteurjan10eng.pdf (accessed 24/10/2014).

Gallopin, G. (2006) Linkages Between Vulnerability, Resilience and Adaptive Capacity. Global Environmental Change, 16: 293-303.

Gambarotto, F. Cammozzo, A. (2010) Dreams of Silence: employee voice and innovation in a public sector community of practice. Innovation: Management, Policy & Practice, 12(2): 166-179.

Ghimre, Y. Shivakoti, G. Perret, S. (2012) Household Level Vulnerability to Drought in Hill Agriculture of Nepal: implications for adaptation planning. International Journal of Sustainable Development and World Ecology, 17(3): 225-230.

Githui, F. Opere, A. Bauwens, W. (2010) Statistical and Trend Analysis of Rainfall and River Discharge: Yala River Basin, Kenya. http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Cairo/pdf/Statistical_And_Trend_Analysis_Of_Rainfall_And_River_Discharge_Yala_River_Basin__Kenya.pdf (accessed 19/06/2012): 171-181.

Government of Australia. (2009) Streamflow Trends in South-West Australia. Surface Water Hydrology Series, HY32: 11-16.

GoN (2012) National Population and Housing Census 2011. National Planning Commission Secretariat, Central Bureau of Statistics, Government of Nepal, Kathmandu.

Goulden, M. Adger, W. Allison, E. Conway, D. (2014) Limits to Resilience from Livelihood Diversification and Social Capital in Lake Social-Ecological Systems. Annals of the Association of American Geographer, 103(4): 906-924.

Grothmann, T. Patt, A. (2005), Adaptive Capacity and Human Cognition: the process of individual adaptation to climate change. Global Environmental Change, 15: 199-213.

Gubbie, S. Linkie, M. Leader-Williams, N. (2009) Evaluating the Legacy of an Integrated Conservation and Development Project Around a Tiger Reserve in India. Environmental Conservation, 35(4): 331 -339.

Gupta, J. Termeer, K. Klostermann, J. Meijerink, S. van den Brink, M. Jong, P. Nooteboom, S. Bergsmaa, E. (2010) The Adaptive Capacity Wheel: a method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. Environmental Science and Policy, 13: 459–471.

Gurung, G. Bhandari, D. (2008) An Integrated Approach to Climate Change Adaptation. LEISA Magazine, 24(4): 6-8.

Haas, P. (1992) Introduction: epistemic communities and international policy coordination. International Organization, 46(1): 1-35.

Harkness, J. Schoua- Glusberg, A. (1998) Questionnaires in Translation. http://isites.harvard.edu/fs/docs/icb.topic506406.files/znspez3_04_Harkness_Glusberg.pdf (accessed 19/12/14).

Harries, T. Penning-Rowsell, E. (2011) Institutional Inertia and Policy Innovation for Climate Change Adaptation: the case of flood risk management. Global Environmental Change, 21: 188-97.

Hatch, M. (1997) Organization Theory: modern, symbolic and postmodern perspectives. Oxford University Press, Oxford.

Heinen, J. and Shrestha, S. (2007) Evolving Policies for Conservation: an historical profile of the protected area system of Nepal. Journal of Environmental Planning and Management, 49(1): 41-58.

Heller, N. and Zavaleta, E. (2009) Biodiversity in the Face of Climate Change: a review of 22 years of recommendations. Biological Conservation, 142: 14-32.

Helsel, D. and Hirsch, R. 2002 Statistical Methods in Water Resources. US Geological Survey, Techniques of Water-Resources Investigations Book 4, Chapter A3. http://pubs.usgs.gov/twri/twri4a3/ (accessed 22/12/14).

Hepworth, N. (2010) A Progressive Critique of Integrated Water Resource Management in Sub-Saharan Africa. Unpublished PhD Thesis, The University of East Anglia.

Hinkel, J. (2011) Indicators of Vulnerability and Adaptive Capacity: towards a clarification of the science-policy interface. Global Environmental Change, 21: 198-298.

Hirsch, R. Slack, J. Smith, R. (1982) Techniques of Trend Analysis for Monthly Water Quality Data. Water Resources Research, 18(1): 107–121.

His Majesty's Government of Nepal. (1973) National Parks and Wildlife Conservation Act 2029. Ministry of Law and Justice, Kathmandu: Nepal.

His Majesty's Government of Nepal. (1989) National Parks and Wildlife Conservation Act (Third Amendment) 2046. Ministry of Law and Justice, Kathmandu: Nepal.

His Majesty's Government of Nepal. (1992) National Parks and Wildlife Conservation Act (Fourth Amendment) 2049, Ministry of Law and Justice, Kathmandu: Nepal.

His Majesty's Government of Nepal. (1996) Buffer Zone Management Regulation (Unofficial Translation). Department of National Parks and Wildlife Conservation, Kathmandu: Nepal.

Holling, C. (1973) Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics, 4: 1-23.

Holling, C. (1978) Adaptive Environmental Assessment and Management.

Hollway, W. Jefferson, T. (2000) Doing Qualitative Research Differently. The Cromwell Press Ltd: Trowbridge.

Holmes, C. (2003) The Influence of Protected Area Outreach on Conservation Attitudes and Resource Use Patterns: a case study from western Tanzania. Oryx, 37(3): 305-315.

Hunter, M. Redford, K. Lindenmayer, D. (2014) The Complementary Niches of Anthropocentric and Biocentric Conservationists. Conservation Biology, 28(3): 641–645.

ICIMOD. (2003) Mapping Nepal Census Indicators 2001 and Trends. International Centre for Integrated Mountain Development, Kathmandu: Nepal.

IPCC. (2001) Impacts, Adaptation, Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press: Cambridge.

IPCC. (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In: Parry, M. Canziani, O. Palutikof, J. van der Linden, P. Hanson, C. (eds.) IPCC Fourth Assessment Report: Climate Change 2007. Cambridge University Press: Cambridge.

IPCC. (2013) Summary for Policymakers. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. In: Stocker, T. Qin, D. Plattner, G. Tignor, M. Allen, S. Boschung, J. Nauels, A. Xia, Y. Bex V. Midgley P. (eds.) Climate Change 2013: The Physical Science Basis. Cambridge University Press: Cambridge.

IPCC. (2014a) Climate Change 2014 Synthesis Report 2014: approved summary for policymakers. http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_SPM.pdf (accessed 01/12/2014).

IPCC. (2014b) Summary for Policymakers. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. In: Field, C. Barros, V. Dokken, D. Mach, K. Mastrandrea, M. Bilir, T. Chatterjee, M. Ebi, K. Estrada, Y. Genova, R. Girma, B. Kissel, E. Levy, A. MacCracken, S. Mastrandrea, P. White, L. (eds.) Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Cambridge University Press, Cambridge, pp. 1-32.

Jamil, I. and Dangal, R. (2009) The State of Bureaucratic Representativeness and Administrative Culture in Nepal. Contemporary South Asia, 17(2): 193-211.

Janssen, M. Schoon, M. Weimao, K. Börner, K. (2006) Scholarly Networks on Resilience, Vulnerability and Adaptation within the Human Dimensions of Global Environmental Change. Global Environmental Change, 16: 240-252.

Jeanrenaud, S. (1998) Can the Leopard Change its Spots? Exploring people-oriented conservation in WWF. Unpublished PhD Thesis, The University of East Anglia.

Jianhua, Z. Yali, W. Junchang, L. (2010) Human Capacity Building of Nature Reserves in China. International Conference on E-Product E-Service and E-Entertainment (ICEEE), Beijing Forestry University: Beijing: 1-4.

Joinson, A. (1999) Social Desirability, Anonymity, and Internet-Based Questionnaires. Behaviour Research Methods, Instruments, & Computers, 31(3): 433-438.

Jnawali, S. Wegge, P. (1993), Space and Habitat Use by a Small Re-introduced Population of Greater One-horned Rhinoceros (Rhinoceros unicornis) in Royal Bardia National Park in Nepal: a preliminary report. In: Ryder, O. (ed) Proceedings of an International Conference on Rhinoceros Biology and Conservation, Zoological Society of San Diego: San Diego: 208-17.

Jones, L. Boyd, E. (2011) Exploring Social Barriers to Adaptation: insights from western Nepal. Global Environmental Change, 21: 1261-1274.

Johnson, D. Ambrose, S. Bassett, T. Bowen, M. Crummey, D. Isaacson, J. Johnson, D. Lamb, P. Saul, M. Winter-Nelson, A. (1997) Meanings of Environmental Terms. Journal of Environmental Quality (26): 581–589.

Judson, A. (1991) Changing Behaviour in Organizations: minimizing resistance to change. Blackwell: Oxford.

Karmacharya, J. (2010) Exploring Daily Rainfall Data to Investigate Evidence of Climate Change in the Kathmandu Valley and its Implication in Rice Farming in the Area. Department of Meteorology and Hydrology, Government of Nepal: Kathmandu.

Keith, D. Martin, T. McDonald-Madden, E. Walters, C. (2011) Uncertainty and Adaptive Management for Biodiversity Conservation. Biological Conservation, 144(4): 1175-8.

Khan, M. (2001) Resistance to Administrative Reforms in South Asian Civil Bureaucracies. In: Farazmand, A. (ed.) Administrative Reform in Developing Nations. Praeger Publishers Inc: Connecticut: 73-89.

Kimura, T. (2005), Organisational learning in aid administration: rethinking its potential and limitations. PhD Thesis, University of East Anglia.

Kingston, C. Caballero, G. (2006) Comparing Theories of Institutional Change. Paper presented at the 2006 ISNIE Annual Meeting. Boulder: Colorado: 1-22.

Klein Tank, A. Zwiers, F. Zhang, X. (2009) Guidelines on Analysis of Extremes in a Changing Climate in Support of Informed Decisions for Adaptation. World Meteorological Organization, WMO-TD No. 1500: 1-53.

Kotter, J. (1995) Leading Change: why transformation efforts fail. Harvard Business Review, 73(2): 59-67.

Kundzewicz and Robson (2004) Change Detection in Hydrological Records: a review of the methodology. Hydrological Sciences Journal, 49(1): 7-19.

Kuruppu, N. Liverman, D. (2011) Mental Preparation for Climate Change Adaptation: the role of cognition and culture in enhancing adaptive capacity of water management in Kiribati. Global Environmental Change, 21: 657-669.

Lewin, K. (1947) Frontiers in Group Dynamics: concept, method and reality in social science; social equilibria and social change. Human Relations, 1: 5-41.

Leys, A. Vanclay, J. (2011) Social Learning: a knowledge and capacity building approach for adaptive comanagement of contested landscapes. Land Use Policy, 28: 574-584.

Linacre, E. (1992) Climate, Data and Resources: a reference and guide. Routledge, London.

Linnenluecke, M. Griffiths, A. Winn, M. (2012) Extreme Weather Events and the Critical Importance of Anticipatory Adaptation and Organisational Resilience in Responding to Impacts. Business Strategy and the Environment, 21: 17-32.

Löf, A. (2010) Exploring Adaptability through Learning Layers and Learning Loops. Environmental Education Research, 16(5-6): 529-43.

Low, N. Gleeson, B. Rush, E. (2005) A Multivalent Conception of Path Dependence: the case of transport planning in metropolitan Melbourne, Australia. Environmental Sciences, 2(4): 391-408.

Locke, P. (2011) The Ethnography of Captive Elephant Management in Nepal: a synopsis. Gajah, 34: 32-40.

Lundmark, C. Matti, S. Sandström, A. (2014) Adaptive Co-Management: how social networks, deliberation and learning affect legitimacy in carnivore management. European Journal of Wildlife Research, 60: 637-44.

Maharjan, S. Sigdel, E. Sthapit, B. Regmi, B. (2011) Tharu Community's Perception on Climate Changes and their Adaptive Initiations to Withstand its Impacts in Western Terai of Nepal. International NGO Journal, 6(2): 35-42.

Malla, Y. (2000) Impact of Community Forestry Policy on Rural Livelihoods and Food Security in Nepal. Unasylva, 51(3): 37-45.

Malleson, R. (2002) Changing Perspectives on Forests, People and 'Development': reflections on the case of the Korup Forest. IDS Bulletin, 33(1): 94-100.

Manandhar, S. Vogt, D. Perret, S. Kazama, S. (2011) Adapting Cropping Systems to Climate Change in Nepal: a cross regional study of farmer's perceptions and practices. Regional Environmental Change, 11: 335-348.

Maplecroft. (2010) Big Economies of the Future: Bangladesh, India, Philippines, Vietnam and Pakistan - most at risk from climate change. www.maplecroft.com/about/news/ccvi.html (accessed 10th June 2012).

Margules, C. Pressey, R. (2000) Systematic Conservation Planning. Nature, 405: 243-253.

Mawdsley, J. (2011) Design of Conservation Strategies for Climate Adaptation. WIREs Climate Change, 2: 498-515.

Meffe, G. (1998) Conservation Scientists and the Policy Process. Conservation Biology, 12(4): 741-742.

Miles, M. Huberman, A. (1994) Qualitative Data Analysis: an expanded sourcebook. Sage: London.

Milliken, F. Wolfe Morrison, E. (2003) Shades of Silence: emerging themes and future directions for research on silence in organisations. Journal of Management Studies, 40(6): 1563-1568.

Milman, A. Bunclark, L. Conway, D. Adger, W. (2012) Adaptive Capacity of Transboundary Basins in the Mediterranean, Middle East and the Sahel. Tyndall Working Paper, 151: 4-8.

Ministry of Environment/GoN. (2010) Climate Change Vulnerability Mapping for Nepal. Government of Nepal: Kathmandu.

Ministry of Environment/GoN. (2011) Climate Change Policy Unofficial Translation. www.moenv.gov.np/newwebsite/moe_admin/download/CC%2520Policy%2520Final%2520English%2520030311.doc (accessed 4/10/2012).

Moorman, R. Podsakoff, P. (1992) A Meta-Analytic Review and Empirical Test of the Potential Confounding Effects of Social Desirability Response Sets in Organizational Behaviour Research. Journal of Occupational and Organizational Psychology, 65: 131-149.

Morecroft, M. (2012) Adapting Conservation to a Changing Climate. Journal of Applied Ecology, 49: 546.

Morecroft, M. Crick, H. Duffield, S. MacGregor, N. (2012) Resilience to Climate Change: translating principles into practice. Journal of Applied Ecology, 49: 547-51.

Moser, S. Kasperson, R. Yohe, G. Agyeman, J. (2008) Adaptation to Climate Change in the North East United States: opportunities, processes, constraints. Mitigation and Adaptation Strategies for Global Change, 13: 643-659.

Munck af Rosenschöld, J. Rozema, J. Frye-Levine, L. (2014) Institutional Inertia and Climate Change: a review of the new institutionalist literature. WIREs Climate Change, 5: 639-648.

Munroe, R. Roe, D. Doswald, N. Spencer, T. Möller, I. Vira, B. Reid, H. Kontoleon, A. Giuliani, A. Castelli, I. Stephens, J. (2012) Review of the Evidence Base for Ecosystem-based Approaches for Adaptation to Climate Change. Environmental Evidence, 13(1): 1-11.

Murphy, M. Oli, K.Gorzula S. (2005) Conservation in Conflict: the impact of the Maoist-Government conflict on conservation and biodiversity in Nepal. International Institute for Sustainable Development: Winnipeg.

Myers, N. Mittermeier, R. Mittermeier, C. da Fonseca, G. Kent, J. (2000) Biodiversity Hotspots for Conservation Priorities. Nature, 403: 853-8.

Naughton-Treves, L. Holland, M. Brandon, K. (2005) The Role of Protected Areas in Conserving Biodiversity and Sustaining Local Livelihoods. Annual Review of Environmental Resources, 30: 219-52.

North, D. (1990) Institutions, Institutional Change and Economic Performance. Cambridge University Press: Cambridge.

Oli, K. (1996) Legal Instruments for Sustainable Environmental Management in Nepal. Environment and History, 2(2): 231–48.

Orwa, C. Mutua, A. Kindt, R. Jamnadass, R. Anthony, S. (2009) Agroforestree Database: a tree reference and selection guide version 4.0. World Agroforestry Centre Database: http://www.worldagroforestry.org/resources/databases/agroforestree (accessed 11/11/13).

Osbahr, H. Dorward, P. Stern, R. Cooper, S. (2011) Supporting Agricultural Innovation in Uganda to Respond to Climate Risk: linking climate change vulnerability with farmer perceptions. Experimental Agriculture, 47(2): 293-316.

Pahl-Wostl, C. (2009) A Conceptual Framework for Analysing Adaptive Capacity and Multi-level Learning Processes in Governance Resource Regimes. Global Environmental Change, 19(3): 354-365.

Pandey, V. Babel, M. Shrestha, S. Kazama, F. (2011) A Framework to Assess Adaptive Capacity of the Water Resource System in Nepalese River Basins. Ecological Indicators, 11: 480-488.

Pant, D. Allinson, C. Hayes, J. (1996) Transferring the Western Model of Project Organisation to a Bureaucratic Culture: the case of Nepal. International Journal of Project Management, 14(1): 53-57.

Parmesan, C. Yohe, G. (2003) A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems. Nature, 241: 37-42.

Peet, N. Watkinson, A. Bell, D. Brown, K. (eds) (1997a) The Management of Tall Grasslands for the Conservation of Biodiversity and Sustainable Utilisation: scientific management report. Department of National Parks and Wildlife Conservation, Government of Nepal: Kathmandu.

Peet, N. Watkinson, A. Bell, D. Brown, K. (eds) (1997b) The Management of Tall Grasslands for the Conservation of Biodiversity and Sustainable Utilisation: final report. Department of National Parks and Wildlife Conservation, Government of Nepal: Kathmandu.

Peet, N. Watkinson, A. Bell, D. Sharma, U. (1999) The Conservation Management of *Imperata Cylindrica* Grassland in Nepal with Fire and Cutting: an experimental approach. Journal of Applied Ecology, 36: 374-387.

Pelling, M. High, C. Dearing, J. Smith, D. (2008) Shadow Spaces for Social Learning: a relational understanding of adaptive capacity to climate change in organisations. Environment and Planning A, 40: 867-884.

Persha, L. Fischer, H. Chhatre, A. Agrawal, A. Benson, C. (2010) Biodiversity Conservation and Livelihoods in Human-Dominated Landscapes: forest commons in South Asia. Biological Conservation, 143: 2918-2925.

Pettorelli, N. (2012) Climate Change as a Main Driver of Ecological Research. Journal of Applied Ecology, 49(3): 542-545.

Pimm, S. Russell, G. Gittleman, J. Broks, T. (1995) The Future of Biodiversity. Science, 269: 347-50.

Plowman, P. (2000) Organisational Change from Two Perspectives: gender and organisational development. Development in Practice, 10(2): 189-203.

Pokharel, T. Ojha, G. (2006) The End of the War: Government, Maoists sign peace agreement. The Kathmandu Post 23/11/06. http://www.ekantipur.com/the-kathmandu-post/2006/11/22/top-story/the-end-of-the-war/92177.html (accessed 18/12/2014).

Prasad, O. (1996) Proceedings of the Fourth International Conference on Environmental Compliance and Enforcement Volume 2, Special Topic Workshop O: Enforcing Domestic Programs Implementing International Agreements. http://www.inece.org/4thvol2/oli.pdf (accessed 18/12/2014).

Prell, C. Hubacek, K. Reed, M. (2009) Stakeholder Analysis and Social Network Analysis in Natural Resource Management. Society and Natural Resources, 22: 501–518

Prell, C. Reed, M. Hubacek, K. (2011) Chapter Five Social Network Analysis for Stakeholder Selection and the Links to Social Learning and Adaptive Co-Management. In: Bodin, Ö. Prell, C. (eds.) Social Networks and Natural Resource Management: uncovering the social fabric of environmental governance. Cambridge University Press: Cambridge: 95-118.

Preskill, H. Torres, R. (2009) Appendix A The Readiness for Organizational Learning and Evaluation Instrument (ROLE). In: Preskill, H. and Russ-Eft, D. (eds.) Evaluation in Organizations. Basic Books: New York: 491-505.

Pretty, J. Ward, H. (2001) Social Capital and the Environment. World Development, 29(2): 209-227.

Pringle, P. Conway, D. (2012) Voices from the Frontline: the role of community-generated information in delivering climate adaptation and development objectives at project level. Climate and Development, 4(2): 104-113.

Ramazanoglu, C. and Holland, J. (2002) Feminist Methodology: challenges and choices. Sage Publications: London.

Randall, D. Fernandes, M. (1991) The Social Desirability Response Bias in Ethics Research. Journal of Business Ethics, 10: 805—817.

Rands, M. Adams, W. Bennun, L. Butchart, S. Clements, A. Coomes, D. Entwistle, A. Hodge, I. Kapos, V. Scharlemann, J. Sutherland, W. Vira, B. (2010) Biodiversity Conservation: challenges beyond 2010. Science, 392: 1298-1303.

Rapley, T. (2001) The Art(fullness) of Open-ended Interviewing: some considerations on analysing interviews. Qualitative Research, 1: 302-323.

Reed, M. Graves, A. Dandd N. Posthumus, H. Hubacek, K. Morris, J. Prell, C. Quinn, C. Stringer, L. (2009) Who's in and Why? A typology of stakeholder analysis methods for natural resource management. Journal of Environmental Management, 90(5): 1933-49.

Redford, K. Sanderson, S. (2000) Extracting Humans from Nature. Conservation Biology, 14(5): 1362-4.

Redpath, S. Young, J. Evely, A. Adams, W. Sutherland, W. Whitehouse, A. Amar, A. Lambert, R. Linnell, J. Watt, A. Gutiérrez, R. (2012) Understanding and Managing Conservation Conflicts. Trends in Ecology and Evolution, 28(2): 100-109.

Reed, M. Graves, A. Dandy, N. Posthumus, H. Hubacek, K. Morris, J. Prell, C. Quinn, C. Strniger, L. (2009) Who's in and Why? A typology of stakeholder analysis methods for natural resource management. Jounral of Environmental Management, 90(5): 1933-1949.

Reid, H. Swiderska, K. (2008) Biodiversity, Climate Change and Poverty: exploring the links. IIED Briefing, International Institute for Environment and Development: London.

Risbey, J. Kandlikar, M. Dowlatabadi, H. and Graetz, D. (1999) Scale, Context and Decision Making in Agricultural Adaptation to Climate Variability and Change. Mitigation and Adaptation Strategies for Global Change, 4: 137-165.

Rist, L. Campbell, B. Frost, P. (2012) Adaptive Management: where we are now. Environmental Conservation, 40(1): 5-18.

Rockman, B. (2014) Bureaucracy in: Encyclopaedia Britannica, online http://www.britannica.com/EBchecked/topic/84999/bureaucracy (accessed 23/09/2014).

Rockström, J. Steffen, W. Noone, K. Persson, Å. Chapin, F. Lambin, E. Lenton, T. Scheffer, M. Folke, C. Schellnhuber, H. Nykvist, B. de Wit, C. Hughes, T. van der Leeuw, S. Rodhe, H. Sörlin, S. Snyder, P. Costanza, R. Svedin, U. Falkenmark, M. Karlberg, L. Corell, R. Fabry, V. Hansen, J. Walker, B. Liverman, D. Richardson, K. Crutzen, P. Foley, J. (2009) A Safe Operating Space for Humanity. Nature 461: 472-475.

Roulston, K. de Marrais, K. Lewis, J. (2003) Learning to Interview in the Social Sciences. Qualitative Enquiry, 9: 643-68.

Runhaar, H. Mees, H. Wardekker, A. Van der Sluijs, J. Driessen, P. (2012) Adaptation to Climate Change-related Risks in Dutch Urban Areas: stimuli and barriers. Regional Environmental Change, 12(4): 777-790.

Salafsky, N. Wollenburg, E. (2000) Linking Livelihoods and Conservation: a conceptual framework and scale for assessing the integration of human needs and biodiversity. World Development, 28(8): 1421-1438.

Schensul, J. (2008) Methodology. In: Given, L. (ed.) The SAGE Encyclopaedia of Qualitative Research Methods. SAGE Publications: London: 516-521.

Schmidt-Soltau, K. (2005) Is forced Displacement Acceptable in Conservation Projects? ID21 Insights, 57: 3.

Secretariat of the Convention on Biological Diversity (2014) Global Biodiversity Outlook 4. Montréal, 155 pages. http://www.cbd.int/gbo/gbo4/publication/gbo4-en-lr.pdf (accessed 9/01/2015).

Senge, P. (2006) The Fifth Discipline: the art and practice of the learning organisation. Random House: London.

Sherwood, S. Bony, S. Dufresne, J. (2014) Spread in Model Climate Sensitivity Traced to Atmospheric Convective Mixing. Nature, 505: 37–42.

Shrestha, S. (2007) Non-governmental Organisations in Nepal: reaching the poor. Unpublished PhD Thesis, The University of East Anglia.

Shultz, L. Lundholm, C. (2010) Learning for Resilience? Exploring learning opportunities in biosphere reserves. Environmental Education Research, 16(5-6): 645-663.

Sill, M. Kirkby, J. (1991) Atlas of Nepal in the Modern World. Earthscan: Oxford.

Singh, P. Singh, V. Skutsch, M. (2010) Rapid Warming in the Himalayas: ecosystem responses and development options. Climate and Development, 2(3): 221-232.

Smit, B. Wandel, J. (2006) Adaptation, Adaptive Capacity and Vulnerability. Global Environmental Change, 16: 282-292.

Smith, B. Braulik, G. (2008) *Platanista Gangetica*. In: IUCN (ed.) IUCN Red List of Threatened Species. Version 2010.4. www.iucnredlist.org (accessed 11/11/2013).

Spector, P. (1987) Method Variance as an Artifact in Self-Reported Affect and Perceptions at Work: myth or significant problem? Journal of Applied Psychology, 72: 438–443.

Spector, P. (1994) Using Self-Report Questionnaires in OB Research: a comment on the use of a controversial method. Journal of Organizational Behaviour, 15: 385–392.

Springate-Baginski, O. Blaikie, P. (2007) Chapter One Annexation, Struggle and Response: forest, people and power in India and Nepal. In: Springate-Baginski, O. Blaikie, P. (eds.) Forests, people and power: the political ecology of reform in South Asia. Earthscan: London: 25-61.

Srivastava, A. Thomson, S. (2006) Framework Analysis: a qualitative methodology for applied policy research. JOAAG, 4(2): 71-79.

Stafford-Smith, M. Horrocks, L. Harvey, A. Hamilton, C. (2011) Rethinking Adaptation for a 4°C World. Philosophical Transactions of the Royal Society A, 369: 196-216.

Storbjörk, S. (2010) It Takes More to get a Ship to Change Course: barriers for organisational learning and local climate adaptation in Sweden. Journal of Environmental Policy and Planning, 12(3): 235-254.

Strichman, N. (2005) Adaptive Capacity in Israeli Social Change NonProfits. Unpublished PhD Thesis, University of Pittsburgh.

Sullivan, S. Brockington, D. (2004) Qualitative Methods in Global Studies: or, saying something about the world without counting or inventing it. CSGR Working Paper, 139(4): 1-29.

Sutherland, W. Adams, W. Aronson, R. Aveling, R. Blackburn, M. Broad, S. Ceballos, G. Cote, I. Cowling, R. Da Fonseca, G. Dinerstein, E. Ferraro, P. Fleishman, E. Gascon, C. Hunter, M. Hutton, J. Kareiva, P. Kuria, A. M et al. (2010) One Hundred Questions of Importance to the Conservation of Global Biological Biversity. Conservation Biology, 23: 557–67.

Taylor, S. Kumar, L. Reid, N. Kriticos, D.J. (2012) Climate Change and the Potential Distribution of an Invasive Shrub, Lantana Camara. PLoS ONE, 7(4): e35565. doi:10.1371/journal.pone.0035565.

Taylor-Powell, E. Renner, M. (2003) Analysing Qualitative Data. Programme Development & Evaluation, University of Wisconsin-Extension Cooperative Extension: Wisconsin: 1-12.

Tellis, W. (1997) Application of a Case Study Methodology. The Qualitative Report, 3(3): http://www.nova.edu/ssss/QR/QR3-3/tellis2.html (accessed 16/04/2012).

Tengo, A. Von Helland, J. (2012) Chapter Three Adaptive Capacity of Local Indigenous Institutions: the case of the taboo forests of southern Madagascar. In: Boyd, E. Folke, C. (eds.) Adapting Institutions: governance, complexity and socio-ecological resilience. Cambridge University Press: Cambridge: 37-75.

Terai Arc Landscape, (2011) A Field Report of Newly Established Bufferzone of Bardia National Park (Chinchhu, Lakhparajul, Hariharpur and Taranga-Siddhachhuli BZUC). Unpublished.

Thapa, B. (2013) National Parks of Nepal. http://zonesagarmatha.blogspot.co.uk/2013/09/national-parks-of-nepal.htmlhttp://zonesagarmatha.blogspot.co.uk/2013/09/national-parks-of-nepal.html (accessed 18/12/2013).

Thapa, S. (2008) Social-ecological Resilience and the Institutions in Protected Areas: a case study of three villages at Bardia National Park. Unpublished PhD Thesis, the University of Sussex.

Thapa, S. Marshall, F. Stagl, S. (2010) Understanding Peri-urban Sustainability: the role of the resilience approach. Working Paper 38, STEPS Centre: Brighton.

Thapa, S. Hubacek, K. (2011) Drivers of Illegal Resource Extraction: analysis of socio-economic factors affecting resource extraction at Bardia National Park, Nepal. Journal of Environmental Management 92(1): 156-164.

Tompkins, E. Adger, W. Boyd, E. Nicholson-Cole, S. Weatherhead, K. Arnell, N. (2010) Observing Adaptation to Climate Change: UK evidence of transition to a well adapted society. Global Environmental Change, 20: 627-635.

Tompkins, E. Eakin, H. (2012) Managing Private and Public Adaptation to Climate Change. Global Environmental Change, 22: 3-11.

Thompson, E. Phua, F. (2005) Reliability Among Senior Managers of the Marlowe-Crowne Short-Form Social Desirability Scale. Journal of Business and Psychology, 19(4): 541-554.

Tosey, P. Visser, M. Saunders, M. (2011) The Origins and Conceptualisations of Triple-loop Learning: a critical review. Management Learning 43(3): 291-307.

United Nations (2012) Bonded Labour. UN Nepal Information Platform: http://www.un.org.np/oneun/bondedlabour (last accessed 30/10/2014).

UNFCCC (1992) Full Text of the United Nations Framework Convention on Climate Change, http://unfccc.int/essential_background/convention/background/items/1350.php (accessed 2/09/2014).

Van de Ven, A. Poole, M. (2005) Alternative Approaches for Organizational Change. Organization Studies, 26(9): 1377-1404.

Vincent, K. (2007) Uncertainty in Adaptive Capacity and the Importance of Scale. Global Environmental Change, 17(1): 12-24.

Vogel, C. Moser, S. Kasperson, R. Dabelko, G. (2007) Linking Vulnerability, Adaptation and Resilience Science to Practice: pathways, players and partnerships. Global Environmental Change, 17(3-4): 349-364.

Walker, B. Carpenter, S. Andieres, J. Abel, N. Cumming, G. Janssen, M. Lebel, L. Norberg, J. Peterson, G. Pritchard, R. (2002) Resilience Management in Social-ecological Systems: a working hypothesis for a participatory approach. Conservation Ecology, 6(1): 14.

Walker, B. Holling, C. Carpenter, S. Kinzig, A. (2004) Resilience, Adaptability and Transformability in Social-Ecological Systems. Ecology and Society, 9(2): 5.

Watkins, K. Marsick, V. (1999) Dimensions of the Learning Organization Questionnaire (DLOQ). http://www.partnersforlearning.com/instructions.html (accessed 11/10/2013).

Weber, M. (1947) The Theory of Social and Economic Organisation. The Free Press: New York. Translated by Henderson, A. and Parsons, T.

Westgate, M. Likens, G. Lindenmayer, D. (2013) Adaptive Management of Biological Systems: a review. Biological Conservation, 158: 128-39.

Wilby, R. Vaughan, K. (2010) Hallmarks of Organisations that are Adapting to Climate Change. Water and Environment Journal, 25: 271-281.

Williams, B. (2011a) Adaptive Management of Natural Resources: framework and issues. Journal of Environmental Management, 92(5): 1346-1353.

Williams, B. (2011b) Passive and Active Adaptive Management: approaches and an example. Journal of Environmental Management, 92(5): 1371-1378.

Winn, M. Kirchgeorg, M. Griffiths, A. Linnenluecke, M. Gunther, E. (2011) Impacts from Climate Change on Organisations: a conceptual foundation. Business Strategy and the Environment, 20: 157-173.

World Bank. (2014) World Development Indicators: rural environment and land use. http://wdi.worldbank.org/table/3.1 (accessed 02/10/2014).

World Meteorological Organisation. (2007) International Workshop on Climate and Land Degradation: final report. World Meteorological Organisation: http://www.wmo.int/pages/prog/wcp/agm/meetings/wocald06/documents/wocald_meeting_report.pdf (accessed 02/01/2012).

World Meteorological Organisation. (2011) Guide to Climatological Practices WMO-No. 100. World Meteorological Organisation: Geneva.

WWF Nepal. (2012) Conservation Past, Present and Future. Unpublished presentation slides.

WWF Nepal. (2013) A Win for Tigers in Nepal. http://worldwildlife.org/stories/a-win-for-tigers-in-nepal (accessed 29/07/2013).

Yang, W. (2013) Performance and Prospects of Payments for Ecosystem Services Programs: evidence from China. Journal of Environmental Management, 127: 86 -95.

Yin, R. (2009) Case Study Research: design and methods (4th edition). Sage Publications: London.

Yohe, G. Tol, R. (2002) Indicators for Social and Economic Coping Capacity — moving toward a working definition of adaptive capacity. Global Environmental Change, 12: 25-40.

Young, O. (2011) Effectiveness of International Environmental Regimes: existing knowledge, cutting edge themes, and research strategies. Proceedings of the National Academy of Sciences, 108(50): 19853-19860.

Young, O. Berkhout, F. Gallopin, G. Janssen, M. Ostrom, E. Van der Leeuw, S. The Globalisation of Socio-ecological Systems: an agenda for scientific research. Global Environmental Change, 16: 304-316.

Zafarullah, H. Huque, A. (2007) Public Management in South Asia: dimensions and directions of change. International Journal of Public Administration, 21(10): 1473-1510.

Zeleňáková, M. Purez, P. Solàková, T. Demeterová, B. (2012) Analysis of Trends of Low Flow in River Stations in Eastern Slovakia. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 60(5): 265-273.

Appendix 3

3.1 Focus Group Introductory Script

Hello and thanks for staying behind, I know that you are all very busy and I really appreciate you sparing the time to be here.

My name is Simon Mercer and I will be the facilitator for today's discussion. As some of you may know, I am a PhD student from the University of East Anglia in the UK and my PhD research is concerned with understanding how conservation organisations in Nepal are able to respond to the challenge of climate change. The focus of my study is the Bardiya National Park which is a particularly relevant area to examine these issues of conservation and climate change as it protects a high number of endangered species in an area that is extremely sensitive to climate change. This is RC and he will be the translator for this focus group.

In today's discussion I am hoping to find out more about the challenges/factors that make conservation organisations change the ways in which they operate. I am also keen to get your thoughts on the aspects of your organisation which help you to address these new challenges, as well as the things that may make it difficult to respond to these challenges.

As staff of the National Park you are all experts on the park, the challenges it faces, and how it is run. I hope that you will relax and enjoy the discussion and will take this opportunity to express your opinions honestly and openly. This meeting should take no more than one hour, and I will introduce a number of topics for discussion.

The issues that are discussed today will be recorded so that we don't miss anything important, but everything that is said will be treated as private and confidential and will not be discussed with anyone apart from my PhD supervisors. No one will be identified by name in my final paper; all participants will remain anonymous.

To make sure that this focus group runs as smoothly as possible and that everyone gets a chance to have their say I would appreciate it if you all stick to the following guidelines.

- Only one person should talk at a time. You may not agree with their opinion but it is important that you listen respectfully to it, as they will to yours.
- As I have said we are recording this Focus Group, but everything that is said here will remain confidential and no names will be attributed to any of the comments. 'What we share in this room stays in this room.'
- It is important for us to hear everyone's ideas and opinions; we want you to do the talking. There are no right or wrong answers to any of these questions, only different points of view and it's important that you speak up whether you agree or disagree.
- It is important that we here all of your opinions either positive or negative. Often negative opinions are even more valuable then positive ones.
- It is important that we all respect each other's opinions, and that everyone's ideas are equally represented.

3.2 Likert Questionnaire

Introduction

This questionnaire forms part of my PhD research, which is concerned with understanding how conservation organisations in Nepal are able to respond to the challenge of climate change. The focus of my study is the Bardiya National Park which is a particularly relevant area to examine these issues of conservation and climate change as it protects a high number of endangered species in an area that is extremely vulnerable to climate change.

Questionnaire Goals

This part of my research involves a study of organisational planning, culture, and learning, as it relates to adaptive capacity. Your responses to the questions in this survey will be analysed and used to improve understandings of the factors that enable and constrain organisational adaptation to change, and in particular to climate change.

Consent

This questionnaire is anonymous so you do not need to include your name. Responses to this survey will be treated as private and confidential and will not be discussed with anyone apart from my supervisors.

Participation in this questionnaire is completely voluntary and you are free to withdraw your participation at any point up to the conclusion of my research 1st April 2013. I can be contacted by phone on 980 383 0141 and will be happy to discuss any additional thoughts or concerns that you may have regarding this research. You are also free to discuss any concerns with the supervisor of this project by email (Professor Declan Conway; d.conway@uea.ac.uk).

Instructions

Thank you for taking the time to complete this questionnaire which should take no longer than 30 minutes. The questionnaire is divided into 13 sections according to theme and in each section you will see a number of statements relating to your organisation. For each statement please circle the option that best fits with the preceding statement. For example, if you 'strongly agree' with the statement below you should circle or underline '5'.

Example:

"I really feel that my job makes a difference in people's lives"

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

The only exception to this is question two where instead of selecting the relevant option, please complete the sentence in the blank space provided.

Section 1 – Organisational Culture

1 – The goal of our organisation is clear and shared by all staff.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – Please complete the following sentence:

The goal of our organisation is:

_____
_____
_____
_____

3 – Staff know how their work contributes to the organisation's overall goal.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – Information about changes in my organisation's goal are effectively spread throughout the organisation by its management.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

5 – The high level leadership in my organisation show a willingness to listen to alternative points of view.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

6 – The leaders of my organisation make important decisions and take decisive action when required.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

7 – Being open to change is viewed positively in this organisation.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

8 – Most attempts to change important things in my organisation are met with resistance.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

9 – Feedback from staff in our organisation often leads to changes in the way the organisation operates.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

10 – In my organisation open discussion is encouraged as a means of overcoming areas of disagreement.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

11 – Any practice or procedure in my organisation can be challenged regardless of how long it has been in place.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

12 – People are encouraged to contribute their opinion on matters regardless of rank.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 2 – Organisational Planning

1 – I have a clear understanding of my organisation's internal policies and how they relate to my work and duties.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – My organisation sets clear targets which are communicated effectively to all staff.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – My organisation is focused on addressing current challenges and does not have time for longer term planning.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – My organisation is actively planning for the future and considers the potential implications of future changes in its external environment.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

5 – In my organisation staff understand how their work relates to the overall goal of the organisation.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 3 – Knowledge Exchange

1 – In my organisation new ideas come from all levels of the organisation.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – My organisation provides opportunities for staff to work together and to share their knowledge.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – Opinions of all staff are regularly sought and action taken based on their recommendations.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – In my organisation we have productive discussions about new ideas and challenges facing our organisation.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

5 – In my organisation the leadership provide formal opportunities for us to share knowledge.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

6 – In my organisation informal sharing of knowledge and ideas is more common than knowledge exchange through formal channels.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 4 – Education and Training

1 – My organisation provides opportunities for formal technical training to all staff that require it.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – My organisation provides access to technical information to all staff when they require it.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – When faced with new challenges my organisation implements awareness raising activities to ensure staff are aware of these challenges and how they may best be addressed.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 5 – Human Resources (including staff recruitment and management issues)

1 – My organisation identifies potential future Human Resource gaps in advance and ensures that they are filled before problems arise.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – My organisation currently has enough staff to effectively achieve its aims.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – People in my organisation often have to fill multiple roles to make up for the lack of adequate staff numbers.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – People in my organisation often work in roles for which they are not suitably trained.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 6 – Perceived Adaptive Capacity (ability of my organisation to respond to change)

1 – My organisation lacks the ability to respond to sudden changes and shocks in its external environment.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – My organisation has the capacity to successfully achieve its aims when faced with new challenges.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – In the past (during e.g. of a specific change event) my organisation was able to respond effectively whilst continuing to achieve its overarching goals.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 7 – Assessment of Progress

1 – My organisation regularly monitors and evaluates its performance against its objectives.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – In my organisation, assessment of performance is seen as a threat to 'business as usual.'

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 - Currently available information tells us all that we need to know about the effectiveness of our programs.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 - In my organization, the staff continually ask themselves how they're doing, what they can do better, and what is working.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 8 – Economic Context

1 – My organisation has the financial resources that it requires to effectively achieve its aims.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – Lack of adequate access to financial resources limits the effectiveness of my organisation.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – Financial contributions from non-governmental organisations are vital in ensuring the successful running of the park.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – When faced with new challenges [e.g. of a specific event] my organisation has the financial resources to effectively address these issues.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

6 – My organisation has to effectively prioritise its key aims as a lack of access to financial resources means that not all issues can be addressed.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 9 – Infrastructure Context

1 – My organisation has the required infrastructure (including roads, buildings, military bases, telecommunications and water management systems) to successfully achieve its aims.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – My organisation cannot effectively achieve its aims due to a lack of appropriate infrastructure.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – Tourism infrastructure in the park Buffer Zone (including access roads, bridges, lodges and guest houses) has a positive impact on my organisation's ability to achieve its aims.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – When faced with new challenges (for example key change events) existing park infrastructure helps my organisation to continue to operate effectively.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 10 – Institutional Context

1 – My organisation is able to operate independently of formal government rules and regulations.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – The activities of my organisation are strictly limited by formal government rules and regulations which dictate how park management must be undertaken.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – My organisation is able to effectively lobby for changes in the rules and regulations governing the operations of the park.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – My organisation is able to resist those rules and regulations which are felt not to contribute the effective running of the park.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

5 – When faced with new challenges (e.g. of change event) formal government rules and regulations limit the ability of my organisation to respond quickly and effectively.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

6 – When faced with new challenges (e.g. of change event) formal government rules and regulations are flexible enough to allow my organisation to address them quickly and effectively.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 11 – Technological Context

1 – My organisation has access to the latest technology (such as monitoring equipment or new fire control techniques) which helps it to achieve its aims.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – With better access to technology my organisation would be better able to perform its role effectively.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – Increased access to new crop varieties and technology such as biomass generators in the Buffer Zone, have reduced human pressures on park resources.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 12 – Ecological Context

1 – New challenges faced by my organisation have limited impact upon the natural environment within the park boundaries.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – The natural environment protected by the park is stable and able to resist social, economic, political and ecological disturbances.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – The natural environment protected by my organisation is fragile and vulnerable to social, economic, political and ecological disturbances.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – The natural environment protected by the park's buffer zone is stable and able to resist social, economic, political and ecological disturbances.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

5 – When faced with new challenges (e.g. of change event), the resilience of the park's natural environment helps to address these challenges.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

Section 13 – Social Context

1 – Feedback from external stakeholders often leads us to change our practices.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

2 – Opinions of our external stakeholders are regularly sought and action taken based on their recommendations.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3 – Informal channels and personal relationships are an important part of knowledge sharing with external organisations.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

4 – It is worthwhile working with other organisations as this allows us to achieve more than we could alone.

Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

5- When we review our policies and approaches we consult with other organisations working in our field. Strongly Agree (5) – Agree (4) – Neither Agree or Disagree (3) – Disagree (2) – Strongly Disagree (1)

3.3 Social Network Analysis Questionnaire

Introduction

This short survey forms part of my PhD research, which is concerned with understanding how conservation organisations in Nepal are able to respond to the challenge of climate change. The focus of my study is the Bardiya National Park which is a particularly relevant area to examine these issues of conservation and climate change as it protects a high number of endangered species in an area that is extremely vulnerable to climate change.

This part of my research involves a study of social networks. Your responses to the questions in this survey will be used to map the extent and relative strength of the links that your organisation has with other individuals and organisations around the National Park.

Survey Goals

The aim of this survey is to gain an understanding of the wider organisational environment around Bardiya and the key organisations with which your organisation interacts, to highlight these links and to examine their relative importance. A key focus of this process is on the formal and informal relationships through which knowledge of conservation and climate change issues is shared. This process will also allow me to identify other key stakeholders with whom I can then undertake further research.

Consent

The nature of this survey requires that you give me your name and position in your organisation. However, your responses to this survey will be treated as private and confidential and will not be discussed with anyone apart from my supervisors. Once I have collected enough data I will map the relationships using computer software. In these maps all names will be replaced by codes and your name and any information that could identify you will not be included in any of the papers that come out of this research.

Participation in this survey is completely voluntary and you are free to withdraw your participation at any point up to the conclusion of my research 1st April 2013. I can be contacted by phone on 980 383 0141 and will be happy to discuss any additional thoughts or concerns that you may have regarding this research. You are also free to discuss any concerns with the supervisor of this project by email (Professor Declan Conway; d.conway@uea.ac.uk).

Instructions

Thank you for taking the time to complete this short survey which should take no longer than 15 minutes. This survey has three parts and contains eight questions; please make sure you answer all of them. Questions one and two require you to answer in the blank space provided. Questions three to eight require that you fill in the table provided. Once you have completed this survey, please return it to Simon Mercer by email at s.mercer@uea.ac.uk, or place it in the collection point in the front office.

Part One – Connections with Other Organisations

Question 1

What is your name?

Question 2

What is your job title?

Question 3

Please list the names of up to 10 organisations with which you have contact/collaborate in your role at work. This includes face-to-face contact as well as contact by telephone and email. Please include the name of the organisation and the name of your main contact there.

	Name of Organisation	Name of Key Contact
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Question 4

Please rank the frequency of contact you have with each of the organisations you have listed above according to the following scale:

0 = Never

1 = Less than once a month

2 = Once or twice a month

3 = Once or twice a week

4 = Once a day

5 = More than once a day

	Name of Organisation	Frequency of Contact
1.	As above…	
2.	As above…	
3.	As above…	

4.	As above…	
5.	As above…	
6.	As above…	
7.	As above…	
8.	As above…	
9.	As above…	
10.	As above…	

Part Two – Connections within your Organisation

Question 5

List up to 10 key individuals within your organisation who you interact with in order to effectively fulfil your role.

	Name of Individual	**Job Title**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Question 6

Please rank the frequency of contact you have with each of the individuals you have listed above according to the following scale:

0 = Never

1 = Less than once a month

2 = Once or twice a month

3 = Once or twice a week

4 = Once a day

5 = More than once a day

	Name of Individual	**Frequency of Contact**
1.	As above…	
2.	As above…	
3.	As above…	
4.	As above…	
5.	As above…	
6.	As above…	
7.	As above…	
8.	As above…	
9.	As above…	
10.	As above…	

Part Three – Personal Connections

Question 7

Please list up to 10 individuals with whom you discuss technical work related issues, outside of your working day. Where possible please include details of the organisation in which they work.

	Name of Individual	Job Title / Organisation
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Question 8

Please rank the frequency of contact you have with each of the individuals you have listed above according to the following scale:

0 = Never

1 = Less than once a month

2 = Once or twice a month

3 = Once or twice a week

4 = Once a day

5 = More than once a day

	Name of Individual	Frequency of Contact
1.	As above	
2.	As above…	
3.	As above…	
4.	As above…	
5.	As above…	
6.	As above…	
7.	As above…	
8.	As above…	
9.	As above…	
10.	As above…	

3.4 Semi-structured Interview Guide for Park Staff

1 – What is the official goal of your organisation?

- Unofficial goal or your organisation?
- Is one part of your organisations goal more important than the other(s)?

2 – Think back over your time in this organisation. What are the key challenges which make it hard for your organisation to achieve its aims?

- Are they related to policy/ legislation/ people (migration/growth)/ international agendas/ market forces/ environmental change?
- Which do you feel are the most important?
- At the national level climate change issues are given increasingly high priority by the government, yet you do not mention it and it does not feature in official park documents, how do you reconcile this?

3 – Perceptions of climate change.

- How long have you lived in Bardiya and how long have you worked for the park?
- During this time have you observed any changes in climate?
- What has changed? (onset/duration/cessation)
- How has it changed? (amount/frequency/intensity/variability between years)
- How has this impacted upon the ability of your organisation to achieve its goals?

4 – How do you find out about new challenges to your organisation? (using their e.g.s)

- Through what processes are responses formulated and decisions made?

5 – What helps you to deal with these challenges? And what adaptations have been made?

6 – What makes it difficult for you to deal with these challenges?

7 – How does your organisation plan for the future, what challenges do you see coming up and how do you learn about them?

8 – How important are relationships with other organisations in addressing these challenges?

9 – How do your interactions with other people in your organisation influence your understanding of these challenges?

10 – How do your interactions with other organisations influence your understanding of these challenges?

3.5 Survey Questionnaire Guide

1 – What is your name?

2 – What is your occupation?

3 – How old are you and how long have you lived in this community?

4 – If you think back over your time here, have you noticed any changes in the weather between the recent past (less than 5 years ago) and 20 years ago?

- What has changed? (Rainfall / Temperature / Timing and Length of Seasons / Frequency of Extreme Events / Interannual Variability?)

- How has it changed? (Amount / Frequency / Intensity / Timing of Onset, Duration or Cessation?)

- How has this impacted upon the community, in particular the community's conservation efforts?

- What has been your response?

5 – Can you feed information about your knowledge and experiences of the changing climate, back to the park staff? If so, how?

6 – Have you heard about the challenge of climate change?

- If yes what was your source of information?

7 - What external support is available to help you to deal with these challenges? (Information and expertise, financial support etc)

3.6 Information Sheet and Consent Form

Information Sheet

My name is Simon Mercer and I am a PhD student from the University of East Anglia in the UK. I am doing research on conservation organisations and climate change adaptation, looking in particular at the case of the Bardia National Park in Nepal. Bardia is a very important place to study these issues because of the high number of endemic and endangered species protected by the park and the sensitivity of the area to increasing climate variability and change.

I would like to talk to you about the work of your organisation, and the wider climate change and conservation sector in Nepal, within which your organisation operates. The aim of this strand of my research is to gain some insight into how conservation and climate change issues are addressed at the national level in Nepal, and the implications that this has for local level conservation efforts.

Should you agree to volunteer for this research it will involve participation in a short interview. You are free to decide whether or not you would like to talk to me. If you do decide to take part you are free to stop the interview at any time, and you do not have to answer any questions that you do not want to.

Once the interview has taken place you are still free to withdraw from the research at any point until my research in concludes on 1st April 2013. I can be contacted by phone on 9803830141 and will be happy to discuss any additional thoughts or concerns that you may have regarding this research. You are also free to discuss any concerns with the supervisor of this project, Prof. Declan Conway, by email (d.conway@uea.ac.uk) or phone (01603 592337).

Everything that we talk about during the interviews will remain completely confidential and your name and any information that could identify you or your organisation will not be included in any papers that come out of this research. All of the information you give me in the interviews will be treated as private and confidential and will not be discussed with anyone apart from my supervisors.

Consent Form –Participant's copy

An Analysis of Organisational Adaptation to Climate Change: the case of the Bardia National Park.

I have read the background information sheet to the above research project and been informed of and understand the purposes of this study. I have been given the opportunity to ask questions and to have anything that I did not fully understand explained to me.

I understand that I can withdraw from this research at any time before the conclusion of the fieldwork and that any information which might potentially identify me will not be used in published material.

I ..... agree to participate in this study and agree/disagree to have the meetings digitally recorded.

Signature of respondent:

Date:

Signature of researcher:

Date:

Consent Form – Researcher's copy

An Analysis of Organisational Adaptation to Climate Change: the case of the Bardia National Park.

I have read the background information sheet to the above research project and been informed of and understand the purposes of this study. I have been given the opportunity to ask questions and to have anything that I did not fully understand explained to me.

I understand that I can withdraw from this research at any time before the conclusion of the fieldwork and that any information which might potentially identify me will not be used in published material.

I ..... agree to participate in this study and agree/disagree to have the meetings digitally recorded.

Signature of respondent:

Date:

Signature of researcher:

Date:

Appendix 4

4.1 Key Species Protected by the BNP

Mammals	Birds	Reptiles
Tiger (Panthera tigris) IUCN Red List: Endangered	Bengal florican (Houbaropsis bengalensis) IUCN Red List: Critically Endangered	Indian python (Python molurus) IUCN Red List: Near Threatened
Greater one horned rhino (Rhinoceros unicornis) IUCN Red List: Vulnerable	Great hornbill (Buceros bicornis) IUCN Red List: Near Threatened	Ghadiyal (Gavialis gangeticus) IUCN Red List: Critically Endangered
Asian Wild Elephant (Elephas maximus) IUCN Red List: Endangered	White throated bush chat (Saxicola insignis) IUCN Red List: Vulnerable	Yellow Monitor lizard (Varanas flavescens) IUCN Red List: Least Concern
Swamp Deer (Rucervus duvaucelii) IUCN Red List: Vulnerable	Bristled grassbird (Chaetornis striata) IUCN Red List: Vulnerable	
Pygmy Hog (Porcula salvania) IUCN Red List: Critically Endangered	Black-caped kingfisher (Halcyon pileata) IUCN Red List: Least Concern	
Four-Horned Antelope (Tetracerus quadricornis) IUCN Red List: Vulnerable	Swamp partridge (Francolinus gularis) IUCN Red List: Vulnerable	
Hispid Hare (Caprolagus hispidus) IUCN Red List: Endangered		
Gangetic Dolphin (Platanista gangetica) IUCN Red List: Endangered		
Striped Hyena (Hyaena hyaena) IUCN Red List: Near Threatened		
Indian Pangolin (Manis crassicaudata) IUCN Red List: Near Threatened		

Table A.4.1 Most Important Species Protected by the BNP DNPWC/GoN 2012 p.6.

4.2 Key Milestones in the Formation of the Bardiya National Park

Date	Event	Reference
1815	The area was taken by the East India company under the the Sugauli Treaty becoming part of British controlled India.	TAL 2011
1857	Bardia re annexed to Nepal as Naya Muluk (new territory) following negotiations between then Prime Minister Jung Bahadur Rana and British controlled India, as a result of Nepal's assistance in suppressing the Indian independence movement.	DNPWC/GoN. 2007, TAL 2011
1954	USAID funded programme of malaria eradication begins.	DNPWC/GoN. 2012
1960	WHO declare malaria eradicated and migration to Terai begins. Other components of this migration include: Nepali nationals residing in Burma returning back to the Terai; thousands of Nepali migrant labourers returning from North-East India following a land reform program.	HMG 2012
1967	Bardia declared as Royal Hunting Protected Forest, protected by an armed guard.	Thapa 2008
1968	FAO/UNDP conservation assessment project was launched.	Thapa 2008
1969	An area of 368km^2 designated a Royal Hunting Reserve; Bardiya NP declared a Royal Hunting Reserve with armed guards deployed for protection. This resulted in the relocation of a number of communities of recently migrated Hill people in Baghaura and Lamkauli outside the reserve boundaries. At this time access to the forest area was unrestricted and cattle were allowed to graze within the reserve boundaries.	Allendorf et al. 2007, DNPWC/GoN. 2007, TAL 2011, DNPWC/GoN. 2012
1971	Work began to prepare for the establishment of a Wildlife Reserve.	Thapa 2008
1972	Wildlife Reserve headquarters established at Thakurdwara.	Thapa 2008
1973	National Park and Wildlife Conservation Act 1950 came into force	Thapa 2008
1974	A Wildlife Reserve Warden was appointed.	Thapa 2008
1976	An area of area of 386km^2 was gazetted as the Royal Karnali Wildlife Reserve, resulting in forced relocation of around 1500 households from villages located in the Baghaura phanta and the Lamkauli Phanta.	TAL 2011, DNPWC/GoN. 2007, DNPWC/GoN. 2012
1982	Renamed Royal Bardiya Wildlife Reserve; the park was extended to the east to incorporate the Babai Valley and renamed Bardia Wildlife Reserve.	TAL 2011, DNPWC/GoN. 2007, DNPWC/GoN. 2012
1982-4	Approximately 9500 people relocated from Babai Valley and resettled in Tara Tal near Guluria.	DNPWC/GoN. 2012
1984	The area of the reserve was increased to include an additional part of the Babai valley, from Parewa odar to Chepang bridge increasing the total area of t the reserve to 968 Km2.	DNPWC/GoN. 2007, Thapa 2008, TAL 2011
1988	Bardia gazetted as a Royal Bardiya National Park, covering an area of 968km^2.	TAL 2011, DNPWC/GoN. 2012
1989	The King Mahendra Trust for Nature Conservation established a field office in Bardiya and the Bardiya Conservation Programme begun.	Thapa 2008
1990	Sections of the East-West highway construction through the BNP.	Thapa 2008
1995	Babai Irrigation Project, Bardia Integrated Conservation Project (WWF) and Parks People Programme (UNDP) were initiated	Thapa 2008, TAL 2011
1996	Bardiya National Park Regulation and Buffer Zone Management Regulation enacted	DNPWC/GoN. 2007
1997	The BZ was created covering an area of 327 km^2 around the core area of the park; Buffer Zone Development Project instigated.	TAL 2011
2006	The people's movement leads to another name change, to Bardiya National Park.	DNPWC/GoN. 2007
2010	An additional 180km^2 of BZ was created along the Northern boundary of the park.	TAL 2011

Table A.4.2 Key milestones in the formation of the BNP

4.3 Key Climate Change Acts, Regulations, and International Agreements

Act	Year	Regulation/Policy	Year
Aquatic Life Protection Act 2017	1960	National Park & Wildlife Conservation Rules 2030	1973
Plant Protection Act 2026	1969	Wildlife Reserve Rules 2034	1977
National Park and Wildlife Conservation Act 2029	1972	Buffer Zone Management Rules 2052	1995
NTNC Act 2039	1982	Bardiya National Park Rules 2053	1996
Forest Act 2049	1992	Buffer Zone Management Guidelines 2056	1999
Environment Protection Act 2053	1996	Conservation Area Rules (Govt. Managed) 2057	2000
		National Adaptation Programme of Action 2067	2010
		LAPA Framework 2068	2011
		Climate Change Policy	2011

International Agreement	Year	Ratified by Nepal
IUCN	1948	1974
CITES	1975	1975
UNESCO World Heritage	1972	1978
RAMSAR	1971	1987
Convention on Biological Diversity	1992	1993
Kyoto Protocol to the UNFCCC	1989	1994
UNFCCC	1992	1994
Convention to Combat Desertification	1994	1996
International Tropical Timber Agreement	1994	1997
Global Tiger Forum	1999	2002
Indigenous and Tribal Peoples Convention	1989	2007

Table A.4.3 National Climate Change and Conservation Relevant Acts, Regulations and International Agreements

4.4 Breakdown of BNPMA Staff Numbers by Position

Position	Number of Staff
Chief Warden	1
Assistant Warden	2
Ranger	7
Veterinarian	1
Legal Ranger	1
Accountant	1
Typist	1
Administrative Staff	5
Administrative Staff (temporary)	1
Driver	2
Senior Game Scout	11
Game Scout	60
	93

Table A.4.4a Number of HQ and Field Staff Employed by the BNPMA by position and Positions, Staff, (Annual report 2011/12)

Position	Number of Staff
Subba	1
Daroga	1
Raut	1
Phanit	10
Pachhuwa	10
Mahut	10
	33

Table A.4.4b Park Staff Stationed at the Elephant Stables from Annual report 2011/12

4.5 BNPMA Income

Year	2000-2001	2000-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Park Income (Nrps)	7,615,769	9,821,784	2,777,655	3,710,147	1,821,863	DNA	DNA	11,400,000	11,400,000	11,400,000	11,400,000	11,400,000
Park Income (£ approx)	47,500	61,000	17,000	23,100	11,400	DNA	DNA	71,000	71,000	71,000	71,000	71,000

Table A.4.5a BNPMA Revenue from Government Sources 2000/1 - 2011/12 (DNPWC/GoN 2007, DNPWC/GoN2012). NB 2007 onwards projected not receipted income.

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Protection & conservation of biodiversity	11,150,000	900,000	800,000	650,000	800,000	25,600,000	21,450,000	21,800,000	22,950,000	23,400,000
Terrestrial and aquatic habitat management	8,490,000	8,310,000	7,820,000	6,530,000	5,150,000	4,400,000	4,200,000	4,350,000	4,450,000	4,600,000
Eco- tourism management	168,000	878,000	118,000	118,000	18,000	3,650,000	2,450,000	2,600,000	2,650,000	2,850,000
Support to Buffer Zone Management	7,896,000	9,446,000	7,001,000	7,096,000	6,096,000	21,336,000	23,538,000	22,879,000	23,315,000	23,707,000
Research, M&E and Capacity Enhancement	32,933,000	37,711,000	23,348,000	30,642,000	27,099,000	4,100,000	4,300,000	4,650,000	4,800,000	2,100,000
Total budget (Nrps)	53,738,000	49,736,000	32,523,000	38,617,000	33,934,000	59,086,000	55,938,000	56,279,000	58,165,000	56,657,000
Total budget (£ approx)	£335,000	£310,000	£202,000	£241,000	£212,000	£368,000	£349,000	£351,000	£363,000	£353,000

Table A.4.5b Five Year Core Area Budget (DNPWC/GoN 2007, DNPWC/GoN2012).

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Conservation	11,238,454	11,878,098	12,848,409	14,063,049	15,174,655	5,348,000	5,988,000	5,536,000	5,556,000	5,691,000
Community Development	11,922,994	11,623,192	12,563,846	13,698,594	14,715,252	5,058,000	5,884,000	5,843,000	5,694,000	5,466,000
Income Generation	7,614,311	7,937,742	8,725,615	9,577,378	10,280,117	3,457,000	3,950,000	3,481,000	3,711,000	3,908,000
Conservation Education	3,616,150	3,668,364	4,032,801	4,397,680	5,248,548	1,993,000	1,866,000	1,853,000	1,902,000	1,867,000
Administration	3,477,444	3,611,588	3,904,147	4,249,061	4,641,567	1,730,000	1,900,000	2,016,000	2,102,000	2,225,000
Total Budget R	37,869,353	38,718,984	42,074,818	45,985,761	50,060,140	17,586,000	19,588,000	18,729,000	18,865,000	19,157,000
Total Budget £	£236,000	£242,000	£262,000	£287,000	£312,000	£110,000	£122,000	£117,000	£118,000	£120,000

Table A.4.5c Five Year Buffer Zone Budget (DNPWC/GoN 2007, DNPWC/GoN2012).

4.6 Government Ministries of Nepal

Ministry	Website
Office of the Prime Minister	http://www.opmcm.gov.np/en/
Ministry of Home Affairs	http://www.moha.gov.np/
Ministry of Finance	http://www.mof.gov.np/en/
Ministry of Foreign Affairs	http://www.mofa.gov.np/
Ministry of Defence	http://www.mod.gov.np/
Ministry of Physical Infrastructure and Transport	http://www.mopit.gov.np/
Ministry of Energy	http://www.moen.gov.np/
Ministry of Irrigation	http://www.moir.gov.np/
Ministry of Information and Communications	http://www.moic.gov.np/
Ministry of Agricultural Development	http://www.moad.gov.np/
Ministry of Industry	http://www.moi.gov.np/
Ministry of Law, Justice, Constituent Assembly and Parliamentary Affairs	http://www.moljpa.gov.np/
Ministry of Commerce and Supply	www.mocs.gov.np
Ministry of Youth and Sports	http://www.moys.gov.np/index-en.html
Ministry of Education	http://www.moe.gov.np/
Ministry of General Administration	http://www.moga.gov.np/main/index.php
Ministry of Culture, Tourism, and Civil Aviation	http://www.tourism.gov.np/
Ministry of Health and Population	http://www.mohp.gov.np/
Ministry of Forests and Soil Conservation	http://www.mfsc.gov.np/
Ministry of Peace and Reconstruction	http://www.peace.gov.np/
Ministry of Federal Affairs and Local Development	http://www.mofald.gov.np/index.php?lang=en
Ministry of Labour and Employment	http://www.mole.gov.np/
Ministry of Science, Technology and the Environment	http://www.moste.gov.np/
Ministry of Women, Children and Social Welfare	http://www.mowcsw.gov.np/en/
Ministry of Land Reform and Management	http://www.molrm.gov.np/
Ministry of Cooperatives and Poverty Alleviation	http://www.mocpa.gov.np/
Ministry of Urban Development	http://www.moud.gov.np/

Appendix 5

5.1 Summary of Selected Interview Coding from NVivo

Drivers of Organisational Change			
Parent Node	**Child Node**	**Number of Sources**	**Number of References**
Environmental Change		29	182
	Climate Change	23	64
	Water Availability	22	67
	Grassland	10	18
	Invasive Species	9	20
	Fire	7	11
Human-wildlife Conflict		18	37
Park-people Conflict		11	24
	Community-park Conflict	10	20
	Illegal Resource Extraction	12	17
Demographic Change		11	18
Poaching		20	33
International Agendas		20	115
	Conventions, Treaties, Agreements	13	23
	Donors	18	43
Poverty		10	19
	Lack of Livelihoods Opportunities	14	25
	Tourism	4	9
Total (Including Parent Node)		**261**	**745**

5.2 Summary of Precipitation Trends

Variable	**Evidence**	**Visible Trend/calculated trend**	**Quantitative trend data**
Total Annual Rainfall Chisapani	47 years precipitation data	Appears relatively stable with 2 extreme years: 1975 (wet) and 1987 (dry).	
47 year trends (SLR)	47 years precipitation data	Increasing trend	**y=4.226x+2138.1 R^2=0.0149**
30 year trend (SLR)	Last 30 years precipitation data	Increasing trend	**y=14.94x+1995.3 R^2=0.0864**
20 year trend (SLR)	Last 20 years precipitation data	Increasing trend	**y=16.714x+2126 R^2=0.06557**
10 year trend (SLR)	Last 10 years precipitation data	Increasing trend	**y=42.61x+2116.5 R^2=0.1538**
47 year trends at 10% (MK Trend)	47 years precipitation data	No trend detected	**Kendall's tau: 0.129 S': 133.000 P value (two tailed): 0.213 Alpha: 0.1**
30 year trend at 10% (MK Trend)	Last 30 years precipitation data	No trend detected	**Kendall's tau: 0.148 S': 60.000 P value (two tailed): 0.272 Alpha: 0.1**

20 year trend at 10% (MK Trend)	Last 20 years precipitation data	No trend detected	**Kendall's tau: 0.170 S': 29.000 P value (two tailed): 0.332 Alpha: 0.1**
10 year trend at 10% (MK Trend)	Last 10 years precipitation data	No trend detected	**Kendall's tau: 0.111 S': 4.000 P value (two tailed): 0.761 Alpha: 0.1**
Total Rainfall per Month Chisapani			
47 year trends at 10% (MK Seasonal Trend)	47 years precipitation data	No trend detected	**Kendall's tau: 0.020 S': 266.000 P value (two tailed): 0.479 Alpha: 0.1**
30 year trend at 10% (MK Seasonal Trend)	Last 30 years precipitation data	No trend detected	**Kendall's tau: -0.004 S': -3.000 P value (two tailed): 0.991 Alpha: 0.1**
20 year trend at 10% (MK Seasonal Trend)	Last 20 years precipitation data	No trend detected	**Kendall's tau: 0.044 S': 90.000 P value (two tailed): 0.360 Alpha: 0.1**
10 year trend at 10% (MK Seasonal Trend)	Last 10 years precipitation data	No trend detected	**Kendall's tau: 0.013 S': 7.000 P value (two tailed): 0.854 Alpha: 0.1**
Total Annual Rainfall Rani Jaruwa	25 years precipitation data	Possible cyclical downward trend. Readings correspond well to Chisapani i.e. wet year wet for both, dry years dry for both.	
26 year trends (SLR)	26 years precipitation data	Decreasing trend	**y=-14.285x+1470.4 R^2=0.11248**
20 year trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-12.756x+1366.6 R^2=0.0575**
10 year trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-10.025x+1182.4 R^2=0.0128**
26 year trends 5% (MK Seasonal Trend)	26 years precipitation data	Strong decreasing trend	**Kendall's tau: -0.280 S': -91.000 P value (two tailed): 0.047 Alpha: 0.05**
20 year trend 10% (MK Seasonal Trend)	Last 20 years precipitation data	No trend detected	**Kendall's tau: -0.263 S': -50.000 P value (two tailed): 0.113 Alpha: 0.1**
10 year trend 10% (MK Seasonal	Last 10 years precipitation	No trend detected	**Kendall's tau: S':**

Trend)	data		**P value (two tailed):** **Alpha:**
Total Rainfall per month Rani Jaruwa			
26 year trends at 1% (MK Seasonal Trend)	26 years precipitation data	Very strong decreasing trend	**Kendall's tau: -0.169** **S': -591.000** **P value (two tailed): 0.000** **Alpha: 0.1**
20 year trend at 5% (MK Seasonal Trend)	Last 20 years precipitation data	Strong decreasing trend	**Kendall's tau: -0.109** **S': -210.000** **P value (two tailed): 0.038** **Alpha: 0.05**
10 year trend (MK Seasonal Trend)	Last 10 years precipitation data	Test cannot be completed because some readings are constant between years	**Kendall's tau:** **S':** **P value (two tailed):** **Alpha:**
NWD Chisapani	47 years precipitation data	Appears relatively stable. Extreme high (1971) extreme low (1979).	
47 year trends (SLR)	47 years precipitation data	Stable	**y=0.0137x+103.3** **R^2=0.0003**
30 year trend (SLR)	Last 30 years precipitation data	Slight decreasing trend	**y=-0.2274+108.25** **R^2=0.0725**
20 year trend (SLR)	Last 20 years precipitation data	Slight decreasing trend	**y=-0.3203x+107.22** **R^2=0.0466**
10 year trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-1.4689x+111.44** **R^2=0.4105**
46 year trends (MK Trend at 10%)	46 years precipitation data	No trend detected	**Kendall's tau: -0.034** **S': -33.000** **P value (two tailed): 0.754** **Alpha: 0.1**
30 year trend (MK Trend at 10%)	Last 30 years precipitation data	No trend detected	**Kendall's tau: -0.197** **S': -73.000** **P value (two tailed): 0.154** **Alpha: 0.1**
20 year trend (MK Trend at 10%)	Last 20 years precipitation data	No trend detected	**Kendall's tau: -0.119** **S': -20.000** **P value (two tailed): 0.504** **Alpha: 0.1**
10 year trend (MK Trend at 10%)	Last 10 years precipitation data	No trend detected	**Kendall's tau: -0.400** **S': -14.000** **P value (two tailed): 0.171** **Alpha: 0.1**
Total NWD/month Chisapani			
46 year trends at 10%(MK Seasonal	46 years precipitation	No trend detected	**Kendall's tau: 0.022** **S': 257.000**

Trend)	data		**P value (two tailed): 0.491** **Alpha: 0.1**
30 year trend at 10% (MK Seasonal Trend)	Last 30 years precipitation data	No trend detected	**Kendall's tau: 0.006** **S': 33.000** **P value (two tailed): 0.860** **Alpha: 0.1**
20 year trend at 10% (MK Seasonal Trend)	Last 20 years precipitation data	No trend detected	**Kendall's tau: 0.036** **S': 73.000** **P value (two tailed): 0.454** **Alpha: 0.1**
10 year trend at 10% (MK Seasonal Trend)	Last 10 years precipitation data	No trend detected	**Kendall's tau: 0.017** **S': 10.000** **P value (two tailed): 0.778** **Alpha: 0.1**
NWD Rani Jaruwa	26 years precipitation data	Apparent step change (down) around 1992. Apparent downward trend – unless mirrored by change in total rainfall this suggests increasing intensity of rainfall events.	
26 year trends (SLR)	26 years precipitation data	Decreasing trend	**y=-1.7935x+82.098** **R^2=0.5239**
20 year trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-0.9714x+61.4** **R^2=0.2195**
10 year trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-1.7333x+56.133** **R^2=0.1930**
26 year trends (MK Test at 1%)	26 years precipitation data	Very strong decreasing trend	**Kendall's tau: -0.540** **S': -174.000** **P value (two tailed): 0.000** **Alpha: 0.01**
20 year trend (MK Test at 10%)	Last 20 years precipitation data	Moderate decreasing trend	**Kendall's tau: -0.319** **S': -60.000** **P value (two tailed): 0.055** **Alpha: 0.1**
10 year trend (MK Test at 10%)	Last 10 years precipitation data	No trend detected	**Kendall's tau: -0.315** **S': -14.000** **P value (two tailed): 0.243** **Alpha: 0.1**
Mean NWD pre and post 1993	Data divided into 1986-1993, 1994-2011	NWD has decreased in all months with biggest drop in June, suggesting late onset of monsoon season. July, August, September, May have also seen significant decreases in NWD.	
Total NWD/month Rani Jaruwa			
26 year trends at	26 years	Very strong decreasing trend	**Kendall's tau: -0.299**

1% (MK Seasonal Trend)	precipitation data		**S': -1032.000 P value (two tailed): <0.0001 Alpha: 0.01**
20 year trend (MK Seasonal Trend)	Last 20 years precipitation data	Very strong decreasing trend	**Kendall's tau: -0.179 S': -344.000 P value (two tailed): 0.001 Alpha: 0.01**
10 year trend (MK Seasonal Trend)	Last 10 years precipitation data	Test cannot be completed because some readings are constant between years	
Total Seasonal Rainfall Chisapani	46 years precipitation data	No apparent trend in any season. Big extremes (wet) in monsoon 1975, and hot and dry 1971 and 1990.	
46 year winter trends (SLR)	46 years precipitation data	Decreasing trend	**y=-0.6552x+122.87 R^2=0.0173**
30 year winter trend (SLR)	Last 30 years precipitation data	Decreasing trend	**y=-3.2575x+157.71 R^2=0.1533**
20 year winter trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-3.2661x+125.69 R^2=0.0735**
10 year winter trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-5.4962x+90.357 R^2= 0.1194**
46 year hot & dry season trends (SLR)	46 years precipitation data	Increasing trend	**y=1.2517x+122.55 R^2=0.0364**
30 year hot & dry season trend (SLR)	Last 30 years precipitation data	Increasing trend	**y=0.5523x+154.3 R^2=0.00298**
20 year hot & dry season trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-4.1651x+217.74 R^2=0.059**
10 year hot & dry season trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-5.9914x+204.48 R^2=0.0568**
Chisapani Monsoon Rainfall	46 years precipitation data	No apparent trends for any month. Extremes in 1975 (wet) all months, 2007 (wet) July and August.	
46 year Monsoon trends (SLR)	46 years precipitation data	Slight increasing trend	**y=2.9078x+1924 R^2=0.0097**
30 year Monsoon trend (SLR)	Last 30 years precipitation data	Increasing trend	**y=9.856+1848.2 R^2=0.0523**
20 year Monsoon trend (SLR)	Last 20 years precipitation data	Increasing trend	**y=25.845+1737.6 R^2=0.1464**
10 year Monsoon trend (SLR)	Last 10 years precipitation data	Increasing trend	**y=65.238x+1733.2 R^2=0.195**
Total Seasonal	25 years	Greater variability than for	

Rainfall Rani Jaruwa	precipitation data	Chisapani (possibly increasing). Extremes include 1981 and 1994 Monsoon (dry), 1990 hot and dry (wet), and 2009 winter (wet).	
26 year Winter trends (SLR)	26 years precipitation data	Decreasing trend	**y=-1.5342x+100.05 R^2=0.0333**
20 year Winter trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-1.6902x+92757 R^2=0.0195**
10 year Winter trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-4.003x+88.667 R^2=0.0182**
26 year Hot & Dry season trends (SLR)	26 years precipitation data	Decreasing trend	**y=-4.1905x+181.54 R^2=0.1547**
20 year Hot & Dry season trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-2.344x+131.13 R^2=0.0782**
10 year Hot & Dry season trend (SLR)	Last 10 years precipitation data	Decreasing trend	**y=-6.657x+132.81 R^2=0.1753**
Rani Jaruwa Monsoon Rainfall	35 years precipitation data	Appears as though June July and August are getting dryer whilst September is getting wetter. Variability is increasing for all months. Extreme (wet) July 1978 and 2007, August 1995, June 2000, and increasing incidence of zero rainfall in June (2003/6/9/10).	
26 year Monsoon trends (SLR)	26 years precipitation data	Decreasing trend	**y=-12.915x+1278.6 R^2=0.1139**
20 year Monsoon trend (SLR)	Last 20 years precipitation data	Decreasing trend	**y=-9.1505x+1146.4 R^2=0.0353**
10 year Monsoon trend (SLR)	Last 10 years precipitation data	Slight increasing trend	**y=1.6152+950.27 R^2=0.0003**
Total Monsoon Rainfall RJ vs. Chisapani	46 yrs ppt data (Chisapani), 35 yrs ppt data (RJ)	Readings correspond well to between both sites i.e. wet year wet for both, dry years dry for both.	
Total Hot Dry Season Rainfall RJ vs. Chisapani	46 yrs ppt data (Chisapani), 32 yrs ppt data (RJ)	Readings correspond well to between both sites i.e. wet year wet for both, dry years dry for both. 1999 as extreme (wet) year for both. Possible drying trend at Rani Jaruwa.	
Total Winter Rainfall RJ vs. Chisapani	46 yrs ppt data (Chisapani), 32 yrs ppt data (RJ)	Readings correspond well between both sites. Apparent increasing variability between years, especially at RJ where extremes include 05/06 and 09/10 (wet), and 00/01, 07/08, 08/09, and 11/12 (dry).	

5.3 Summary of Temperature Trends

Variable	Evidence	Visible Trend/calculated trend	Quantitative Trend Data
Average Annual Temperature Chisapani	38 years temperature readings	Apparent downward trend but significant amounts of missing data.	
38 year trends (SLR)	38 years temperature readings	Decreasing trend	y=-0.006x+24.599 R^2=0.0346
30 year trend (SLR)	Last 30 years temperature readings	Increasing trend	y=0.0159x+24.137 R^2=0.16208
20 year trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0285x+24.187 R^2=0.25302
10 year trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.1042x+24.134 R^2=0.39323
42 year trends at 10% (MK Trend)	42 years temperature readings	No significant trend	Kendall's tau: -0.112 S': -63.000 P value (two tailed): 0.361 Alpha: 0.1
30 year trend at 10% (MK Trend)	Last 30 years temperature readings	Moderate increasing trend	Kendall's tau: 0.281 S': 65.000 P value (two tailed): 0.071 Alpha: 0.1
20 year trend at 10% (MK Trend)	Last 20 years temperature readings	Moderate increasing trend	Kendall's tau: 0.363 S': 33.000 P value (two tailed): 0.079 Alpha: 0.1
10 year trend at 10% (MK Trend)	Last 10 years temperature readings	No significant trend	Kendall's tau: 0.333 S': 5.000 P value (two tailed): 0.469 Alpha: 0.1

Mean Monthly Temperature Chisapani			
47 year trends at 10% (MK Seasonal Trend)	47 years temperature readings	No significant trends	Kendall's tau: -0.045 S': -490.000 P value (two tailed): 0.410 Alpha: 0.1
30 year trend at 10% (MK Seasonal Trend)	Last 30 years temperature readings	No significant trends	Kendall's tau: 0.002 S': 8.000 P value (two tailed): 0.964 Alpha: 0.1
20 year trend at 10% (MK Seasonal Trend)	Last 20 years temperature readings	No significant trends	Kendall's tau: 0.086 S': 124.000 P value (two tailed): 0.110 Alpha: 0.1
10 year trend at 10% (MK Seasonal Trend)	Last 10 years temperature readings	No significant trends	Kendall's tau: 0.056 S': 14.000 P value (two tailed): 0.573 Alpha: 0.1
Mean monthly maximum temperature Chisapani			
49 year trends at 1% (MK Seasonal Trend)	49 years temperature readings	Very strong decreasing trend	Kendall's tau: -0.146 S': -1582.000 P value (two tailed): <0.0001 Alpha: 0.01
30 year trend at 10% (MK Seasonal Trend)	Last 30 years temperature readings	No trend detected	Kendall's tau: 0.035 S': 138.00 P value (two tailed): 0.383 Alpha: 0.1

20 year trend at 1%(MK Seasonal Trend)	Last 20 years temperature readings	Very strong decreasing trend	Kendall's tau: 0.074 S': 1556.000 P value (two tailed): 0.116 Alpha: 0.01
10 year trend at 10% (MK Seasonal Trend)	Last 10 years temperature readings	No trend detected	Kendall's tau: 0.065 S': 22.000 P value (two tailed): 0.453 Alpha: 0.1
Mean monthly minimum temperature Chisapani			
47year trends at 10% (MK Seasonal Trend)	47 years temperature readings	No significant trends	Kendall's tau: 0.037 S': 441.000 P value (two tailed): 0.214 Alpha: 0.1
30 year trend at 10% (MK Seasonal Trend)	Last 30 years temperature readings	No significant trends	Kendall's tau: 0.051 S': 232.000 P value (two tailed): 0.188 Alpha: 0.1
20 year trend at 10%(MK Seasonal Trend)	Last 20 years temperature readings	No significant trends	Kendall's tau: 0.060 S': 110.000 P value (two tailed): 0.233 Alpha: 0.1
10 year trend at 10% (MK Seasonal Trend)	Last 10 years temperature readings	No significant trends	Kendall's tau: 0.018 S': 6.000 P value (two tailed): 0.858 Alpha: 0.1
Average Annual Temperature Rani Jaruwa	24 years temperature readings	No apparent trend, 2010 extreme (high) max be misleading due to lack of December data. 1986 reading (relatively low) doesn't show on plot.	
26 year trends (SLR)	26 years temperature readings	Increasing	y=0.0223x+24.187 R^2=0.16376

20 year trend (SLR)	Last 20 years temperature readings	Increasing	y=0.0291x+24.209 R^2=0.19218
10 year trend (SLR)	Last 10 years temperature readings	Increasing	y=0.1007x+24.112 R^2=0.5538
25 year trends at 10% (MK Trend)	25 years temperature readings	No significant trend	Kendall's tau: 0.209 S': 53.000 P value (two tailed): 0.172 Alpha: 0.1
20 year trend at 10% (MK Trend)	Last 20 years temperature readings	No significant trend	Kendall's tau: 0.193 S': 33.000 P value (two tailed): 0.267 Alpha: 0.1
10 year trend at 10% (MK Trend)	Last 10 years temperature readings	Moderate increasing trend	Kendall's tau: 0.500 S': 18.000 P value (two tailed): 0.075 Alpha: 0.1
Mean Monthly Temperature Rani Jaruwa			
26 year trends at 10% (MK Seasonal Trend)	26 years temperature readings	No significant trends	Kendall's tau: 0.003 S': 10.000 P value (two tailed): 0.952 Alpha: 0.1
20 year trend at 10% (MK Seasonal Trend)	Last 20 years temperature readings	No significant trends	Kendall's tau: 0.021 S': 43.000 P value (two tailed): 0.671 Alpha: 0.1
10 year trend at 10% (MK Seasonal Trend)	Last 10 years temperature readings	No significant trends	Kendall's tau: 0.067 S': 29.000 P value (two tailed): 0.399 Alpha: 0.1
Mean monthly maximum			

temperature Rani Jaruwa			
26 year trends at 1% (MK Seasonal Trend)	26 years temperature readings	Very strong increasing trend	Kendall's tau: 0.121 S': 437.000 P value (two tailed): 0.003 Alpha: 0.01
20 year trend at 1% (MK Seasonal Trend)	Last 20 years temperature readings	Very strong increasing trend	Kendall's tau: 0.192 S': 393.000 P value (two tailed): <0.0001 Alpha: 0.01
10 year trend at 1% (MK Seasonal Trend)	Last 10 years temperature readings	Very strong increasing trend	Kendall's tau: 0.315 S': 136.000 P value (two tailed): <0.0001 Alpha: 0.01
Mean monthly minimum temperature Rani Jaruwa			
26 year trends at 10% (MK Seasonal Trend)	26 years temperature readings	No significant trends	Kendall's tau: -0.036 S': -128.000 P value (two tailed): 0.392 Alpha: 0.1
20 year trend at 10% (MK Seasonal Trend)	Last 20 years temperature readings	No significant trends	Kendall's tau: -0.008 S': -15.000 P value (two tailed): 0.888 Alpha: 0.1
10 year trend at 10% (MK Seasonal Trend)	Last 10 years temperature readings	No significant trends	Kendall's tau: 0.058 S': 25.000 P value (two tailed): 0.470 Alpha: 0.1
Ave Seasonal Max Temp Chisapani	41 years temperature readings	Apparent small decreasing trend for all months	

Ave Seasonal Min Temp Chisapani	41 years temperature readings	Apparent small increasing trend for all months suggesting reduced daily temperature variability, fewer daily extremes.	
Ave Seasonal Max Temp Rani Jaruwa	32 years temperature readings	No Apparent trends. Smaller seasonal differences between hot and dry and monsoon.	
Ave Seasonal Min Temp Rani Jaruwa	25 years temperature readings	Apparent increasing trend for hot and dry and winter seasons, apparent decreasing trend during monsoon. Bigger differences between seasons.	
Average Max Winter Temp Chisapani	46 years temperature readings	Apparent decreasing trend for all months, most pronounced for January.	
46 year Winter trends (SLR)	46 years temperature readings	Decreasing trend	y=-0.042x+25.314 R^2=0.235
30 year Winter trend (SLR)	Last 30 years temperature readings	Decreasing trend	y=-0.0622x+24.983 R^2=0.1626
20 year Winter trend (SLR)	Last 20 years temperature readings	Decreasing trend	y=-0.1223x+25.033 R^2=0.2209
10 year Winter trend (SLR)	Last 10 years temperature readings	Decreasing trend	y=-0.4781x+25.821 R^2=0.5422
Average Min Winter Temp Chisapani	46 years temperature readings	Apparent increasing trend for all months.	
46 year Winter trends (SLR)	46 years temperature readings	Increasing trend	y=0.0124x+14.207 R^2=0.0393
30 year Winter trend (SLR)	Last 30 years temperature readings	Decreasing trend	y=-0.0264x+15.045 R^2=0.0849
20 year Winter trend (SLR)	Last 20 years temperature readings	Decreasing trend	y=-0.0936x+15.53 R^2=0.3889
10 year Winter trend (SLR)	Last 10 years temperature readings	Decreasing trend	y=-0.2705x+15.482 R^2=0.7035
Average Max Winter Temp Rani Jaruwa	26 years temperature readings	Apparent increasing trend for October and November.	
26 year Winter trends (SLR)	26 years temperature readings	Increasing trend	y=0.0419x+25.87 R^2=0.104

20 year Winter trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.1019x+25.34 R^2=0.3507
10 year Winter trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.2107x+25.773 R^2=0.4238
Average Min Winter Temp Rani Jaruwa	25 years temperature readings	Apparent increasing trend for all months.	
25 year Winter trends (SLR)	25 years temperature readings	Increasing trend	y=0.0426x+11.966 R^2=0.1583
20 year Winter trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0734x+11.782 R^2=0.2515
10 year Winter trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.1494x+11.992 R^2=0.2265
Average Max Hot & Dry Temp Chisapani			
44 year Hot & Dry trends (SLR)	44 years temperature readings	Decreasing trend	y=-0.0436x+32.607 R^2=0.1879
30 year Hot & Dry trend (SLR)	Last 30 years temperature readings	Increasing trend	y=0.0331x+30.665 R^2=0.0826
20 year Hot & Dry trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0588x+30.69 R^2=0.1585
10 year Hot & Dry trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.0594x+31.23 R^2=0.0466
Average Min Hot & Dry Temp Chisapani			
43 year Hot & Dry trends (SLR)	43 years temperature readings	Slight increasing trend	y=0.0181x+18.269 R^2=0.0704
30 year Hot & Dry trend (SLR)	Last 30 years temperature readings	Slight increasing trend	y=0.028x+18.356 R^2=0.0673
20 year Hot & Dry trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0485x+18.456 R^2=0.1507
10 year Hot & Dry trend (SLR)	Last 10 years temperature readings	Slight increasing trend	y=0.0398x+18.955 R^2=0.0321
Average Max Hot &			

Dry Temp Rani Jaruwa			
26 year Hot & Dry trends (SLR)	26 years temperature readings	Increasing trend	y=0.0383x+31.884 R^2=0.1103
20 year Hot & Dry trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.034x+32.163 R^2=0.0599
10 year Hot & Dry trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.1105x+32.083 R^2=0.1278
Average Min Hot & Dry Temp Rani Jaruwa			
26 year Hot & Dry trends (SLR)	26 years temperature readings	Slight increasing trend	y=0.0276x+15.69 R^2=0.045
20 year Hot & Dry trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0449x+15.543 R^2=0.0822
10 year Hot & Dry trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.1561x+15.41 R^2=0.1405
Average Max Monsoon Temp Chisapani			
46 year Monsoon trends (SLR)	46 years temperature readings	Decreasing trend	y=-0.0312x+33.313 R^2=0.2023
30 year Monsoon trend (SLR)	Last 30 years temperature readings	Increasing trend	y=0.0254x+31.847 R^2=0.0977
20 year Monsoon trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0526x+31.781 R^2=0.164
10 year Monsoon trend (SLR)	Last 10 years temperature readings	*Not possible to calculate trend*	
Average Min Monsoon Temp Chisapani			
46 year Monsoon trends (SLR)	46 years temperature readings	Increasing trend	y=0.0224x+24.318 R^2=0.1732
30 year Monsoon trend (SLR)	Last 30 years temperature readings	Increasing trend	y=0.0172x+24.8 R^2=0.1706

20 year Monsoon trend (SLR)	Last 20 years temperature readings	Decreasing trend	y=-0.0119x+25.315 R^2=0.0647
10 year Monsoon trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.0135x+25.067 R^2=0.0505
Average Max Monsoon Temp Rani Jaruwa			
26 year Monsoon trends (SLR)	26 years temperature readings	Increasing trend	y=0.0432x+33.726 R^2=0.1665
20 year Monsoon trend (SLR)	Last 20 years temperature readings	Increasing trend	y=0.0646x+33.711 R^2=0.1853
10 year Monsoon trend (SLR)	Last 10 years temperature readings	Increasing trend	y=0.2033x+33.638 R^2=0.4035
Average Min Monsoon Temp Rani Jaruwa			
26 year Monsoon trends (SLR)	26 years temperature readings	Decreasing trend	y=-0.0293x+25.785 R^2=0.1439
20 year Monsoon trend (SLR)	Last 20 years temperature readings	Decreasing trend	y=-0.0364x+25.689 R^2=0.1177
10 year Monsoon trend (SLR)	Last 10 years temperature readings	Slight increasing trend	y=0.0047x+25.076 R^2=0.0004

5.4 Summary of River Discharge Trends

Variable	Evidence	Visible Trend/calculated trend	Quantitative Trend Data
Mean Monthly discharge Chisapani			
47 year monthly river discharge Mk trend at 10%	47 year monthly discharge readings	No significant trend	Kendall's tau: 0.040 S': 524.000 P value (two tailed): 0.166 Alpha: 0.1

30 year monthly river discharge Mk trend at 5%	30 year monthly discharge readings	Strong increasing trend	Kendall's tau: 0.079 S': 412.000 P value (two tailed): 0.034 Alpha: 0.05
20 year monthly river discharge Mk trend at 10%	20 year monthly discharge readings	No significant trend	Kendall's tau: -0.004 S': -8.000 P value (two tailed): 0.948 Alpha: 0.1
10 year monthly river discharge Mk trend at 10%	10 year monthly discharge readings	Moderate increasing trend	Kendall's tau: -0.122 S': -66.000 P value (two tailed): 0.093; Alpha: 0.1

Appendix 6

6.1 Likert Questions Pertaining to Internal Adaptive Capacity

		Headquarters					Hattisar					Overall				
	Question	Strongly Disagree	Disagree	Neither Agree / Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree / Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree / Disagree	Agree	Strongly Agree
Knowledge exchange	**In my organisation open discussion is encouraged as a means of overcoming areas of disagreement**	0	1	0	10	8	1	1	1	2	1	1		1	12	9
	People are encouraged to contribute their opinion on matters regardless of rank.	2	4	2	7	4	2	2	0	1	1	4	6	2	8	5
	In my organisation new ideas come from all levels of the organisation	1	0	1	8	9	1	2	1	1	1	2	2	2	9	10
	My organisation provides opportunities for staff to work together and to share their knowledge	1	0	0	10	8	3	1	0	1	1	4	1	0	11	9
	Opinions of all staff are regularly sought and action taken based on their recommendations	1	0	1	8	9	2	2	0	1	1	3	2	1	9	10
	In my organisation we have productive discussions about new ideas and challenges facing our organisation	0	0	2	11	6	1	2	0	2	1	1	2	2	13	7

	In my organisation informal sharing of knowledge and ideas is more common than knowledge exchange through formal channels	1	4	4	7	3	0	2	0	4	0	1	6	4	11	3
Training	**In my organisation the leadership provide formal opportunities for us to share knowledge**	0	0	2	7	10	2	2	1	0	1	2	2	3	7	11
	My organisation provides opportunities for formal technical training to all staff that require it	1	4	2	6	6	1	3	0	1	1	2	7	2	7	7
Access to Info	**My organisation provides access to technical information to all staff when they require it**	2	0	1	12	4	0	0	3	2	1	2	0	4	14	5
	When faced with new challenges my organisation implements awareness raising activities to ensure staff are aware of these challenges and how they may best be addressed	1	0	1	12	5	0	0	2	4	0	1	0	3	16	5
Clear Internal Policies	**I have a clear understanding of my organisation's internal policies and how they relate to my work and duties**	0	0	0	7	12	0	0	0	5	1	0	0	0	12	13

	In my organisation staff understand how their work relates to the overall goal of the organisation	1	0	0	11	7	0	2	0	4	0	1	2	0	15	7
Planning	**My organisation sets clear targets which are communicated effectively to all staff**	1	0	2	5	11	0	3	0	2	1	1	3	2	7	12
	My organisation is focused on addressing current challenges and does not have time for longer term planning*	2	7	3	3	4	1	0	3	2	0	3	7	6	5	4
	My organisation is actively planning for the future and considers the potential implications of future changes in its external environment	2	0	1	5	11	0	1	4	1	0	2	1	5	6	11
M&E	**My organisation regularly monitors and evaluates its performance against its objectives**	1	1	1	10	6	0	1	2	3	0	1	2	3	13	6
	In my organisation, assessment of performance is seen as a threat to 'business as usual'*	3	6	4	5	1	0	3	0	3	0	3	9	4	8	1
	Currently available information tells us all that we need to know about the effectiveness of our programs	0	0	0	11	8	0	0	3	3	0	0	0	3	14	8

	In my organization, the staff continually asks themselves how they're doing, what they can do better, and what is working	1	1	1	9	7	0	2	1	3	0	1	3	2	12	7
Clear Goals	**The goal of our organisation is clear and shared by all staff.**	0	0	1	6	12	0	0	1	5	0	0	0	2	11	12
	Staff know how their work contributes to the organisation's overall goal	0	0	0	7	12	0	0	0	3	3	0	0	0	10	15
Flexibility and Willingness to Change	**Information about changes in my organisation's goal are effectively spread throughout the organisation by its management**	0	0	2	9	8	1	1	0	2	2	1	1	2	11	10
	Being open to change is viewed positively in this organisation	0	1	3	10	5	1	1	1	1	2	1	2	4	11	7
	Most attempts to change important things in my organisation are met with resistance*	8	7	1	2	1	1	0	1	2	2	9	7	2	4	3
	Feedback from staff in our organisation often leads to changes in the way the organisation operates	1	0	1	11	6	0	3	1	0	2	1	3	2	11	8

	Any practice or procedure in my organisation can be challenged regardless of how long it has been in place	0	6	5	7	1	1	2	2	0	1	1	8	7	7	2
Leadership	**The high level leadership in my organisation show a willingness to listen to alternative points of view.**	0	0	1	7	11	0	3	1	1	1	0	3	2	8	12
	The leaders of my organisation make important decisions and take decisive action when required	1	0	1	9	8	0	1	1	2	2	1	1	2	11	10
Perceived Adapt Cap	**My organisation lacks the ability to respond to sudden changes and shocks in its external environment***	2	6	4	5	2	0	4	2	0	0	2	10	6	5	2
	My organisation has the capacity to successfully achieve its aims when faced with new challenges	0	0	2	9	8	0	0	3	2	1	0	0	5	11	9
	In the past my organisation was able to respond effectively whilst continuing to achieve its overarching goals	1	0	1	12	5	0	1	2	2	1	1	1	3	14	6
Human Resources	**My organisation identifies potential future Human Resource gaps in advance and ensures that they are filled before problems arise**	0	3	4	10	2	2	2	1	1	0	2	5	5	11	2

	My organisation currently has enough staff to effectively achieve its aims	4	7	2	3	3	2	2	1	1	0	6	9	3	4	3
	People in my organisation often have to fill multiple roles to make up for the lack of adequate staff numbers*	10	6	1	1	1	0	5	0	1	0	10	11	1	2	1
	People in my organisation often work in roles for which they are not suitably trained*	6	8	1	2	2	0	4	0	2	0	6	12	1	5	2
Economic Resources	**My organisation has the financial resources that it requires to effectively achieve its aims**	4	7	2	6	0	0	5	1	0	0	4	12	3	6	0
	Lack of adequate access to financial resources limits the effectiveness of my organisation*	8	8	1	0	2	2	4	0	0	0	10	12	1	0	2
	When faced with new challenges my organisation has the financial resources to effectively address these issues	3	9	2	4	1	1	2	1	1	1	4	11	3	5	2

	My organisation has to effectively prioritise its key aims as a lack of access to financial resources means that not all issues can be addressed*	9	9	0	1	0	1	4	1	0	0	10	13	1	1	0
Infrastructure	**My organisation has the required infrastructure (including roads, buildings, military bases, telecommunications and water management systems) to successfully achieve its aims**	2	6	2	7	2	3	1	1	0	1	5	7	3	7	3
	My organisation cannot effectively achieve its aims due to a lack of appropriate infrastructure*	5	9	1	4	0	0	5	1	0	0	5	14	2	4	0
	When faced with new challenges existing park infrastructure helps my organisation to continue to operate effectively	0	0	0	15	4	1	3	0	2	0	1	3	0	17	4
Technological	**My organisation has access to the latest technology (such as monitoring equipment or new fire control techniques) which helps it to achieve its aims**	3	8	2	5	1	3	2	0	1	0	6	10	2	6	1
	With better access to technology my organisation would be better able to perform its role effectively*	10	8	1	0	0	0	5	1	0	0	10	13	2	0	0

Figure 6.1 Likert questions pertaining to internal adaptive capacity and number of respondents by section of the organisation and overall. *These questions have been reverse coded.

6.2 Likert Questions Pertaining to External Adaptive Capacity

		Headquarters					Hattisar					Overall				
	Question	Strongly Disagree	Disagree	Neither Agree / Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree / Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Neither Agree / Disagree	Agree	Strongly Agree
Institutional	**My org is able to operate independently of formal govt rules and regs**	2	4	1	7	5	0	0	1	4	1	2	4	2	11	6
	The activities of my org are strictly limited by formal govt rules and regs which dictate how park management must be undertaken*	6	8	3	2	0	1	3	2	0	0	7	11	5	2	0
	My org is able to effectively lobby for changes in the rules and regs governing the operations of the park	0	3	3	8	5	0	1	3	2	0	0	4	6	10	5
	My org is able to resist those rules and regs which are felt not to contribute the effective running of the park	3	1	3	9	3	0	2	3	1	0	3	3	6	10	3
	When faced with new challenges formal government rules and regulations limit the ability of my organisation to respond quickly and effectively*	4	7	5	3	0	0	5	1	0	0	4	12	6	3	0
	When faced with new challenges formal govt rules and regs are flexible enough to allow my org to address them quickly and effectively	1	3	2	10	3	0	4	2	0	0	1	7	4	10	3
Ecological Context	**New challenges faced by my organisation have limited impact upon the natural environment within the park boundaries**	0	3	4	8	4	0	1	3	2	0	0	4	7	10	4

	The natural environment protected by the park is stable and able to resist social, economic, political and ecological disturbances	1	5	2	9	2	1	1	1	3	0	2	6	3	12	2
	The natural ement protected by my org is fragile and vulnerable to social, economic, political and ecological disturbances*	4	6	3	5	1	0	1	1	4	0	4	7	4	9	1
	The natural ement protected by the park's buffer zone is stable and able to resist social, economic, political and ecological disturbances	2	12	0	4	1	0	3	1	2	0	2	15	1	6	1
	When faced with new challenges, the resilience of the park's natural ement helps to address these challenges	3	1	0	12	3	0	0	1	5	0	3	1	1	17	3
Social Context	**Feedback from external stakeholders often leads us to change our practices**	0	0	1	11	7	0	0	1	5	0	0	0	2	16	7
	Opinions of our external stakeholders are regularly sought and action taken based on their recommendations	1	0	1	10	7	0	1	2	3	0	1	1	3	13	7
	Informal channels and personal relationships are an important part of knowledge sharing with external orgs	0	0	1	11	7	0	0	0	5	1	0	0	1	16	8

	When we review our policies and approaches we consult with other organisations working in our field	0	0	1	11	7	0	0	0	6	0	0	0	1	17	7
Resource Context	**Financial contributions from non-governmental organisations are vital in ensuring the successful running of the park**	0	1	0	6	12	0	1	1	3	1	0	2	1	9	13
	Tourism infrastructure in the park Buffer Zone (including access roads, bridges, lodges and guest houses) has a positive impact on my organisation's ability to achieve its aims	0	1	2	11	5	1	2	1	2	0	1	3	3	13	5
	It is worthwhile working with other orgs as this allows us to achieve more than we could alone	0	0	1	8	10	0	0	0	4	2	0	0	1	12	12
	Increased access to new crop varieties and technology such as biomass generators in the Buffer Zone, have reduced human pressures on park resources	1	1	0	7	10	0	3	1	2	0	1	4	1	9	10

Appendix 7

Climate Change Section BNP Management Plan

Additions to Section 1.1 Climate

BNP has a sub-tropical monsoon climate with a mean annual temperature of 21^0 Celsius. The maximum temperature may exceed 40^0 Celsius in May and June, and the lowest temperature recorded is 3^0 Celsius in January. Three distinct seasons may be identified in the annual cycle i.e. hot and dry (February to mid June), hot and wet i.e. monsoon (mid June to late Sept.) and cool and dry season (late Sept. to February). About 90% of precipitation occurs during three months (July, August and September). Annual rainfall records show that it varies from about 2000 mm at Chisapani to about 1400 mm at Gularia depending upon the proximity to hills.

A growing number of scientific publications, most notably the IPCC's 2007 Climate Change report, have highlighted the potential vulnerability of Nepal's rich biodiversity to the impacts of increasing climate variability and change. The projected impacts of climate change in Nepal include mean annual temperature increases of up to 1.4 degree Celsius by 2030, and 4.7 degree Celsius by 2090, along with increases in mean annual rainfall with drier winters and wetter summers (NCVST 2009). Whilst there is uncertainty as to the exact nature of these changes at the local level, a growing number of studies (for example Gurung and Bhandari 2008, Maharjan et al. 2011) have examined observed impacts on the ground. To date, however, there has been limited consideration of the potential implications of these changes in Nepal's National Parks, or possible responses to these changes, particularly at the local scale. These issues are discussed in more detail in Section ??? of this Management Plan.

Chapter ??? Climate Change and the BNP

1.1 Climate Change in Nepal

According to the Intergovernmental Panel on Climate Change we can now say with near certainty that human induced climate change is taking place and a number of studies have projected Nepal's future climate. The Nepal Climate Vulnerability Study Team (2009), for example, found that Nepal's mean annual temperature is likely to increase by 1.4°C by 2030, 2.8°C by 2060 and 4.7°C by 2090. In terms of precipitation, McSweeney et al. (2008) found that JJA rainfall is projected to change by -36mm (-22%) to +224mm (+104%) per month by the 2090s. SON rainfall is projected to change by -17mm (-38%) to +44mm (+71%) per month by the 2090s. These changes are likely to be accompanied by increasing climate variability and an increased frequency of extreme events such as floods and droughts, which will also impact upon the effectiveness of current conservation strategies.

There is significant uncertainty surrounding these projections particularly associated with Nepal's complex topography which means that climatic changes at the local level are likely to vary significantly between regions. There are also further uncertainties associated with modelling the contribution of monsoon processes to future rainfall in the country. Whilst these climate change projections are therefore inherently uncertain there remains a need for proactive decisions to be taken regarding the management of Protected Areas in a changing climate. What is needed is a 'no regrets' approach that enhances adaptive capacity in response to increasing climate variability and frequency of extreme events, even if the exact path and magnitude of future changes is not currently certain.

1.2 Climate Change and Protected Areas, Importance and Challenges

There is a clear and pressing need to adapt traditional conservation strategies in the face of increasing climate variability and change which will increase the already significant threats posed to the success of Protected Areas by anthropogenic factors such as increasing human resource demands (discussed elsewhere in this Management Plan). Protected Areas are built upon the notion of permanence but in a changing climate they may no longer provide the appropriate habitats needed to ensure the survival of the very species which they were created to conserve. At the same time, the adverse impacts of an increasingly variable climate upon the communities living in the Buffer Zone may increase human pressures on park resources, posing further challenges for successful park management.

In many countries such as Nepal the immediate pressures on parks, particularly issues such as human-wildlife conflict, combined with the limited availability of financial resources mean that there is, at present, limited consideration of current climatic trends and the potential future impacts of increasing climate variability and change. The recent DNPWC publication 'Biodiversity Conservation in Nepal, a Success Story' (Acharya and Dhakal 2012) highlights the pressing nature of the climate change challenge and the need to ensure that these threats to Protected Areas are adequately addressed.

1.3 Climate Change and Protected Areas, Planning for the Future

At the regional, national and international scales the solution to the climate change challenge is widely thought to involve the management of protected areas as a coherent network rather than as isolated habitat islands, an approach which Bardiya is already at forefront of. In a changing climate it will be vital to examine opportunities to ensure that Protected Areas are large enough to encompass a broad range of elevations, slope aspects, and habitat mosaics (Sharma 2012). At the local scale, further actions need to be taken to strengthen the scientific knowledge base, to provide a platform from which to develop activities that mitigate the threats posed by climate change whilst increasing the capacity of the park to effectively respond to these new challenges.

1.4 – Climate Change Adaptation Planning: 'Climate Proofing' the Bardia National Park

There is no doubt that the current Management Plan of the Bardia National Park includes a number of appropriate strategies and approaches that will be invaluable to the success of the park in a changing climate. The parks position as part of the wider Terai Arc Landscape programme and its links to Katerniaghat Wildlife Sanctuary in India through the Khata corridor and to the other parks in the Terai, will certainly prove pivotal to successful conservation efforts in a changing climate. Furthermore, current monitoring and evaluation practices, which include the annual monitoring of keystone and endangered species such as Tigers and Gharial crocodiles, will likely form an important foundation upon which to mainstream climate change considerations into the running of the park. There is, however, scope for further work to assess the current state of climatic trends in the region, as well as formulating policies to prepare for future climate change impacts. International commitments to addressing the challenge of climate change and a growing awareness of

the potential impacts of climate change on conservation efforts mean that increasing international finances may potentially be available to support adaptive actions. As the DNPWC's 'Biodiversity Conservation in Nepal, a Success story' highlights, additional funds to address this issue could be generated through mechanisms such as increased sources of external funding and the introduction of market based fees for goods and services.

The following strategy is suggested as an initial step towards mainstreaming climate change considerations in park management:

i. Investigate potential sources of sustainable funding for climate change related activities in the park and buffer zone.
ii. Conduct a study of recent climate trends and extreme weather events in the area and create mechanisms to monitor local climate on an ongoing basis.
iii. Correlate local stakeholder perceptions of climate change with meteorological data.
iv. Provide further climate change training for park staff and communities to raise awareness of climate change and its current observed and potential future impacts on conservation efforts and livelihoods.
v. Use data gathered on climatic trends and perceptions, along with projections of future climatic changes, to identify the most vulnerable species, ecosystems, and activities, and to prioritise and target broad adaptation actions.
vi. Develop and integrate climate change indicators into the park's logical framework, to allow targets to be set and progress to be monitored and evaluated on an ongoing basis.