

Climate Change Adaptation Planning for Rhino population in Chitwan National Park, Nepal

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ABSTRACT

Chitwan National Park, a natural world heritage site, is the flagship for biodiversity conservation in Nepal and One-horned Rhino (Rhinoceros unicornis) is the iconic species of the park. Rhino population in Chitwan National Park is highly vulnerable to climate change as its survival has already been challenged by serious decline in both quality and quantity of the habitat. Rhino population in Nepal is likely to be affected from temporal and spatial shift in suitable habitat as a result of regional climate shift and the adverse impact of extreme weather events such as excessive drought and flood. This report has identified key areas of interventions needed to facilitate this mega herbivore in Nepal to withstand likely adverse impacts in the face of climate change. Further, it has emphasized the need of further research and stakeholders' engagement for ensuring the effectiveness of climate change adaptation planning for rhino population in Nepal.

KEY WORDS: Rhino, Chitwan, population, climate change, adaptation, relocation, stakeholders.

INTRODUCTION

Climate change has been one of the most serious challenges for biodiversity conservation over the last decades. Species assemblage and ecosystem dynamics has started responding to the recent climate shift globally. Shifts in species distributions particularly along elevation gradients, changes in the timing of life-history events or phenology, effects on demography such as survival and fecundity, reductions in population size, increased fire frequency, pest and disease outbreaks, increased spread of wildlife diseases, parasites, and zoonotic, increased spread of invasive or non-native species, including plants, animals, and pathogens, direct loss of habitat and species extinction are some of the identified biodiversity related impact of climate change (Mawdsley *et al.*, 2009, Olson *et al.*, 2009, CBD, 2013).

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One of the most likely impacts of climate change is shift in spatial and temporal pattern in availability of suitable habitats for terrestrial species. Some species can simply move to suitable habitats, while other animals try to adapt in new habitat conditions or shift gradually over generations. As climate change is occurring rapidly, most species may not be able to respond through local adaptation or migration across landscapes (Olson *et al.*, 2009). One-horned Rhino (*Rhinoceros unicornis*) is a definitive example of such type of species which is neither capable to adapt rapid change nor can migrate to other areas. Rhino is a specialist species, which is confined to the riverine grasslands in the foothills of the Himalayas. As a result of habitat destruction and climatic changes, its range has gradually been reduced. At present, remnant population of rhino thrive in the grasslands of southern Nepal and in the Brahmaputra Valley of Assam, India (Talukdar *et al.*, 2008, DNPWC, 2006).

CLIMATE CHANGE ADAPTATION

Climate change adaptation as defined by The Intergovernmental Panel on Climate Change (IPCC) is “adjustment in natural or human systems to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2007). Adaptation involves the planning and implementation of measures that intends to increase the resilience, or the ability of natural or human system to withstand shocks resulted from direct or indirect effects of a changing climate. The following framework illustrates the difference between mitigation and adaptation.

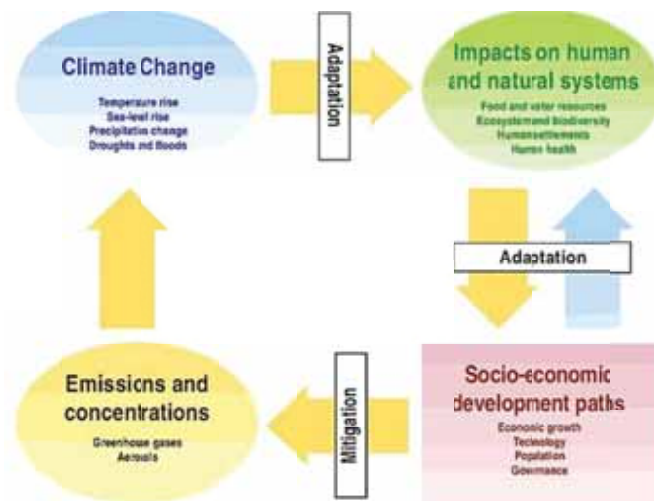


Figure 1. Conceptual Framework for Climate Change Adaptation and Mitigation adopted from IPCC, 2001

Source: <http://www.intechopen.com>

Adaptation is any measures intended to minimize impact of climate change on human and natural systems whereas mitigation refers to any strategy or action to reduce the amount of green house gases in atmosphere. It is claimed that human and natural systems are capable to adapt autonomously to some extent, while planned adaptation is supposed to supplement autonomous adaptation. The following diagram depicts the interrelationship between climate change impact, adaptation and mitigation.

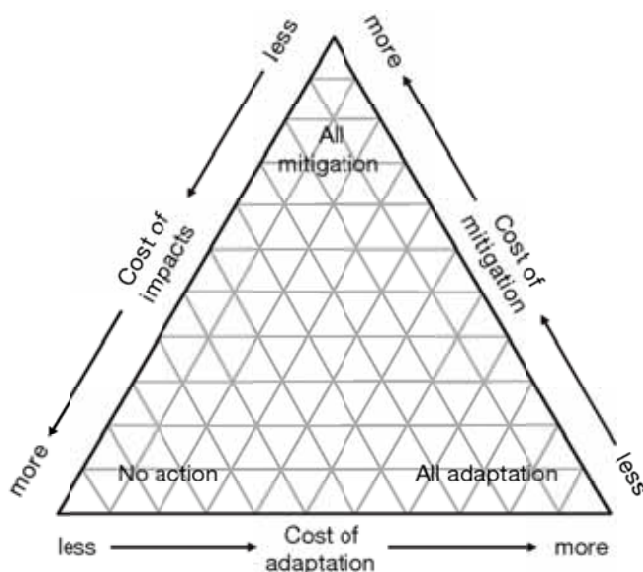


Figure 2. A schematic overview of inter-relationships between adaptation, mitigation and impacts adopted from Holdridge, 1947

Source: <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter18.pdf>

In other words, climate change adaptation is those activities intended to minimize the adverse effects of climate change on human infrastructure and natural environment. The adaptation strategies for biodiversity in the face of climate change are broadly grouped into four categories viz. land and water protection and management, direct species management, monitoring and planning and law and policy (Mawdsley *et al.*, 2009).

Adaptation consists of measures that are taken in response to the actual or expected changes in climate to minimize their impact. Such measures help in reducing vulnerability of natural or human systems to the likely adverse effects of climate change by increasing the system's resilience. Loss prevention, loss sharing, behaviour modification and relocation are the broad categories of adaptation

measures in the face of climate change. Thus, effectiveness of climate change adaptation heavily relies on rigorous planning which can adequately combine these types of measures in relation to most significant and eminent vulnerabilities of the concerned system taking into account of available resources, skill and institutional roles and capacities (DoCC, 2009). Loss prevention refers to the actions taken for reducing vulnerability to climate change whereas loss sharing is spreading the risk of loss among wider population such as insurance. Likewise, behaviour modification intends to eliminate the activity or behaviour that is likely to cause hazard. Last but not least, relocation involves moving vulnerable population or systems away from areas prone to hazards.

CLIMATE CHANGE ADAPTATION PLANNING FOR RHINO POPULATION IN NEPAL

Nepal, a landlocked country in South Asia is highly vulnerable to the impacts of climate change. The factors that make Nepal highly sensitive to climate change includes higher rate of temperature increase than global average, exposure to diversity of climatic conditions, high dependency on natural resources, steep topography, fragile geology and inadequate financial and human resources (Gurung and Bhandari, 2009). Chitwan district, which encompasses more than 70% of Chitwan National Park (CNP, 2012) has been ranked as high-risk category district of Nepal in the face of likely impact of climate change (MoE, 2010). Chitwan National Park is second home to one-horned rhino in the world, which supports about 20 % of global population of one-horned rhino and more than 90% of the rhino population in Nepal (DNPWC, 2012).

Rhino, which inhabits flood plain grasslands, is a true specialist in terms of food and habitat requirement. It also requires plenty of water holes in its habitat to wallow for keeping its body cool in extreme temperatures (DNPWC, 2006, Talukdar et al., 2008). Poaching of rhino for illegal trade of its horn and inadequacy of suitable rhino habitat are the major challenges of rhino conservation in Nepal (DNPWC, 2012). Chitwan National Park has already experienced serious decline in both quantity and quality of rhino habitat due to encroachment of woodland in grasslands, invasion by alien plants into grasslands and riverine forests, and silting up of wetlands (Talukdar et al., 2008). The extent of grassland in Chitwan National Park has dropped from about 20 % of the park area during 1970s to about 5 % of the park area in 2008 (Kafley et al., 2009). Grassland comprises the major portion of suitable rhino habitat

and the drastic decline in rhino habitat, which is attributed to climate change, has serious implication for long-term survival of rhino population in Nepal.

There exists very limited information on impact of climate change on rhino population and adaption measures needed for its long-term conservation. Based on available information, the rhino population in Nepal seems to be highly vulnerable to climate change as its exposure to climate change related risk is high and adaptive capability to moderate the associated risk is low. In this context, immediate management intervention is required to assist this mega herbivore to adapt under predicted impact of climate change. However, there could be multiple impacts of climate change on rhino population; drastic decline of suitable rhino habitat from severe drought has been identified as the most serious risk resulted from climate change.

The ultimate goal of adaptation planning for rhino population is to complement the ongoing rhino conservation initiatives for maintaining viable rhino population in Nepal. The expected outcome of this adaptation planning is to ensure adequate suitable habitat for the rhino population in Nepal in the context of likely adverse impact of climate change. In order to achieve this outcome, at least 10 % of the park area will be restored and maintained as suitable rhino habitat by 2020.

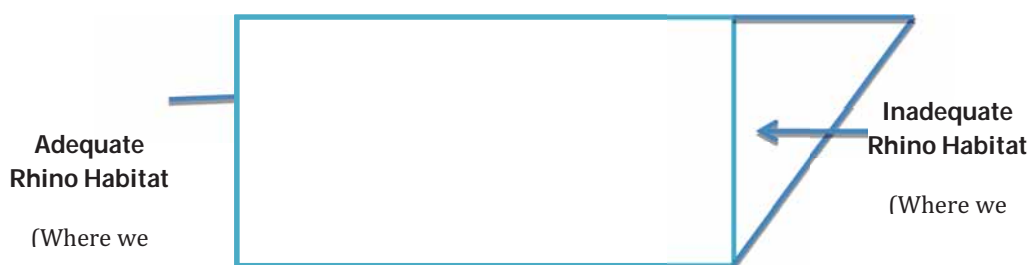


Figure 3. Diagrammatic representation of current and desired condition related to rhino habitat in Chitwan National Park Nepal

The adaptation strategies to climate change demand integrated approaches, both within and between the natural ecosystem and the socio-economic system (Gurung and Bhandari, 2009). In order to enhance resilience of rhino population in Chitwan National Park, combinations of adaptation measures should be applied. Among four broad categories of adaptation measures, loss prevention and relocation seems to be applicable for adaptation planning of rhino population based on the available information so far. In addition, loss sharing and behaviour modification strategies could be developed to moderate harm to local community especially through diversification of livelihood options apart from rhino-based tourism.

LOSS PREVENTION

Loss prevention refers to the actions taken for reducing vulnerability to climate change. The system which is less sensitive to climate and able to adapt the changes is likely to be less vulnerable to impacts of climate change. Thus, increase in sensitivity and exposure increases the vulnerability whereas an increase in adaptive capacity will reduce the vulnerability of the system (Nair and Bharat, 2011). The following management actions for active habitat management are proposed, as rhino population is vulnerable mainly due to habitat shrinkage.

- ✓ Restoration of at least 5 km² of grassland annually by removing woody species selecting most suitable sites
- ✓ Develop and maintain fire lines in prime rhino habitats in order to avoid accidental fire especially in grasslands
- ✓ Management of wetlands and maintaining at least one waterhole within 2kmX2km grid in suitable rhino habitat
- ✓ Removal of invasive species (*Mikania mikarantha*) from at least 5 km² of grassland and riverine habitat
- ✓ Regular monitoring of habitat dynamics and habitat use pattern by rhino especially in the newly restored habitats

RELOCATION

Relocation involves moving vulnerable population or systems away from areas prone to hazards. Numbers of rhinos have been translocated to Bardia National Park to establish new viable breeding population especially to protect this species from likely catastrophic events such as natural calamities and epidemics (DNPWC, 2012). However, there are less than 30 rhinos in Bardia, which is not a viable population. Thus, supplementation and management of this new population would be one of the adaptation measures to minimize vulnerability to rhino population likely to arise from climate change.

INVOLVEMENT OF STAKEHOLDERS

Stakeholders' involvement is vital in climate change adaptation planning as it is the stakeholders who will be most affected from the adverse impact of climate change and they may need to adapt (IPCC, 2007). Identification and engagement of relevant

community of interests in adaptation planning is key to success as stakeholders contribute in the process through the skills and knowledge they have. Meaningful involvement of stakeholders ensures better understanding of nature and extent of risk and vulnerabilities through the amalgam of scientific, technical and factual information with local traditional knowledge and experience. Thus, stakeholders can develop adaptation strategies and measures through shared knowledge and experience, which is likely to be socially, economically, environmentally as well as culturally appropriate (CIP, 2013).

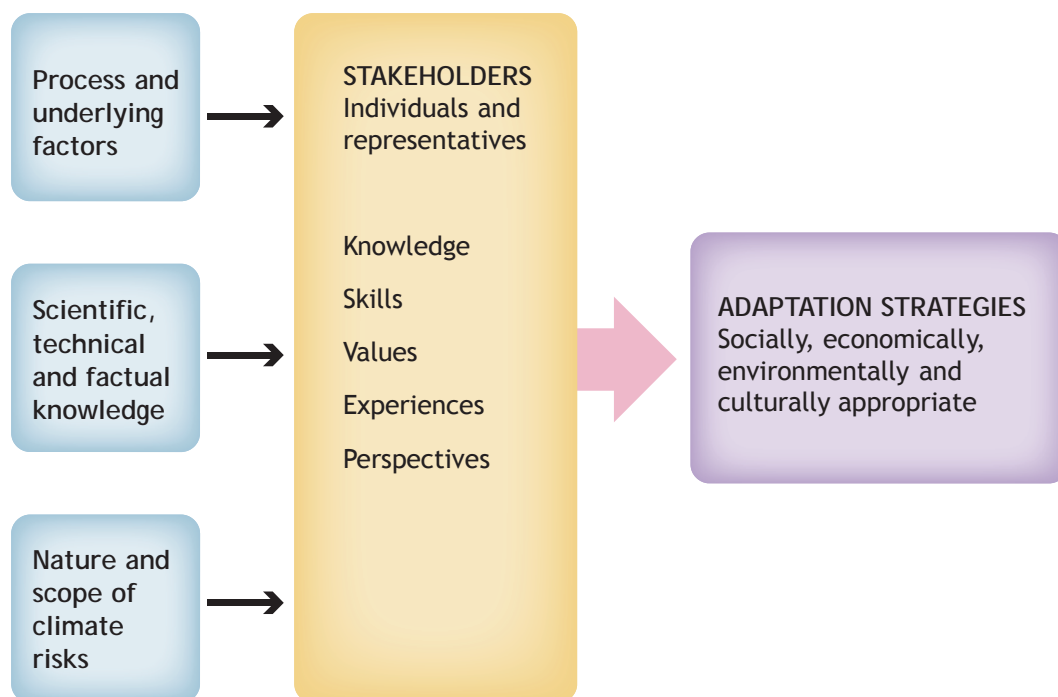


Figure 4. Involvement of stakeholders in the adaptation process

Source: http://www.ukcip.org.uk/wordpress/wp-content/PDFs/ID_Adapt_options.pdf

In the context of climate change, stakeholders refers to individuals or groups of people who are likely to be affected either by climate change or by the measures taken to moderate anticipated harm (IPCC, 2007). Thus, key stakeholders who should be consulted for climate change adaptation planning are policy-makers, managers, scientific community, local communities and interest groups. For developing adaptation plan for rhino population in Nepal involvement of Department of National Parks and Wildlife Conservation and Ministry of Forests and Soil Conservation as decision making institution is crucial. Likewise, experts in biodiversity sector and

conservation partners are vital from conservation community sector. Local people living around Chitwan National Park and individuals involved in wildlife-based tourism entrepreneurs the group of people who are most likely to be affected by impact of climate change on rhino population. Thus, their meaningful participation in adaptation planning of rhino population is very important.

FURTHER RESEARCH

Climate change is expected to have impact on ecosystem and biodiversity, but the impact of climate change on ecosystem and species is still poorly understood. Likewise, changes in population of wildlife species are poorly documented with few exceptions (Sukumar, 2000). Nepal falls under "white spot" because of the limited number of scientific studies conducted in this region (IPCC, 2007). It is imperative to acquire more comprehensive knowledge on likely impacts of climate change for the adaptation planning to be effective. There is clear lack of information on climate change and its impact on rhino population and potential measures to moderate harm. In order to develop more comprehensive and practical adaptation plan for Rhino population in Nepal, there is a need of scientific study related to risk and vulnerabilities of climate change in Chitwan National Park in general and impact of climate change on rhino population in Nepal in particular.

CONCLUSION

Climate change is a wicked problem, which is likely to continue affecting every walk of life on earth. National Adaptation Plan of Action in Nepal prepared in 2010 recognizes that climate will be uncertain and vulnerability will continue to increase in Nepal. Rhino population in Nepal is highly vulnerable to the likely impacts of climate change particularly due to serious decline in suitable habitat caused by multiple factors. Thus, there is a need of adaptation strategy to build resilience and reduce vulnerability to the rhino population. This plan has identified restoration and management of adequate suitable habitat as a key adaptation measures for rhino population in Nepal. Scientific research on relationship between climate change and rhino population and potential adaptation measures is recommended, as there is lack of information to develop comprehensive adaptation plan. Moreover, stakeholders' engagement in adaptation planning is essential to devise socially, economically, environmentally and culturally appropriate adaptation strategies and measures for rhino population in Nepal.

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