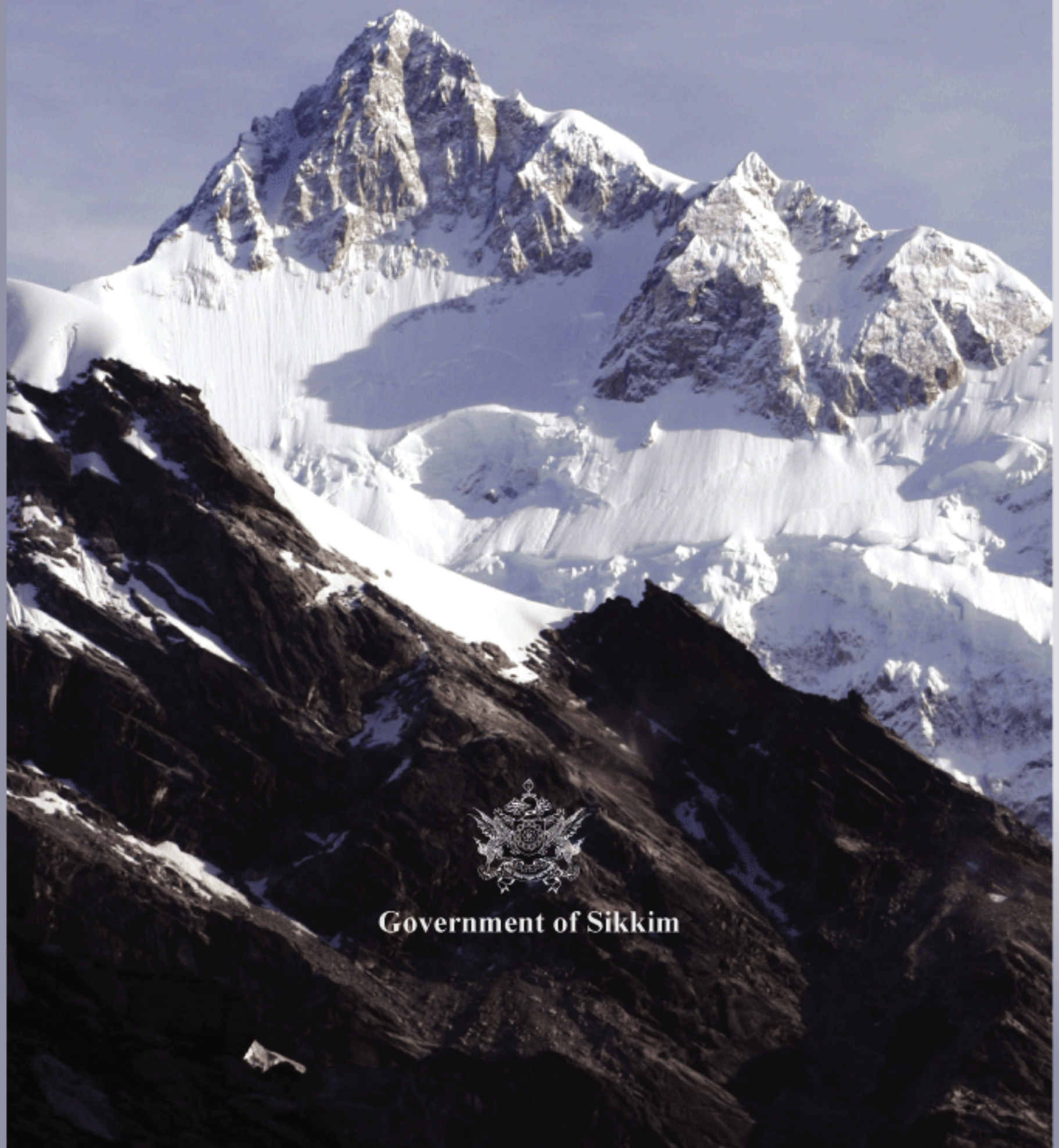
Climate Change in Sikkim

Patterns, Impacts and Initiatives



Government of Sikkim

Introduction

Climate change is emerging as a new challenge that governments have to address effectively. Climate change discussions which were earlier restricted to academic circles are now taking place amongst farmer's clubs, elected representatives, development institutions and donor agencies. Mountain regions are facing accelerating climate change, thereby adversely impacting ecosystems services, biodiversity elements and livelihood security. Mountain ecosystems due to their sensitive and fragile nature act as a laboratory where the impacts of climate change get amplified and can be studied closely and understood better. Impacts on mountain ecosystems are diverse and include receding glaciers, reduced snowfall, frequent natural hazards, higher surface runoff and soil erosion and declining dry season base-flow of rivers, streams and springs. Biodiversity gets affected due to phenology changes, reduced food availability in the wild, forest fires, degradation in habitat quality and even extinction. Also livelihood security gets compromised due to reduced productivity, water shortage, increased pest attacks, weed infestation and depredation by wildlife.

The strategy to combat climate change impacts will involve a greater use of science in decision making, new multi-sectoral institutional mechanisms and innovative use of financial resources. Rural areas where livelihoods are sensitive need to be addressed first. The Chief Minister of Sikkim – Shri Pawan Chamling has been sensitive to this emerging threat and proactive steps are already underway to mainstream climate change adaptation in the development planning of the State. Scientific studies, adaptation programs, multi-sectoral institutional mechanisms and village consultations have been organized to better understand and tackle this threat. The State Government has initiated a number of scientific studies to better understand climate change in the local context, established institutional mechanisms for implementing multi-sectoral programs, undertaken resource survey of water sources, taken up large-scale construction of water storage tanks at household and community level, initiated revival of springs, streams and lakes, expanded the network of minor irrigation channels and torrent control measures, ensured universal sanitation, strengthened the last mile delivery of social assistance and safety net programs, undertaken climate change related vulnerability assessments at Gram Panchayat level, launched the State Green Mission, the Sikkim Organic Mission and the Ten Minutes to Earth annual programme. Also the State Action Plan for Climate Change has been prepared after detailed multi-stakeholder consultations.

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Editors
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Gangtok

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Front cover: Mt. Khangchendzonga, the third highest peak in the world (8,598 m) dominates the Sikkim landscape and is regarded as the guardian deity

Front spread: Semi-frozen Sungmoteng Tso glacial lake (also known as Samiti lake) in the Khangchendzonga National Park. There are more than 500 lakes in the state which provide vital ecosystem services and a few also serve as favourite tourist destinations

Inner before title: Gochela Peak, adjacent to Mt. Khangchendzonga is a favoured high altitude trekking destination

Back cover: Mountain women have traditional knowledge to adapt to changing climatic conditions

Back inner: The Teesta river has carved out a gorge and along with its tributaries provides vital hydrological, recreational, economic and ecosystem functions

Back spread: *Rhododendron campylocarpum* - Sikkim is home to as many as 38 species of Rhododendrons, many of which occur in the alpine zone and are sensitive to changes in climate

Disclaimer: The views and information provided by the various authors in this book are entirely their own and do not necessarily reflect the views of the Government of Sikkim

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Pawan Chamling
(Honoris Causa)
Chief Minister of Sikkim

FOREWORD

Climate change is emerging as a new challenge that governments have to address effectively. Mountain regions are facing accelerating climate change, thereby adversely impacting ecosystems services, biodiversity elements and livelihood security. Mountain ecosystems due to their sensitive and fragile nature act as a laboratory where the impacts of climate change get amplified and can be studied closely and understood better. Impacts on mountain ecosystems are diverse and include receding glaciers, reduced snowfall, frequent natural hazards, higher surface runoff and soil erosion and declining lean season base-flow of rivers, streams and springs. Biodiversity gets affected due to phenology changes, reduced food availability in the wild, forest fires, degradation in habitat quality and even extinction. Also, livelihood security gets compromised due to reduced productivity, water shortage, increased pest attacks, weed infestation and depredation by wildlife.

The strategy to combat climate change impacts will involve a greater use of science in decision making, new multi-sectoral institutional mechanisms and innovative use of financial resources. Rural areas where livelihoods are sensitive need to be addressed first. Activities related to conserving springs, streams and lakes, supplementing recharge of underground aquifers and better water storage infrastructure need to be prioritized. The rainwater harvesting potential of forest lands needs to be fully utilized and wider opportunities for non-farm employment need to be provided in rural areas.

We have initiated a number of scientific studies to better understand climate change in the local context, established institutional mechanisms for implementing multi-sectoral programs, undertaken resource survey of water sources, taken up large-scale construction of water storage tanks at household and community level, initiated revival of springs, streams and lakes, expanded the network of minor irrigation channels and torrent control measures, ensured universal sanitation, strengthened the last mile delivery of social assistance and safety net programs, undertaken climate change related vulnerability assessment at Gram Panchayat level, launched the State Green Mission, the Sikkim Organic Mission and the Ten Minutes to Earth annual programme. Also the State Action Plan for Climate Change has been prepared after detailed multi-stakeholder consultations.

Our rich mountain ecosystems, glaciers, lakes and forests are all held sacred and revered as a sacred landscape by our people. My Government has been sensitive to the challenges that are impacting these systems due to global warming and climate change. We are conscious and alert to the fact that these mountains and forests are a water reservoir for not only our people but also our countrymen across in the plains.

This book contains articles detailing the patterns of climate change, signals and indications, impacts on livelihoods, ecosystems and biodiversity and vulnerability and adaptation experiments. I am confident that this book will help to highlight this important global issue. At a time when consensus in the global climate change debate is still awaited, nations and states should not miss the opportunity to act locally and effectively to safeguard the long term interests of their citizens.

Dated: 1st August 2012

(Pawan Chamling)

PREFACE

The Himalayas are under impact of rapid climate change, adversely impacting the mountain ecosystems, rich biodiversity and sensitive livelihoods. Being a new, external threat, local communities are also not fully prepared to combat and adapt satisfactorily. Studies of long term weather data indicate that climate change in Sikkim is manifested in the form of reduction in the temporal spread of rainfall, rise in its intensity and frequent winters droughts. Nights have become warmer and days cooler, with increase in the minimum and decrease in maximum temperatures. Major environmental impacts are manifested in the form of receding glaciers, declining lean season base flow of rivers, streams and springs, higher surface runoff, reduced groundwater recharge, ascending and more frequent forest fires, upward shifting of tree line and snow line, shortages in food availability in the wild, increased man-animal conflicts and disturbed phenology of flowering and fruiting.

Climate change discussions which were earlier restricted to academic circles are now taking place amongst farmer's clubs, elected representatives, development institutions and donor agencies. Mountain farming is facing higher risk due to declining productivity of cash crops, long winter droughts, difficulty in seed storage and increased pest attacks. Also farmers have to cope with a higher frequency of extreme weather events like hailstorms, landslides and flash floods. Consequently, the production of important cash crops like large cardamom, ginger, orange and fruits has declined, while crops such as maize, broom grass and turmeric are found to be more resilient. Local communities are coping by improving the water storage infrastructure and storing spring water overnight in tanks and containers. Crop residue is being stored for use as winter fodder for livestock and seed bank expanded and new preservation methods tried out. There is now a greater participation in off-farm employment opportunities in rural areas.

The Chief Minister of Sikkim – Shri Pawan Chamling has been sensitive to this emerging threat and proactive steps are already underway to mainstream climate change adaptation in the development planning of the State. Scientific studies, adaptation programs, multi-sectoral institutional mechanisms and village consultations have been organized to better understand and tackle this threat. The State has taken several pioneering steps in the field of climate change:

- Identifying a nodal department for climate change and setting up of the Sikkim State Council of Climate Change for providing policy direction for effective implementation of various climate change programs.

- Constituting the glacier and climate change commission under the aegis of which several studies have been taken up in collaboration with various Central Government institutes. To better understand the climate change impacts, the state has proactively taken up studies in collaboration with national institutions on glaciers and different aspects of climate change. Studies related to wetland mapping, snow cover mapping, forest fire impacts have also been taken up.

- The State Action Plan on Climate Change has been prepared after detailed multi-sectoral consultations and village PRAs in consonance with the National Action Plan on Climate Change and is currently under review by the Ministry of Environment and Forests, Government of India.

- Sikkim is the first state to complete a pan-state, micro-level climate change related vulnerability assessment of the rural communities at the Gram Panchayat level. This study found that the subtropical villages (less

than 1000m) especially in the drought prone zone are more vulnerable due to an increased outbreak of pest, disease and weeds. Spring water sources are drying up and preservation of seeds during the warm winter is becoming risky. A high variation was found in the sensitivity and adaptive capacity due to the diverse developmental profile of the villages. Hence while climate change adaptation related developmental interventions need to have a diverse sectoral profile, however they must geographically target areas with specific interventions.

- Mountain springs emanating naturally from unconfined aquifers are the primary source of water for the rural households in the Himalayan region. With impacts of climate change, manifested in the form of rising temperatures, rise in rainfall intensity, reduction in its temporal spread and a marked decline in winter rain, the problem of dying springs is being increasingly felt across this region. The lean period (mar-may) discharge is perceived to have declined by nearly 50% in drought prone areas and 35% in other areas over the last decade. Action research has been initiated to revive dying springs, streams and lakes under the *dhara vikas* initiative using rainwater harvesting and geohydrology techniques and is showing encouraging results.

This book which has been packaged as an academic coffee-table book is second in the series after *Biodiversity of Sikkim*, and is a compilation of a diverse set of articles from eminent scholar and academicians. The articles include patterns of climate change, signals and indications, historical perspective, impacts of climate change on forests, glaciers, lakes, environment, flora, fauna, agro-biodiversity, indigenous livelihoods, vulnerability assessment, adaptation experiments and initiatives which are being up-scaled and mainstreamed in the ongoing development programs.

Most of the photographs have been contributed by the authors themselves, and the photo credits have been explicitly indicated only when others have done so. The synthesis article has been authored by renowned biodiversity expert - Dr. Kamaljit S. Bawa, Distinguished Professor at the Massachusetts Institute of Technology, Boston, USA. The whole book has also been made available online at the official website of the forest department - www.sikenvis.nic.in/climate-change-in-sikkim.

We are thankful to the Secretary, Information and Public Relations Department and the Chief Minister's Office for all assistance and cooperation provided in bringing out this publication. We would like to express our heartfelt thanks to all those who selflessly contributed in the making of this publication. This effort would have served its purpose if it brings about a clearer understanding of the global issue of climate change, which is emerging as the single biggest challenge for mankind.

Editors
M. L. Arrawatia, IFS (Retd.)
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Place: Gangtok
Date: 30th July, 2012

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