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Sangam Shrestha



Climate Change Impacts and Adaptation in Water Resources and Water Use Sectors

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Sangam Shrestha
Water Engineering and Management
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Foreword

The threat to sustainability of water resources—one of the most vital of all natural resources—is becoming more and more severe by the day, caused by a variety of anthropogenic activities and natural phenomena. There is a growing body of literature which suggests that this threat will further intensify under the effects of climate change. Recent research reveals that even if all emissions were stopped now, future climate will still be warmer than the pre-Industrial Revolution levels because the greenhouse gases already emitted are likely to persist in the atmosphere for thousands of years. Hence, understanding the potential impacts of climate change on water resources and water use sectors, and developing appropriate adaptation options is the need of the hour.

This book, *Climate Change Impacts and Adaptation in Water Resources and Water Use Sectors*, provides in-depth and comprehensive knowledge about various techniques to analyze the impact of climate change on water resources using contemporary climate and hydrological models. Further, through the use of case (research) studies, a step-by-step procedure has been illustrated to evaluate the impacts of climate change on water resources and selected water use sectors like agriculture. The level of details provided for each case study will provide readers with enough insight to replicate this work in diverse settings. Additionally, useful information can be obtained on developing adaptation options in selected water use sectors in order to counter the effects of climate change.

The author, Sangam Shrestha, has considerable research experience in climate change impact assessment and adaptation in the water sector in South and Southeast Asia, particularly on hydrology; crop production; and evaluating adaptation measure to offset the negative impacts. Apart from holding a faculty position at the Asian Institute of Technology (AIT), he is also a Research Fellow at the Institute for Global Environmental Strategies (IGES), Japan. Climate change adaptation in the water sector is a key area of scientific and policy research at IGES, and over the years significant strides have been made by the institute in informing judicious

decision support tools to foster the sustainability of water resources in the region and beyond. At IGES we hope to work as an “agent of change,” facilitating the transition to a sustainable society and improving the well-being of people in the region.

This book is an excellent resource for students, researchers, and water managers. Further, the implications of the outcomes of the various case studies will be of particular interest to decision and policy makers. The importance, and need, of an effective water management system in the existing times cannot be overstated, particularly in Southeast Asia which, among the regions in the world, is one of the most vulnerable to the impacts of climate change. This book can be a useful tool for addressing this imminent need.



Hideyuki Mori
President
Institute for Global Environmental Strategies



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About the Author



Dr. Sangam Shrestha is an Assistant Professor of Water Engineering and Management at Asian Institute of Technology (AIT), Thailand. He is also a Visiting Faculty of University of Yamanashi, Japan and Research Fellow of Institute for Global Environmental Strategies (IGES), Japan. His research interests are within the field of hydrology and water resources including the climate change impact assessment and adaptation on water sector, water footprint assessment, and groundwater assessment and management.

After completing his Ph.D., Dr. Shrestha continued his postdoctoral research in the GCOE project of University of Yamanashi in Japan until 2007 where he was involved in development and application of material circulation model and groundwater research in the Kathmandu Valley. He then worked as a policy researcher at Institute for Global Environmental Strategies (IGES) where he was actively involved in research and outreach activities related to water and climate change adaptation and groundwater management in Asian cities. Dr. Shrestha has published more than two dozen peer-reviewed international journal articles and presented more than three dozen conference papers ranging from hydrological modeling to climate change adaptation in the water sector. His recent publication includes “Kathmandu Valley Groundwater Outlook” and “Climate Change and Water Resources.”

His present work responsibilities in AIT include delivering lectures at the post-graduate and undergraduate levels, supervising research to postgraduate students, and providing consulting services on water-related issues to government and donor agencies and research institutions. He has been conducting several projects related to water resources management, climate change impacts, and adaptation being awarded from International organizations such as APN, CIDA, EU, FAO, IFS, IGES, UNEP, and UNESCO.

Abbreviations

ADB	Asian Development Bank
APN	Asia-Pacific Network for Global Change
AR5	Fifth Assessment Report
Cal	Calibration
CDC	Canopy Decline Coefficient
CGC	Canopy Growth Coefficient
CICS	Canadian Institute for Climate Studies
CV	Coefficient of Variation
DAT	Days After Transplanting
DEM	Digital Elevation Model
DHI	Danish Hydraulic Institute
ECHAM5	European Centre-Hamburg Model Version 5
EI	Efficiency Index
EV	Extreme Value
FAO	Food and Agriculture Organization
FC	Field Capacity
GCM	General Circulation Model
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
HadCM3	Hadley Centre Coupled Model Version 3
HEC-HMS	Hydrologic Engineering Center's Hydrologic Modeling System
HRUs	Hydrological Response Units
HYV	High Yielding Variety
IFPRI	International Food Policy Research Institute
IGBP	International Geosphere Biosphere Programme
IPCC	Intergovernmental Panel on Climate Change
IWR	Irrigation Water Requirement
MCM	Million Cubic Meters
MPI-OM	Max Planck Institute Ocean Model
NAM	Nedbør-Afstrømnings-Model
NCEP	National Centers for Environmental Prediction