

# Preface

Individually, each of the three issues of this book, water security, climate change and sustainable development, is a difficult, complex and somewhat challenging subject. Academics and policy-makers may often differ with each other as to even the definitions of each of the topics, let alone their implications and ramifications. Thus, and not surprisingly, when these three topics are combined together, their complexities, uncertainties and intricacies multiply by several orders of magnitude.

The fact is, in the real world, irrespective of how each of these three issues are defined, or how they interrelate and interact with each other with numerous known and unknown feedback loops, from a development-related policy perspective they have to be viewed, considered and analysed together. The danger is if each of these three topics is considered independently for formulation of appropriate policy responses, they may have negative implications on the other two issues. This could, for the most part, ensure that the impacts of the pursued policies on the society and the environment as a whole would most likely be sub-optimal, and in many cases even negative over the medium to long terms.

Water security, climate change and sustainable development are closely inter-related and, though difficult and challenging it may be to consider them together, we really have no other choice. Thus, this is a concerted attempt to consider them together from multi-sectoral, multidisciplinary, and multi-issues perspectives.

The book is based on the papers that were presented during an international seminar on the topic during the Vibrant Gujarat Investors' Summit, in Gandhinagar, in January 2015. All the authors were specifically invited to outline their views and thinking on these related issues. Following intensive peer reviews, only the best papers presented were selected. These were then modified by the authors in line with the reviewers' comments. The Government of Gujarat, through its Water Supply and Sewerage Board and Gujarat and Narmada Valley Fertilizers and Chemicals Limited was the main host and organizer of the Seminar with the Third World Centre for Water Management as the main knowledge partner.

Gujarat accounts for 6 % of India's land mass and around 5 % of its population. The state now contributes to 7.6 % of India's GDP, and about 10 % national

employment, but a stunning 22 % of the country's total exports. Between 2001 and 2012, Gujarat had an average annual growth rate of 10 %, almost consistently well above India's GDP growth rates. Furthermore, in 1991, Gujarat was a seriously electricity deficient state. However, it is now a power surplus state. All its 18,000 villages have been electrified.

In terms of water security, Gujarat has not been so fortunate. It is situated in a very arid climate within the Asian monsoon belt. Historically, people of the state have suffered serious water scarcity in non-monsoon months. During drought periods, which have been quite frequent, the people have suffered from serious water shortages for drinking, as well as for agricultural and livestock uses. Migrations in search of water have been a recurrent phenomenon during dry summer periods, when social tensions have been quite prevalent, including even water-related riots.

Fortunately, with good water governance practices, and accelerated construction of a state-wide drinking water grid, most of the ravages of water shortages and social tensions of the past have now been basically eliminated.

The socio-economic and water-related developments of the recent past, laudable though they have been, do not guarantee similar levels of continued progress in the future. This is partly because the water regimes of the past appear to be changing, rapidly changing urbanization and development patterns in the state, and equally rapid evolution of global Indian conditions.

Consider climate. Globally, driven by continued economic and population growth rates, anthropogenic emissions are now higher than ever. Annual emission growth rates up to the year 2000 were 1.3 %. Since then, this has increased to 2.2 %. Such developments are changing climate patterns all over the world, including changes in inter-annual and intra-annual precipitations in different parts of the world. This, in turn, is impacting on river flows and groundwater recharge potentials, and thus water availability and use patterns which will undoubtedly impact upon the future water security conditions of the world.

Gujarat has not been immune to these changes. Current data indicate that the frequency of hot days is showing a gradually increasing trend. Furthermore, frequency of cold days seems to be decreasing. Ahmedabad, the largest city in Gujarat, with already over 6 million people, has had serious heat waves in the recent past. In May 2010, temperatures soared to 46.8 °C, which led to heat stress resulting in serious health problems, including deaths, of its citizens. Many have predicted that the temperature may increase by an additional 2 °C which would have serious health, economic and social implications. It is the first Indian city which formulated a heat action plan in 2013.

Climate change may also bring a rise in seawater levels. The average annual rise in mean sea level in Gujarat is estimated to be around 1.3 mm. This is important for the state since it has 1,600 km of coastline, the longest in any Indian state. Rising sea level is likely to increase salinity of groundwater which would affect both humans and ecosystems. A one-metre sea level rise is estimated to affect 14,149 km<sup>2</sup> of area, about 6 % of its coastal population. Higher sea surges in the future may further exacerbate water security problems.

There is no question that water security has to be an integral and essential component of Gujarat's future sustainable development plans. Climate change and subsequent erratic and unpredictable rainfall patterns will affect river flow regimes of the past and groundwater recharge rates. Since a reliable and assured water supply of appropriate quantities and qualities is an essential prerequisite for sustainable development, the interplay and interactions between water, climate change and sustainable development will dictate the future of Gujarat's socio-economic development, as it will in all other Indian states and other countries.

The situation will be especially difficult and complicated in Gujarat since people during the post-2000 period have got used to steadily improving water availability as well as standard of living. They expect the future to be a continuation of the same. It will be a challenging task to meet the people's expectations and aspirations with all the uncertainties imposed on by climate change and rapidly evolving Indian and global conditions.

Fortunately, water is a renewable resource, and with good and efficient management, it can be used and reused numerous times. In addition, in the coming years, there will most certainly be tremendous advances in science and technology as well as management practices to store, use and reuse water. The starting point for solutions to ensure global water security will have to come from strong and effective institutions, political will, appropriate pricing for all types of water uses, good education for all water uses and continuous scientific, technological and management innovations.

We are convinced that the world's water problems are solvable, even after considering the uncertain implications of climate change over space and time.

The contributors to this book come from different disciplines. They represent different sectors like academia, government, business, international organizations and media. All the contributors are leading figures in their fields. We are convinced that this book will make significant contributions to the ongoing global debates and discussions on how we can best link water security, climate change and sustainable development to ensure a bright global future.

And finally we would like to pay compliments to Honourable Chief Minister of Gujarat Smt. Anandiben Patel who not only graced the occasion but also found time from her extraordinarily busy schedule to meet the experts who attended this international Seminar. Due to dedication and support of her team of officers headed by Dr. Rajiv K. Gupta IAS we could organize such a high quality event. We would also like to express our appreciation to Ms. Thania Gomez of the Third World Centre for Water Management, Mexico, for all her work to finalize this book.

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