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BALANCING WATER FOR HUMAN AND NATURE: A VISION FOR SUSTAINABLE WATER FUTURE

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Abstract- Water separates our planet from all those we are aware of. While the worldwide supply of available freshwater is more than sufficient to meet all of our water demands, the spatial and temporal distributions of that supply are not. There are many regions where our freshwater resources are inadequate to meet domestic, economic development and environmental needs. In such regions, the lack of adequate clean water to meet human drinking water and sanitation needs is indeed a constraint on human health and productivity and hence on economic development as well as on the maintenance of a clean environment and healthy ecosystems. All of us involved in research must find ways to remove these constraints. We face multiple challenges in doing that, especially given a changing and uncertain future climate, and a rapidly growing population that is driving increased social and economic development, globalization, and urbanization. How best to meet these challenges requires research in all aspects of water management This paper identifies the issues facing water managers today and future research needed to better inform those who strive to create a more sustainable and desirable water future.

Keywords: Sustainable. Drought, Flood, Groundwater, Sanitation, Contamination, Globalization.

1. INTRODUCTION

Over a decade of worldwide water research has revealed the global scale of the water crisis and the involvement of humanity as a major influence on the global water cycle. According to mounting evidence, there will be no big trend reversals, and water problems will become more severe and pandemic. In the past, research has placed a greater emphasis on identifying issues than on identifying solutions. It is necessary to make a clear change in emphasis toward solutions-oriented methods. The next decade of research should be directed towards motivating a transition from knowledge-to-concrete action, and to find solutions through the co-production of knowledge involving scientists and stakeholders. This paper summarizes a blueprint for a Sustainable Water Future initiative, arguing for the necessity of a strong water programme in global change research. We provide specific suggestions on forming a strategic partnership of scientists, public stakeholders, decision-makers, engineers, researchers and the private sector to implement a reality-based, multi-perspective, and multi-scale knowledge-to-action water agenda.

2. SAVING WATER FOR A SUSTAINABLE FUTURE

Water is a priceless gift from nature to humanity; water makes life possible on Earth. Water scarcity is a problem in India and other countries, even though water covers three-quarters of the planet. Due to water scarcity, people teach us to save water and protect the environment, life and the world because of the difficulties faced by people in different areas. Water is the most important source of life on Earth because we need water to fulfill all the activities of life like drinking, eating, bathing, making clothes and producing crops. Without water pollution, we need to save water for the proper supply of water for the future generation. We must stop the waste of water, use the water properly and should maintain the quality of water. Clean water is affecting the lives of people in India and other countries of the world in many ways, and the lack of clean water is becoming a major problem. This big problem cannot be solved by the people alone or by a group of some groups, it is a problem for which people's efforts meet at the global level. Water-saving is becoming an important global issue as water demand increases, but water supply is likely to become less yet to be paid to population growth and climate change. Water maintenance in the urban residential sector is highly related to land use and development density, as well as other socioeconomic and behavioral characteristics of residents. Water conservation in the industrial sector has been the most successful partially because of financial incentives to reduce wastewater. Water conservation in the agricultural sector has been slow and has much room for improvement to save water through educational, economic, and policy incentives. Water conservation at one scale may not necessarily save water at another scale. Water is a crucial natural resource without which, there would be no life on Earth. However, 97 per cent of water is in the oceans which are salty and cannot be used for drinking purpose. Of the remaining 2.5 per cent that is fresh water, most is frozen in glaciers and polar ice caps. As a result, only less than 1 per cent of the Earth's water is available for drinking. Moreover, the Earth's water supply is fixed. Therefore, it is important to conserve and sustainably use it for the health of human society, life support systems and maintaining ecosystem services of the planet earth. In India, ensuring water security is a way to ensure food and nutritional security as well as economic security. The National Water Policy and the National Water Mission are all smart steps in this direction [1].

3. CURRENT AND FUTURE DIFFICULTIES IN WATER MANAGEMENT

3.1 Human Aspirations and the Limits of the Earth

Demographic, economic, and technological developments around the world have increased our potential to alter the environment we live in and that sustains us, both deliberately and unknowingly. Humans have emerged as the primary cause of environmental change. Our actions have an impact on the environment around us, especially the climate. This has an impact on the amount of precipitation that falls on watersheds, as well as the spatial and temporal distributions of that precipitation and the timing of its flow. We are modifying the quantity and quality of our freshwater resources that we rely on to thrive, both physically and economically, due to changes in landscapes, expansion in food and energy production, and the influx of people into urban areas. In the last 50 years or so we have come to recognize the movements in all Earth's layers, including the plates at the surface, the mantle and the core as well as the atmosphere and ocean. The momentum and acceleration of the impacts of business as usual threaten to tip the complex Earth System out of the environment in which everything living on this Earth has evolved and developed. Some call this new geological period the Anthropocene Crutzen, 2002; Williams et al., 2011[2][3].

The expansion in the production and supply of goods and services in the recent past has meant more jobs, income, and, generally, greater possibilities for a better life. It has also meant an increase in the use and pollution of natural resources. The adverse effects on water and other vital components of the Earth System are evident. Many river basins in the world are labeled as ''closed'' or are on the verge of being closed; their flows no longer reach the oceans Seckler, 1996; Gleick and Palaniappan, 2010[4][5][6]. An estimated 1.4 billion people live in closed basins Smakhtin, 2008 [7]. with more limited development options. The development of potential flood zones along rivers and coastlines has increased the incidence and impact of flood-related damages. According to the World Health Organization (WHO) 2007[8]. during the last decade of the last century about two billion people were victims of natural disasters, 85% of which were floods and droughts.

3.2 Stress of Fresh Water

Everyone is concerned about the possibility of water shortages in the face of rising, primarily population-driven, water needs, as well as the implications for our energy and food production. According to the World Economic Forum's Global Risk Perception Survey, which polled 900 well-known specialists, that water crises will have the greatest societal impact in the next ten years.

By 2050, the world will have to feed and provide energy for an additional 2–2.5 billion people as well as meet the current unsatisfied power needs of a billion. To meet the nutritional needs of this additional population, we should consider the amount of water that is consumed in the production of different goods and energy and food. Energy and food security are demands that are particularly critical to water managers. Energy production, water, food security, and climate change are all connected through interactions and feedbacks. For example, the growing, transportation, processing, and trading of food products require large amounts of water and energy. A complete analysis is provided by the Comprehensive Assessment of Water Management in Agriculture.

At the worldwide level, water is becoming a more important policy concern. The third United Nations World Water Development Report [United Nations World Water Assessment Programmed (UNWWAP),2009. Cautions, in an unprecedented manner, that the existing inequitable and unsustainable usage of water may have highly significant implications. Poor water management jeopardizes both economic progress and security. Hoff, *et al* 2011; World Economic Forum Water Initiative.

3.3 The Impact of Globalization on Water

Increasing globalization is motivating the implementation of new rules and procedures for the international trade of goods and services, reflecting the increasing influence of multinational firms engaged indirectly in water use and transfers. This globalization of trade has wide-ranging implications for consumers, governments, and the environment [Hoekstra and Chapagain, 2008][16].

The impact of globalization on water may be considered from two other perspectives: the negative effects on water of the growing integration of the world economy, in particular concerning water contamination and associated environmental degradation; and water itself as an object of global trade policies.

Water is different than many other natural resources that are traded because the costs of transport are very significant in comparison to the understated economic value of water and, perhaps more importantly, because of perceptions about the human right to water, and objections to the commodification of the resource [Gleick et al., 2002; Hoekstra and Chapagain, 2008].

3.4 Water for the Environment

Floods and droughts can have a substantial impact on the ecosystems of wetlands and forests. Cycles of droughts and floods are a natural part of ecosystems; they adjust to and are influenced by them. Natural ecosystems can be recharged by floods and their associated sediments, producing more abundant water and fertile soil for plants

(including food crops). Urbanization and other land use changes, poor agricultural practices, and industrialization are among those activities that can change water quantity and quality regimes in ecosystems, and hence adversely modify ecosystems [Palaniappan et al., 2010].

Today perhaps half of economically available freshwater is used to satisfy human demands—twice what it was only 35 years ago [Young et al., 1994][19]. We are not sure how much water must remain in our natural ecosystems to maintain them; many have already been destroyed by over withdrawals of water. However, there are signs that we are approaching the boundaries of how much water we can divert from them while still preserving their health and, by extension, ours. [Cosgrove and Rijsberman, 2000].

Fortunately, studies of the role of water in ecosystems are improving our ability to value it and to understand large scale, long-term ecosystem processes and the flows of water they require [Oki et al., 2006][22].

Scientists, engineers, managers, policy makers and stakeholders must work cooperatively together to identify and develop strategies to sustain largely ignored ecosystem values. A fundamental scientific challenge is to be able to specify the spatial and temporal scales needed to understand and manage for ecosystem resilience and sustainability. Focused effort on better articulating the relationships between flow regime, its alteration, and ecosystem dynamics is increasing rapidly [Arthington and Balcombe, 2010; Poff and Zimmerman, 2010]. but identifying the ‘‘bounds’’ on ecosystem sustainability [Postel and Richter, 2003; Richter, 2009] remains a research goal.

3.5 Management of Drought and Flood

The drought has many definitions, but mostly it originates from a deficiency of precipitation over an extended period, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration in a particular area, a condition often perceived as “normal”. It is also related to the timing (i.e., the principal season of the occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity. There can be Meteorological Drought (degree of dryness and the duration of the dry period), Agricultural Drought (links various characteristics of meteorological or hydrological drought to agricultural impacts), Hydrological Drought (associated with the effects of periods of precipitation shortfalls on surface or subsurface water supply), and Socio-economic Drought (associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought).

Some of the methods that may be suggested as technical strategies to mitigate the adversities of drought are mentioned below.

- Adding storage to the surface
- Preparing for a less reliable yield
- Eliminating evaporation losses in reservoirs
- Changes to a reservoir's sanctioned water or its discharges
- Conveyance losses are reduced; equitable distribution is achieved.
- Irrigation system maintenance Improved irrigation practises
- Irrigation timetables
- Pattern for cropping
- Use of surface and groundwater in tandem
- Development of watersheds
- Construction of massive storage facilities
- Linking smaller reservoirs to larger reservoirs

Flood management activities can be broadly classified into four major groups:

- 1. Attempts to modify the flood
- 2. Attempts to modify the susceptibility to flooding damage.
- 3. Attempts to modify the loss burden
- 4. Bearing the loss

All these measures for flood management can be classified as structural measures or non-structural measures. Broadly, all measures taken up under the activity of “Modifying the flood” which are in the nature of physical measures are “Structural measures”, while the others which are taken up as management tools without major construction activity are grouped as “Non-structural measures”.. The main thrust of the flood protection program undertaken in India so far has been in the nature of taking structural measures like:

- Flood walls, sea walls, and embankments
- Reservoirs and dams
- Natural detention basins
- Channel improvements

- Drainage improvements
- Flood water diversion
- The current trend in reducing flood losses is equally towards non-structural measures. The following are a few examples of such strategies. Floodplain management and zoning
- Floodproofing
- Flood forecasting and warning
- Floodplain management and zoning27.28

CONCLUSION

We are the only species capable of reflecting on and changing our behavior in order to protect our health, economic, and social well-being. Our fundamental challenge in this century is to provide healthy and fulfilling livelihoods for all of humanity. A localized water management approach is need of the hour. It should empower village and neighborhood communities and build their capacity to manage, allocate and value their water resources. Any 21st century water policy must factor in the concept of the value of water. It is going to require all of us as a society to identify, through research, develop, through engineering and science, and implement, through governance, the technological, economic, political, and social measures that will set a course toward the achievement of a desirable and more sustainable and secure future Research will always be needed to identify and evaluate the impacts of alternative paths toward this future, and the tradeoffs that will be inevitable given our multiple, and not always compatible, dreams or goals.

They would do well to be inspired by the Vision of the American Society of Civil Engineers whose members see themselves as: ‘‘Entrusted by society to create a sustainable world and enhance the global quality of life, civil engineers serve competently, collaboratively, and ethically as

- Master planners, designers, builders, and operators of the built environment, society's economic and social engine.
- Stewards of the natural environment and its resources.
- Innovators and integrators of ideas and technology across the public, private, and academic sectors.
- Managers of risk and uncertainty caused by natural events, accidents, and other threats; and
- leaders in discussions and decisions shaping public environmental and infrastructure policy.

The fundamental issue facing everyone is how to reconcile our desires for all of us on this globe to have a good life with the constraints imposed by the availability of a renewable, but limited, water resource. It can be done.

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