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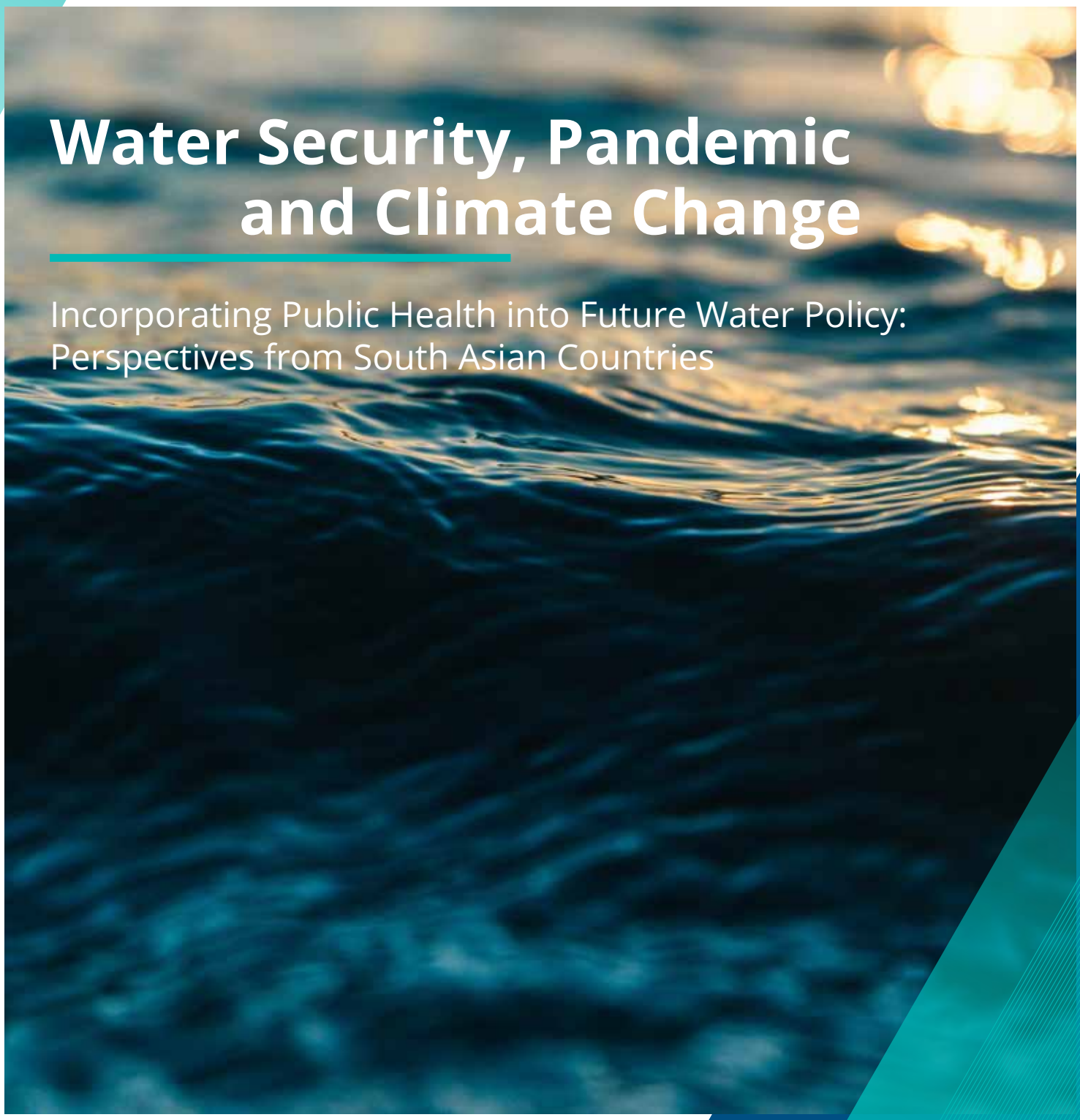

Water Security, Pandemic and Climate Change

Incorporating Public Health into Future Water Policy: Perspectives from South Asian Countries

CONSORTIUM OF SOUTH ASIAN THINK TANKS

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BRIDGING POLICY RESEARCH IN SOUTH ASIA

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Foreword

Water security has already become a major concern for South Asia. For the most part, the issue does not lie in the lack of supply itself but in hygiene and accessibility. The pandemic this year exposed plenty of new challenges to the world and particularly to developing regions like South Asia. Although South Asian governments recognise the importance of the linkage between clean water supply and public health, such consideration is often restricted to minor local outbreaks. As the region realises from the current pandemic that public health and water security go hand in hand with each other and neither of the two can be dealt with a vacuum, South Asian countries are finally incorporating public health factor into their water policies.

It is one thing to design water management strategy, quite another to implement it. Countries in South Asia are facing various types of hurdles when it comes to implementation: from lack of infrastructure to complex water governance, especially considering the unique circumstances – ranging from the mountains of Afghanistan to the sea of the Maldives. Moreover, the current pandemic raises public attention to gain access to WASH facilities and better water quality, meaning that it is no longer sufficient to merely supply water to the population. All these will certainly raise the bar on achieving regional water security, but will also provide the necessary public support for investment in these essential but oft-neglected water infrastructures in the long run.

We, the Regional Project Energy Security and Climate Change Asia-Pacific of the Konrad-Adenauer-Stiftung e. V. and the Consortium of South Asian Think Tanks, launched this study on how pandemic influences water security and a likely prognosis of future water policy in South Asia. This publication is a collection of well-argued papers from experts from Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka.

We wish you an interesting read.

Dr. Nishchal N. Pandey
Director, CSAS

Dr. Christian Hübner
Director, KAS RECAP

Executive Summary

South Asia, in general, is not a region that physically lacks water supply. Nonetheless, water security has already become a serious problem, and this has a massive influence on public health and vice versa. The COVID-19 pandemic this year has exposed the crucial but oft-neglected need to incorporate public health factors into water policy. Although some countries are struggling to contain the spread of the virus, others are achieving success in doing so, and water security is found to be one of the contributing factors.

This report aims to explore the dynamics between public health and water security under the context of the COVID-19 pandemic in all eight South Asian countries: Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka.

Experts from these countries have been asked what the current and future situations are in relation to water security and the pandemic, and how the pandemic reveals the relation and dynamic between water security and public health. The data displayed in this publication are until late August.

There were common issues throughout South Asia in regard to current water policies that led to increased difficulty in containing the spread, such as:

- *The lack of reliable water access forces the public to use communal facilities for drinking water and basic hygiene, which causes social distancing and self-isolation to be nigh on impossible to implement and in turn increases the risk of spreading the virus.*
- *Water pollution is still a serious issue because of the limited sewerage system which makes water unsafe to drink albeit that the public has access to it. This causes other water-borne diseases to continue to be prevalent and threatening in the midst of the pandemic and thus diversify countries' effort to fight against COVID-19.*
- *Due to poor sanitation access, open defecation is still a common practice in rural parts of South Asia. This poses another threat of spreading diseases and pollution of water sources.*

Even though South Asian countries had a difficult situation regarding water security before the pandemic and has formulated various water policies and reforms to ameliorate this, implementation has proven to be equally challenging. Here are the common factors:

- *As of late, water governance in South Asia is generally conducted via a piecemeal approach, functionally or geographically, meaning that there is no clear mandate or institution with the authority to deal with everything related to water. This creates overlapping responsibilities and implementation of a consolidated approach to water management arduous.*
- *The absence of a national-wide Master Plan regarding water management causes inconsistency in approach as well as unsystematic water infrastructure development.*

Table of Contents

1 Afghanistan

Author: Hamidullah Arefi

Introduction

Water is one of the most basic elements of life. No country can maintain economic, social and political stability sans water resources. Without attention to water resources, the security of future generations in terms of water and food will be uncertain and with this fear, sustainable development will be impossible. Developed countries prioritize water management in their working affairs and are not unaware of its importance. Industry and economic growth as well as well-being of life are inextricably linked to a country's water resources.

Afghanistan, however, is one of the countries where about 80 per cent of its people make a living through agriculture. The growth of industry and self-sufficiency in electricity, which is linked to water resources, is still not in good shape. As a landlocked country, Afghanistan has continental dry climate. Afghan farmers attribute their crop harvest to the associated rainfalls each year. Agriculture is not possible without water, but agricultural lands are often not beside the rivers.

Afghan farmers used to look up to the sky or dig wells in dry years, however there is evidence that wells were not dependable for agricultural purposes. They are also drying up in a very short period of time. Meanwhile, safe drinking water is also not available to the majority people in the war-torn country. Hence, water management crisis in Afghanistan has caused economic instability and impacted stability and security.

The crisis of groundwater shortages in the capital Kabul has become one of the major problems. The digging of deep and arbitrary wells has put the city at serious risk of water shortages. In other provinces of the country, there is no regular system for the proper use of

water resources. In such a situation, Afghanistan is still thirsty, despite possessing five water basins and enough fresh water. As per researchers, Afghanistan, with 57 billion cubic metres of water per year, uses only 30 per cent and rest 70 per cent flows to neighbouring countries.

Besides, climate change has been another contributing factor in recent years to adversely affect the water resource, primarily rivers. A number of the country's provinces are witnessing unprecedented flash floods and rainfall while most of the country's rivers have changed their patterns and temperatures have increased in the Northern provinces. Few studies related to climate change have been conducted in Afghanistan. But review of the historical trends of rainfall, groundswells, glaciers, stream flow, and snowpack will be helpful for implementing local applications for the future.

This article is, therefore, itself a pioneering study about a nation reeling under decades of conflict. It will help scientific communities, to have some information about the current water resource conditions, water security and scarcity, pandemic and public health in Afghanistan.

Water Security

Various factors have contributed to the current water management crisis in Afghanistan, the most important of which are insecurity, lack of investment, lack of specialized and experienced manpower, non-implementation of laws and regulations, dependence on foreign investments and most importantly the reluctance of government officials to draw up water agreements with neighbours.

In Afghansitan, water-related issues are always addressed through formal and informal means in urban and rural areas. In rural areas, people often prefer tribal means to address their water disputes and they refer to local village water masters, also known as Mirabs, whom they respect the most to settle their issues. However, on many occasions, water disputes and irrigation of the agricultural lands in remote areas have led to tension and enmity between various tribes.

Afghan government introduced "Water Law" in 2009 to help establish river basin management system as well as to address water crisis in the country, evolving ministries and independent directorates. The government also established the National Water Affairs Regulation Authority in 2019, to help improve the country's physical water-related infrastructure. But the Water Regulation Authority could not implement the water-related laws and regulations and failed to win people's trust in most of the areas. Since the country has been badly hit by insecurity arising from terrorist activities, most of the districts or rural villages have remained out the development programmes. The central government too has been largely unable to address people's problems. This is the reason that people often prefer tribal laws and regulations over the government one.

In addition, wide-spread corruption and general distrust on the country's judiciary are the main reasons behind the non-implementation of the formal laws in the country. The villagers mostly seek the Mirab's guidance and assistance with regards to their water-related issues. However villagers nowadays complain also about Mirabs, saying they too are corrupt and cannot stand against the warlords. The Taliban too has been preventing people from referring to the judiciary and justice organs, instead they have set up their own local courts, in a bid to weaken the government's influence in tribal areas.

In an incident in southern Uruzgan province, Taliban fighters prevented flow of water to agricultural lands, as a tool to force local people to obey their rules. Farmers incurred economic loses with the group's such move.

Meanwhile due to imposed war in the last four decades, Afghansitan could not establish or construct dams as well as utilize its water

resources. In recent years, since the Afghan government started to construct dams and manage its rivers, tension has risen with neighbouring Iran and Pakistan, wherein the leaders of these countries made harsh comments against Afghan leaders. To achieve economic development through better water management, Afghanistan needs Treaties and agreements on hydro resources with its neighbours.

But it is easier said than done. Afghanistan's neighbours fear that building dams would dry up their rivers one day. Pakistan has time and again prevented construction of dams on Kunar river in the east, believing that their territory would be dry if there is a dam from the Afghan side. Reaching a negotiated agreement over water distribution policies is the need of the hour. Therefore, it needs to be underscored that to achieve the goal of better water management, it is necessary to establish effective communication and coordination between different users at the local, regional and national levels.

In addition, there is also a need to establish mechanisms for consultation, regulation, mediation and dispute resolution. In this regard, the Afghan High Council for Land, Water and Environment has a key role to play and needs to consider water management-related activities within the framework of the National Water Strategy. It goes without saying that Afghan government should do more to implement the Water Law in all the basins. Relying on traditional and local way of addressing water-related issues, may have some outputs, but lacks transparency and would prevent implementation of the formal laws, which were codified in accordance to international standards.

Water Scarcity

According to the United Nations, water scarcity is the main reason for internal displacement in war-torn Afghanistan. There are estimated 1.5 million people, approximately four per cent of the overall population, that are internally displaced and more than 580,000 were added in 2019 alone. The U.S. Geological Survey had earlier indicated that the groundwater level has already declined by 2.4 mm between 2012-2018, where serious droughts threatening life of the masses in Afghanistan's 22 out of 34 provinces.

But it is not to say that Afghanistan does not enjoy enough amount of water. There are five major river basins in the country — Amu Darya, Harrirud-Murghab, Helmand, Kabul, and Northern — which provide 75 billion cubic metres (BCM) of accessible water.

According to National Water Affairs Regularity Authority of Afghansitan, this averages out to 3,063.1 cubic metres per capita. Meanwhile, the country's National Development Strategy, has listed the present usage as 19.08 BCM — which is merely 33 per cent of total surface water.

Meanwhile, due to increasing population and industrial expansion, the importance of water has multiplied. Preparing and formulating major policies to conserve and use fresh water optimally and prevent water from flowing to neighbouring countries without being utilised is one of the important tasks of the government. Implementation is however tardy.

Afghanistan also imports electricity from neighbouring countries worth millions of dollars, but if its rivers are used optimally, the country will be able to export electricity. On the other hand, 85 per cent of the Afghan people are engaged in agriculture, but water shortage is currently one of the main problems before farmers, which also plays a key role in decreasing agricultural products.

Experts predict that water scarcity is now a major problem in many parts of the world due to improper use, water pollution and climate change. According to the United Nations, more than 80 countries are currently facing water shortages. Water and environmental experts cite wastewater and climate change as the main causes of water shortages in the world.

On the other hand, currently the groundwaters of some cities of Afghanistan are exposed to pollution due to non-standard constructions,

non-technical burial of various types of waste and digging septic wells, of which the Kabul river is a clear example. Therefore, Afghanistan is facing water crisis due to mismanagement of its available water resources.

Climate Change and Geopolitics

Climate change is one of the most crucial challenges all over the world. Flash floods, global warming, unprecedented low and high temperatures in different parts of the world, more frequent droughts, rising sea levels, outbreak of plant diseases, depletion of the ozone layer, and melting of the ice are all due to climate change.

Research shows that normal rainfalls have been reduced; instead heavy rainfalls, which are often accompanied by flash floods, occur more intensively in different parts of the country. On the other hand, the decrease in rain and increase in temperature in some provinces of the country, especially in the Hindu Kush region, have caused significant decrease in water in most basins that has endangered the lives of people, animals, birds and plants.

The Ministry of Water and Energy says climate change in recent years has been behind most of Afghanistan's water crisis, reporting a 62 per cent drop in rainwaters. According to the ministry, rising temperatures are also increasing the amount of snowmelt from the mountains in recent years.

As per the UN data, as cited by an article in The Diplomat Magazine published in 2018, with more than 9 million Afghans currently facing severe food insecurity, this number will drastically increase with the drought aggregating the food deficit in coming years. Afghanistan is considered one of the world's most vulnerable countries to natural disasters and climate change.

Water is a trans-boundary resource that goes beyond political borders. Afghanistan is not the only state in the region facing water crisis. Among other states, neighbouring Pakistan and Iran too are facing severe water shortages. Reduction in water resources has led to conflicts in different countries. Afghanistan, too, has its share of problems with its neighbours, especially with Iran and Pakistan. The Helmand river continues to flow in Iran and the waters of the Kabul, Panjshir, Ali Shing and Ali Negar rivers flow to Pakistan, where thousands of acres of land in these countries are being irrigated. However, thousands of acres of land along these rivers inside Afghanistan suffer from severe water shortages.

Afghanistan has only one agreement with Islamic Republic of Iran that was signed in 1973, which highlights the allocation of discharge from Helmand river to Iran year-round.

Pandemic and Public Health

Clean water, sanitation and good hygiene practices are essential to the survival and development of communities, mainly children. In Afghanistan, diarrheal diseases are the second most common cause of death for children under the age of five, after acute respiratory infections.

Open defecation continues to be a dangerous challenge because human waste near waterways and living environment spreads diseases quickly and puts children and their families at risk.

Ministries of Rural Rehabilitation and Development, Public Health, and Education, as well as local and international partners, have joined forces to end open defecation by 2025. They support communities to become "open defecation free" by using the "Community-Led Total Sanitation" approach, where a combination of shock, shame, disgust and pride, motivates people to build and use their own latrines. Since Afghanistan has been mostly engaged in war on terror, proper attention has not been paid to other essential aspects such as public health. Nowadays people have been suffering from another pandemic which is H. Pylori, stemming from contaminated water.

After four decades of devastating war, the rapid increase in population and urbanisation is a matter of serious concern, as construction across major cities of Afghanistan, mainly Kabul, have

been without proper canalization system, where wastewater flows to the same area where people drink water. In the last couple of years, water scarcity has increased tremendously and is getting worse every day. Population growth, which tripled in the last three decades, economic development, rapid urbanisation, industrialization etc. have contributed to the depletion of safe drinking water.

Water management sector largely remains unnoticed at the policy level and thus does not get much attention. Weak law enforcement in drinking water regulation and mitigation of the vulnerable effects of climate change has pushed the country into crises compared to other regional countries.

The effects of these crises are visible in the capital city where groundwater table successively drops down due to over exploitation of groundwater aquifers against a limited recharge in return. The country's water resources are heavily dependent on rain and snowfall, whilst groundwater withdrawal is the primary source of drinking water supply.

According to the Ministry of Urban Development Affairs, about 90 per cent residents of Kabul city have access to drinking water, but with very poor water quality. The government and other relevant agencies are slow in raising awareness on the topic. As a result, citizens are not playing their due role in safeguarding water.

In the case of Kabul, there are four major wastewater treatment plants: in Wazir Akbar Khan, Qala e Zaman Khan, Tahia Maskan and Karte-4. Wastewater treatment plants have poor infrastructure and do not have the potential to treat water. Despite this, their inefficiency can barely cover half of the population of the city.

The underground as well as surface water are contaminated. Many forms of biological and chemical pollutants are drained to the streets and canals which either infiltrates, percolates or reach the groundwater table. This eventually ends up in the Kabul River. Since Kabul River is flowing in the heart of the city, haphazard discharge of sewage from residential and commercial areas has turned it into a hub of dangerous pathogens and germs causing disease especially among the communities living and working alongside this river.

Fig 4.1.1: Pollution in the Kabul River

Conclusion

“Kabul be zar basha be barf ne!” goes an ancient proverb. “May Kabul be without gold rather than snow” — referring to snowmelt from the Hindu Kush Mountains, a primary source of Afghanistan’s water supply.

To recover from the aid-dependency and armed conflict, Afghanistan should have workable hydro treaties with neighbouring countries and better water management mechanism inside the country. As 80 per cent of the country’s population works in agricultural sector, construction of water supply networks and management of the country’s water are of immense importance. Good management of overall water system would definitely have a positive impact on the future stability of the country.

The decades-long unrest, repatriation of refugees and internal migration has caused unequal distribution of water as well as marginalization of communities. If the government doesn’t take steps to solve this issue and tackle the situation, the projected climate change scenario will further exacerbate and may trigger migration for getting safe drinking water.

Therefore, better administrative arrangement, consumer well-being, public health, and environmental protection — all need to be taken into holistic consideration and water resources sector now needs to be the topmost priority for the Afghan state.

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Hamidullah Arefi is Editor-in-Chief of The Kabul Times in Kabul.

2

Bangladesh

Author: Shafqat Munir

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Introduction

As a deltaic country, Bangladesh depends on water for its survival more so than others. For Bangladesh its very survival is related to water. Ensuring water security is therefore a key imperative. This paper gives a preview of the causes of water security challenges that the country is facing in the COVID-19 era. It will also analyse the challenges and discuss its impact on Bangladesh's blue economy. Finally, the paper offers a few recommendations that can help counter the mentioned threats. Concretely, the paper puts a key emphasis on the progress that has been made across the Bay of Bengal, alongside the challenges it presents for sustainable maritime security in the region amidst the pandemic.

Geographical Reality from a Bangladeshi Perspective

Bangladesh is situated in the deltaic part of South-East Asia. A huge volume of water enters the country from the South Asian region and flows into the Bay of Bengal through three mighty rivers and their tributaries and distributaries, namely the Ganges, the Brahmaputra, and the Meghna drain.[1] The Bay of Bengal occupies the northeastern end of the Indian Ocean bordering India to the west, Bangladesh to the north, Myanmar to the east, and Sri Lanka and Indonesia to the south. It is the largest bay in the world, covering over 839,000 square miles of the Indian Ocean.[2] It is a vital transport hub that facilitates the South Asian Association for Regional Cooperation (SAARC) and the Association of Southeast Asian Nations (ASEAN) member states. On the right, Fig 4.2.1 shows the comparison of major maritime industries among the neighbouring countries of the Bay of Bengal.

Water Security in the South Asian Region and Implication for Bangladesh

Water security in the Bay of Bengal is vital to maritime stability and governance in the South Asian region. States in the Bay of Bengal, especially Bangladesh, are battling to varying degrees with issues of corruption, inadequate provision of public and private services, political and economic exclusion, and the imminent environmental effects of climate change. All these problems, if left unresolved, have the potential to adversely affect the relations between the coastal countries. This paper will describe these mechanisms in greater detail, focusing especially on how security issues of state officials are related to problems such as poor maritime law enforcement, slow development of the regional blue economy, pervasive illicit maritime economies, and even organised political violence in coastal areas.[3]

Given these kinds of maritime security threats as well as the health impact of the pandemic, government transparency is a must in this specific region. For Bangladesh, to achieve greater penetration of social services to vulnerable coastal communities, it needs to polish its blue economy policies.

As can be seen from Fig 4.2.1, Bangladesh is still lagging behind in terms of maritime industries. To address this, broad progress in these areas is a critical prerequisite for a lasting solution to the water security threats that have arisen following the COVID-19 outbreak.

Blue Economy of Bangladesh (Before and After COVID-19)

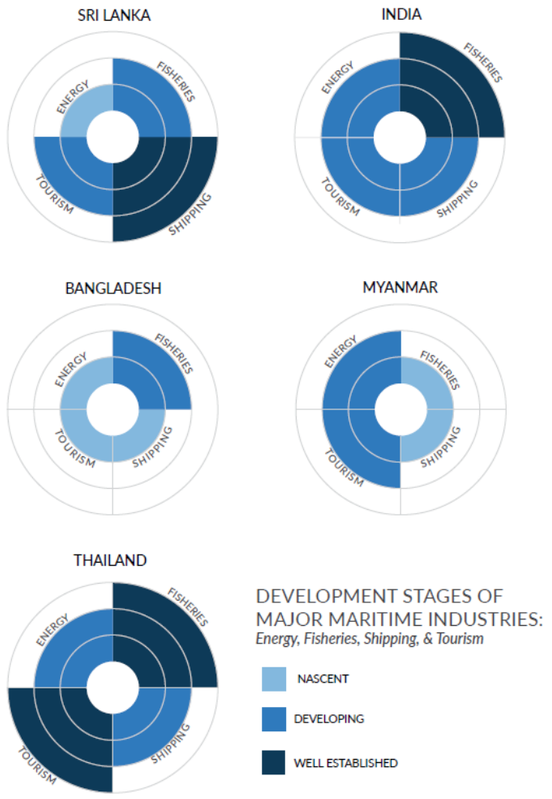
While countries like China, Japan, and The Philippines have been earning from the ocean economy for around 300 years, Bangladesh is relatively new to this industry. Marine fish, plants, and animals provide 15 per cent of the protein that 4.30 billion people consume globally.[4] About 30 per cent of the world's gas and fuel demand is supplied from different seaside gas and oil fields.[5] With time the global blue economy is becoming more prominent. Using the Bay of Bengal, Bangladesh earns a significant amount of foreign currency.

According to Bangladesh's Ministry of Foreign Affairs, 26 maritime economic functions have been identified among the fishery, maritime trade and shipping, energy, tourism, coastal protection, maritime safety and surveillance sectors for the development of the blue economy in Bangladesh.[6] But the recent pandemic has halted many of the ongoing projects and the economy is thus facing a setback. The following points summarise the phenomena: how some of the maritime economic activities were underway to harness the benefits of the blue economy and how the COVID-19 outbreak has affected them.

a) Managing Freshwater Resources

The freshwater reservoir is effective for storing a portion of freshwater that flows into the ocean during monsoon periods. The reservoir plays a crucial role in the livelihood of the rural and urban coastal populations. It has many advantages: there is no need for land acquisition, and no land and forest submergence is likely to happen in inland reservoirs. These were found to be a great success in countries like India, The Netherlands, Singapore, China, South Korea and Hong Kong have proven to be beneficial to the local population and their livelihoods. Bangladesh too had undertaken projects to create such reservoirs as it had the

Fig 4.2.1: Development Stages of Major Maritime Industries



Source: Stable Seas: Bay of Bengal, January 2020

potential to create new freshwater ecosystems. The plan was to increase industrial, recreational and freshwater fishery activities in the reservoir. But all infrastructural development has been put on hold due to the pandemic.

b) Livelihood Security in the Coastal Zones

Combating a pandemic and providing treatment for affected people will likely increase the demand for water to be used for public health and human consumption. For example, the coastal agricultural system in Bangladesh faces a multitude of problems caused by the rise in sea levels and lack of freshwater. More than 30 per cent of the arable land and one-fourth of the population lives in the coastal belt. A total of 366,650 ha of land is affected by salinity in Barisal and Patuakhali, where farmers usually only cultivate during winter and leave the land uncultivated during other seasons.[7] Thus, biodiversity, crop yields, cropping intensity, production levels, and the quality of people's livelihoods are much lower than other parts of the country. At the same time, demand for food in the area is increasing with the steady increase in population.

Therefore, to provide secure livelihood in the coastal zones, building resilience for this cultivation system is very important. Bangladesh plans to develop a coastal agro-ecosystem stewardship strategy[8] which will identify indicators for measuring climate resilient agriculture and develop a conceptual framework for profiling the spatial resilience across various agro-ecosystems for appropriate location-specific policy interventions. It will cover all five dimensions, namely social, economic, ecological, physical, and institutional in order to mitigate the COVID-19's effect on coastal agriculture.

On the other hand, Bangladesh has a total area of 166,000 sq.km. of water including the Exclusive Economic Zone (EEZ) in the Bay of Bengal. According to the Department of Fisheries, there are about 255 trawlers, and 67,669 mechanised and non-mechanised boats engaged in fishing.[9] In the year 2017 – 18 total fish production from Marine sources was 6.55 lac MT. There might be a decline in the production rate due to the COVID-19 pandemic as people's spending capacity has decreased and it is affecting the aggregate demand.

c) Environmental Sustainability

Climate vulnerability is a looming challenge that has the potential to increase maritime migration, degrade coastal welfare, and undermine the potential of the blue economy. Bangladesh is one of the most climate vulnerable nations, due to its geographical location surrounded by deltas of three of the world's biggest rivers, and the flat, low-lying deltaic topography.[10] Climate change will create barriers to future poverty reduction initiatives and reverse many of the consequential socio-economic gains made by the country. Sea-level rise (SLR) will affect the vast coastal area and low-lying river estuary zones of the country. A recent study revealed that the SLR rate in coastal areas during the last 22 years is many fold higher than the mean global SLR rate.

Table 4.2.1 explaining the SLR trend in Bangladesh is given below. With the steady SLR rate shown in the table, the livelihoods of coastal communities and the natural environment of the coastal zones are expected to be severely affected. People will be forced to move out of their homes, take refuge on drylands, and change their way of earning an income. This will result in a complete change of their way of life.[11]

Recently, amidst the pandemic, an increase in the intensity or frequency of many extreme events such as floods, land erosion, heat waves and salinity intrusion in Bangladesh can be observed. Such impacts pose additional risks for already vulnerable communities striving to combat poverty and achieve sustainable development. On June 9, this year, Bangladesh took over the reins of the "Climate Vulnerable Forum" (CVF) for the next two years, and said it would push for more ambitious climate action despite the global economic strain caused by COVID-19.[12]

d) Arsenic Effect

The extensive and excessive occurrence of arsenic in the groundwater of the Bengal Aquifer System (BAS) in Bangladesh, mostly within 100 metres of the ground surface across the floodplains of the Ganges, Brahmaputra and Meghna

Table 4.2.1: Trend of SLR along the coast of Bangladesh

Station Name	Region	Trend(mm/year)
Hiron Point	Western	4.0
Char Changa	Central	6.0
Cox's Bazar	Eastern	7.8

Source: SAARC Meteorological Research Council (SMRC)

Rivers, is resulting in a national public health catastrophe.[13] Groundwater from shallow hand-pumped tube wells installed at a few tens of metres to 150 m below ground level (bgl) is used for domestic supply by 80 per cent of the population.[14] Most of these tube wells are privately owned and are operated throughout the year at a very low discharge rate. Approximately, 27 per cent of them provide water exceeding the Bangladesh national limit of arsenic in drinking water, and 46 per cent of them exceed the World Health Organisation guideline value.

Deeper groundwater throughout Bangladesh is almost uniformly free of excessive arsenic and therefore installation of deep wells for domestic water supply is a practical and economic mitigation response to the arsenic crisis. But the concern also includes the fact that deep tube wells are not available in every rural household. Sometimes there is one for a village and in the pandemic situation, it is tough to collect water from those places. This may play a role in rising cases of arsenicosis and the continuing exposure increases the risk of non-fatal outcomes and slow death.

e) Poor Sanitisation

Bangladesh has made significant progress in reducing open defecation, from 34 per cent in 1990 to just 1 per cent of the national population in 2015. However, the current rate of improved sanitation is 61 per cent, growing at only 1.1 per cent annually.[15] Still, the quality of sanitation coverage is an emerging area of concern, with more than 40 per cent of all latrines classified as "unimproved". Drinking water access is widespread, but half of the drinking water consumed fails to meet water safety standards. In urban areas of Bangladesh, piped water supply reaches only about one-third of the population, and there is no systematic sewer disposal and treatment system. Only Dhaka, Bangladesh's capital city, has a sewer system, and it serves just 18 per cent of the city.[16]

Planning and service delivery are often supply driven, and government agencies have overlapping functions and pay insufficient attention to operation and maintenance issues. Along with the contagious coronavirus, the aforementioned points are contributing to the spread of waterborne diseases which may result in disastrous impact on health and nutrition.

Policy Recommendations

While the outbreak of COVID-19 has affected all sectors of the economy, probable implications for the water security and blue economy of Bangladesh largely remain unexplored. At this stage when the country is besieged by numerous challenges, it is somewhat natural to think that water-related challenges are not the highest priority; however, addressing water security issues is crucial for long-term growth and sustainability.

Therefore, an inter-ministerial appraisal of the current situation has to be immediately formulated, which will consequently produce some policy-level modifications and revitalisation. There is a need to look at the challenges of Climate Change, water security and prevention of future pandemics as combined challenges. Bangladesh has achieved major strides in the area of humanitarian assistance and mitigation of disasters, some of which lessons could potentially be applied to mitigating the challenges of water, climate and pandemics. Bangladesh could also take the lead in initiating a collective regional effort in this regard.

Conclusion

Blue Economy may be stimulated by putting the right "enablers" in place which are the prerequisites to create an environment open to innovation and growth. This includes research and education but also spatial planning. Additionally, Bangladesh needs to remove barriers to create better conditions for innovation and the maritime economy to develop. The strategic foresight of extracting opportunities amid difficult times, even a pandemic, will determine the strategic adaptability of a growing economy like Bangladesh.

This paper has strived to provide a framework of this much-needed appraisal and suggest a set of policy-oriented recommendations. With a view of improving food security, eradicating poverty and delivering shared prosperity, it suggests that global leaders, ocean practitioners, scientists, and representatives from government, business, civil society, national and international organisations need to come together to explore action-oriented partnerships, governance arrangements, investment frameworks and new financing vehicles to turn the tide not only on the health of the oceans but also how the resources of the sea could be used for economic emancipation in this pandemic situation.

The COVID-19 pandemic will exacerbate existing water insecurity and potentially other ecological challenges. It is therefore critical to use new tools such as strategic foresight to predict such challenges and seek solutions. Harnessing the resources and ensuring water security is crucial for Bangladesh's overall economic development. Furthermore, there is also a need for greater cooperation with neighbouring countries in order to formulate an effective regional approach towards addressing water security challenges.

Shafqat Munir is a Research Fellow at the Bangladesh Institute of Peace and Security Studies (BIPSS) in Dhaka. He is a member of the Konrad-Adenauer-Stiftung e. V. Network of Young Asian Security Experts.

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3 Bhutan

Author: Sonam Choden Wangdi

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Introduction

The Kingdom of Bhutan is located in the Eastern Himalayas in South Asia, with a land area of 38,394 square kilometres and a population of 734,374 in 2018. The country is a democratic constitutional monarchy and a member of South Asian Association of Regional Cooperation and Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation. Bhutan is one of the fastest-growing economies in the region with an average GDP growth rate of about 7.86 per cent from 1996 – 2018. Bhutan is a leader in environmental conservation and the development philosophy of Gross National Happiness. The country has a forest cover of about 72 per cent with over 51 per cent of the land area protected as wildlife sanctuaries, biological corridors and parks, and boasts of being the only carbon negative country in the world. The environmental assets of the country favourably position it in terms of public health and the environment.

1. Current COVID-19 Scenario

Bhutan has been one of the most successful countries in the world in combating COVID-19 with a little over 200 positive cases and zero mortality as of 31 August, 2020. This success can be attributed to holistic and sound pandemic management strategies, which include proactive preventative measures such as early sealing of national borders, area zonation, good public awareness outreach, and implementation of safety protocols.

2. Issues on Access to Water

In terms of water resources, Bhutan has one of the highest per capita water availability, measuring 94,500 cubic metres per person per annum.[1] Despite the vast abundance of water, the country has experienced issues related to allocating water resources to its population due to three reasons: the country's uneven terrain that has disrupted the distribution of water, management issues relating to the supply lines and system, and increasing urbanisation. These reasons, in addition to Bhutan's geographical positioning in the Himalayas, have been further exacerbated by climate change, which has increased the vulnerability of Bhutan's water security. Bhutan's issue is not water shortage; rather, the main issues at hand are accessibility to water and distribution of water. One of the major challenges is the rural nature of scattered populations over mountainous terrain, making the provision of water supply costly.[2]

3. Water Resources

Bhutan's water resources can be broadly classified into four categories: glaciers; glacial and high-altitude wetlands; river and river basins; and groundwater and reservoirs.[3] The country has five major river basins and five minor river basins. The five major river basins include: Amochhu, Wangchhu, Punatsangchhu, Maangdechhu and Drangmechhu; and the five minor river basins include: Jaldakha, Aiechhu, Nyera Amari, Jomori and Merak Sakteng.

The planning, implementation and monitoring of water security in Bhutan is based on the Bhutan Water Security Index (BWSI) that is comprised of five dimensions, namely

(i) rural household drinking water supply and sanitation;
(ii) economic water security;
(iii) urban drinking water supply, sanitation and drainage;
(iv) environmental water security; and
(v) resilience to disaster and climate change.

The BSWI is measured on a scale of 1 to 5, where 1 refers to hazardous, and 5 refers to model state. In 2015, the BWSI baseline was assessed as 3.08. BSWI is currently measured for each individual major river basin. In 2017, the Wangchhu river basin which accounts for 11 per cent of the country's total land area scored 3.9 for the BSWI.[4]

4. National Plans and Strategies

The 12th Five-Year-Plan (FYP), which is the national developmental roadmap for all governmental agencies for the next five years (2018 – 2023) has allocated budgets to improving water security, decreasing the outbreak of infectious and zoonotic diseases, and combating the impacts of climate change. The National Environment Commission (NEC) is the central apex body responsible for governing and regulating all environmental issues including water, climate change and waste management among other issues. The Environmental Assessment Act 2010 empowers the NEC to appoint competent authorities to monitor, control and enforce environment, health and safety standards.[5]

5.1. Water

Strengthening Water Security and Enhancing Management is the NEC's developmental programme related to water for the 12th FYP; targets in the programme relevant to this paper include the implementation of the Water Act of Bhutan 2011 (Water Act) and Water Regulation of Bhutan 2014 (Water Regulation) and institutionalising the National Integrated Water Resource Management Plan 2016. The indicators measure the water availability of surface and groundwater in selected districts and maintaining water quality within the environmental standards in selected districts.

Notable clauses in the Water Act and Water Regulation addressing drinking water include

(1) reviewing and evaluating the status of drinking water supply systems for maintaining and applying remedial measures;

(2) developing a master plan for drinking and wastewater management; mainstreaming water resource management into the policies, plans and programmes;

(3) exploring alternative sources of drinking water such as rainwater harvesting and linkages to hydropower reservoirs;

(4) ensuring proper implementation of the Water Safety Plan that ensures safe drinking water through risk assessment and risk management approaches to the water supply chain from the catchment to the consumer point; and

(5) adopting measures required to ensure efficient and reliable drinking water infrastructure and systems.[6]

Prior to the frameworks governing water management, individual districts and municipalities were responsible for their individual water management policies. The implementation of the Water Act and Water Regulation has streamlined the overall water management and surveillance, and respective townships and municipalities are responsible for implementing these policies.

While Bhutan has improved its coverage of accessibility to safe drinking water from 95 per cent in 2016 to 98 per cent in 2017 and 2018,[7] the country aims to further improve access to safe drinking water. In 2019, the NEC launched a Safe Drinking Water Flagship Programme (SDWFP) to be implemented by the Ministry of Works and Human Settlement, where the main policy objectives in the programme include:

(1) the protection of watersheds and wetlands;

(2) the development of adequate and climate-resilient infrastructure;

(3) improving the surveillance of drinking water quality; and

(4) strengthening the implementation of water legislation to ensure 24 x 7 safe drinking water to 11 districts in the first phase of this programme.[8]

The districts faced with the highest difficulties in accessing water were chosen for the first phase of the SDWFP; the coverage of 24x7 water supply for these 11 districts was 53.5 per cent.[9]

5.2. Water and sanitation-related infrastructure in urban and rural areas

Communities in rural areas are dependent on small streams and spring water. Changes brought about by climate change have been discerned by the communities through decreasing quantities of water, and drying up of water sources. The population using improved drinking water sources was 97 per cent, and the population using improved sanitation facilities was 69 per cent.[10]

In 2018, latrine coverage was recorded at 95.4 per cent, households with functional piped water were 77.9 per cent; and drainage was recorded at 71.7 per cent.[11] Increased job prospects and better education among several other reasons have led to increased urban migration, which has increased the water demand in urban areas. This has led to low- and middle-income urban residents having a limited water supply and poor sanitation, making these residents turn to alternative untreated sources of water. In 2019, the urban population in Bhutan was 40.9 per cent, relative to the urban population in 2009 which was 34 per cent.[12]

In 2019, the urban population growth rate was recorded at 2.9 per cent. The lack of the necessary water supply-related infrastructure required will adversely impact the issue of poor water access and infrastructure, and could also increase the number of waterborne diseases in urban municipalities.[13]

6. Climate Change

Bhutan is highly vulnerable to climate change due to its mountainous terrain. Bhutan's glaciers account for 1.6 per cent of the total land area of the country. The melting of glaciers has led to the formation of depressions that form glacial lakes over time. Glacial and freshwater lakes account for 10 per cent of the total land area.

As of 2016, there were 2,674 glacial lakes in the country.[14] While glacial lakes have benefitted the country by increasing the amount of freshwater, these glacial lakes have led to glacial lake outburst floods (GLOF) which have proven fatal for downstream communities. Bhutan has experienced 10 GLOF events since 1956. Global warming leading to arise in temperatures has increased precipitation, specifically rainfall as opposed to snowfall, triggered erratic rainfalls, increased the time spans for snowmelt, led to shorter winters and wet season floods, thereby increasing the transportation of debris and sediment. The intense monsoon rains have exacerbated the destabilisation of slopes, increased damage to life, infrastructure and property as well as soil erosion.

The NEC is the lead agency for climate change and Focal Point for United Nations Framework Convention on Climate Change negotiations. According to the NEC, the country has been planning and adapting to the impacts of climate change. Adaption measures for early warning systems, soil stabilisation, flood protection, agriculture, forestry and climate-proofing, and building resilience through a series of three National Adaption Action Plans funded by the Least Developed Countries Fund have been implemented since 2008.

The country has also formulated Low Emission Development Strategies for the three key sectors: industrial, transport and human settlement. The country is currently implementing the National Adaptation Plan with funding from the Green Climate Fund. The country is also updating its Nationally Determined Contribution and formulating a Long-term Low Emission Climate-resilient Development Strategy.

7. Waste Management Situation and Strategies

Bhutan has improved its urban sanitation coverage. As of 2020, 19 towns had sewerage treatment plants, relative to 2010, when only five towns had sewerage treatment plants.[15] Despite the progress, Bhutan is still in the early stages of providing modern sewerage systems, so the risk of sewage contaminating groundwater and surface water bodies continues to be a hazard for all.

Waste management is an emerging challenge for Bhutan, and the failure to cope with the growing waste generated will negatively impact the air, soil quality, quality of life and water. According to a National Waste Survey conducted in 2019, the country generates 172.16 metric tonnes of waste per day, and a per capita waste generation of 0.23 kilogrammes per day.[16]

While Bhutan is in the early stages of waste management, it has prepared to take up the challenges faced in waste management. The NEC formulated the National Waste Management Strategy in 2019 and the BluePrint for managing all forms of waste in the same year. The BluePrint is being implemented through the National Waste Management and Stray Dog Population Control flagship programme.

The current strategy streamlines the waste management system from an ad-hoc one to a nationally coordinated management process. However, the shortage in human, technical and financial resources remains a challenge despite the strategies put in place.

8. Public Health Scenario and Strategies

The Ministry of Health has focused on health promotion and disease prevention through strengthening surveillance and laboratory capacity for preventing and controlling emerging and re-emerging infectious/zoonotic diseases as well as adopting measures to reduce the health impact of climate change.[17]

Major water-borne and water-prevalent diseases in Bhutan include: conjunctivitis, dengue, diarrhoea, malaria, skin infections, and typhoid/para-typhoid fever.

Figure 4.3.1 shows the number of water-related morbidity cases from 2014 – 2019. While there has been a slight decline in the number of conjunctivitis, diarrhoea, malaria and skin-infections cases, there has been an increase in the number of dengue and typhoid/para-typhoid fever cases.

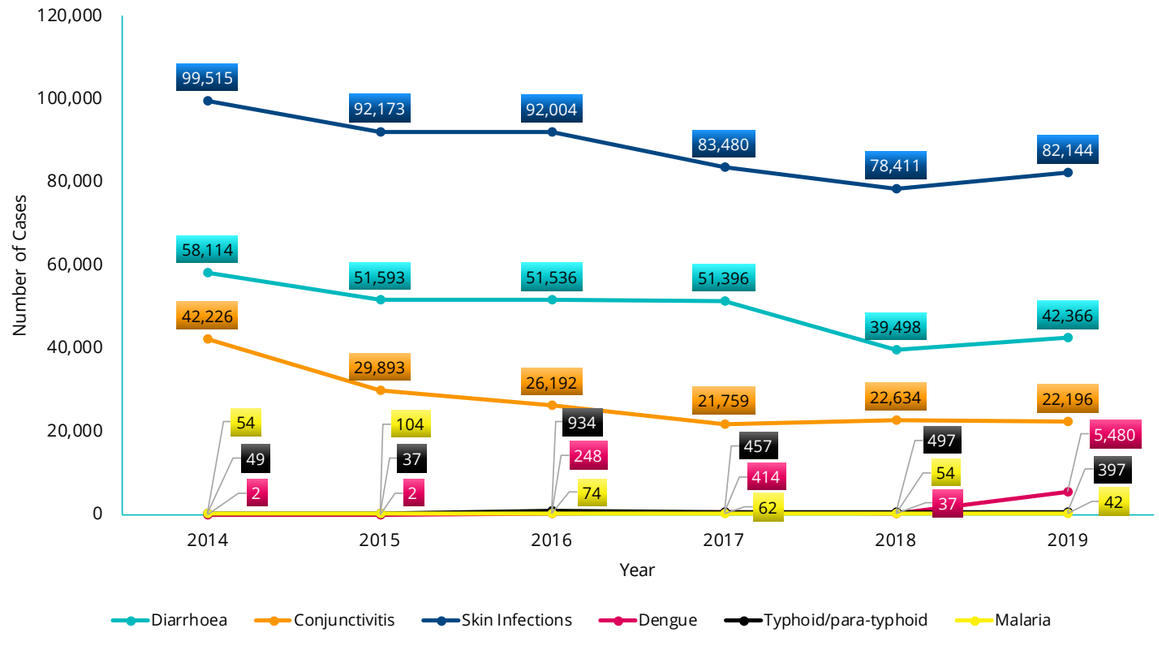
In 2019, the country suffered from a dengue outbreak in the southern parts of the country, which have warmer climates and higher rainfall relative to other parts of the country. The dengue outbreak was attributed to heavy rainfall and floods, coupled with poor sanitation in the Indian bordering town, and water shortage.[18]

An improvement in water drainage infrastructure in the southern parts of the country to decrease water stagnation could help to reduce the likelihood of future dengue outbreaks. The development of infrastructure for handwashing in public spaces could also aid in reducing the spread of the ongoing pandemic and also reduce water-borne morbidities.

To ensure the quality of drinking water, the National Water Reference Laboratory, a part of the Royal Centre for Disease Control conducts monthly tests on the quality of drinking water and is responsible for the water quality in Thimphu municipality.[19]

In other urban parts of the country, laboratories under the regional and district referral hospitals, and specified BHU-I are responsible for testing water quality on a monthly basis.

Figure 4.3.1: Water-borne / water-prevalent Diseases in Bhutan



Source: Ministry of Health (2015 - 2020). Annual Health Bulletin

Lastly, water quality is tested in rural areas by health workers working in BHU-I, BHU-II, CHU, RHU, and Sub-post. All testing units and laboratories are held accountable for the water quality as these units are mandated to input the data by the 7th day of the next month into the Water Quality Monitoring Information System.

The Ministry of Education has targeted to strengthen healthy hygienic habits and to prevent health-related issues faced by schoolchildren by improving the water, sanitation and hygiene facilities at schools through improved water supply, toilets, and overall hygiene.[20]

9. The Way Forward

The COVID-19 pandemic has exposed the country's insufficient capacities and infrastructure and is a wakeup call for preparedness in regard to pandemic-scale disasters in the future. The event presents opportunities to incorporate lessons learnt into the National Recovery Plans.

The linkage of public health to sanitation and water is an important requirement for countries to note in their recovery plans. Climate change has worse implications than the COVID-19 pandemic and it is impacting the world on a daily basis. The world needs to recognise the emergency of climate change and implement transformative plans and action to combat its impact.

Bhutan has incorporated health and sanitation into water policies with the adoption of the Environment Assessment Act, 2000; Waste Prevention and Management Act of the Kingdom of Bhutan, 2009; the Water Act of the Kingdom of Bhutan, 2011; National Environment Strategy 2020 and the Climate Change Policy 2019. The country is in the process of implementing the provisions of the laws through the 12th FYP, which began in 2018. The findings of this paper indicate that within the next five years, Bhutan will have integrated public health into its water policies in effect at ground level.

Sonam Choden Wangdi is a Consultant of International Trade Centre in Thimphu.

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Abbreviations

BHU-I	Basic Health Unit Grade 1
BHU-II	Basic Health Unit Grade 2
BHU-III	Basic Health Unit Grade 3
BWSI	Bhutan Water Security Index
CHU	Community Health Unit
FYP	Five Year Plan
GLOF	Glacial Lake Outburst Flood
GDP	Gross Domestic Product
NEC	National Environment Commission
RHU	Rural Health Unit
SDWFP	Safe Drinking Water Flagship Programme
Water Act	Water Act of Bhutan 2011
Water Regulation	Water Regulation of Bhutan 2014

4 Water Security in India

Author: Joyeeta Bhattacharjee

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Introduction

UN-Water defined water security as the capacity of a population to safeguard sustainable access to adequate quantities of quality water for sustaining livelihoods, human well-being, and socio-economic development, for securing protection against water-borne pollution and water-related disasters, and for preservation of ecosystems during a climate of peace and political stability.[1] Considering the UN definition as the basis, broadly, water security means the availability of an acceptable quantity and quality of water for securing health, livelihood and protection of the environment. In the Indian context, water security will mean ensuring the equitable supply of quality water to its people to raise the health, development and environmental safety of the country.

The recent outbreak of the Covid-19 pandemic has reinforced the inherent linkage between public health and water, thus heightening the need for close analysis of water security in the country. In the absence of a vaccine against the virus, maintenance of hand hygiene through frequent handwashing or use of hand sanitisers is one of the credible defences against the virus. In India, a country that is one of the worst affected by the pandemic with the number of infections running into millions and thousands of fatalities, stricter implementation of the recommended safety measures is a necessity to curb the spread of the virus. For a developing country like India, hand sanitiser is a luxury for the masses and handwashing with soap is the only viable alternative for the general public and the practice of which requires a supply of quality water. Given this background, here an attempt is made to understand the water security situation and its challenges in India. The aim of this paper is to suggest some recommendations for improvement of the situation.

Water situation in India

India, the world's second-most populous nation, is one of the most water-starved nations in the world. According to the World Research Institute, India is the 13th most water-stressed country in the world.[2] The primary reason for India's water scarcity is inadequate rainfall and inefficient management of water with high wastage. Almost 50 per cent of India's annual precipitation is received on 15 days of a year.[3] Nevertheless, most of this waters is not adequately utilised largely due to shortage of capacity. Besides, inefficient management of the water supply system that includes a large amount of wastage of water mounting up to 50 per cent is a reason for India's water stress. Again, unchecked use of groundwater resources that results in the depletion of groundwater is adding to India's worries.

Considering the primacy of water in the socio-economic development of the people, significant attention has been given to improving the infrastructure, especially for agricultural purposes, and various dams and reservoirs are being constructed in India.[4] Also, attention has been given to enhancing the supply of drinking water and sanitation. The effort seems to have helped improve the situation substantially but it is not sufficient to meet the demands of the growing population of the country that has surpassed a billion. Rising demand for water has increased the extraction of groundwater which is extremely unsustainable in the long run. In India, groundwater is depleting on average by 10 cm annually.[5] Across the country, around 600 million people experience water shortages every year.[6] The water demand and supply gap are estimated to be 50 per cent by the year 2030.[7] Climate change is expected to complicate the situation further as it is likely to impact patterns of rainfall and glacial melt which are expected to change the river flow, recharge of groundwate, and could cause floods and droughts, salination and a number of water quality issues. Access to safe water remains a challenge for many in India. Around 63.3 per cent of rural households and 19.7 per cent of urban households lack access to water and sanitation facilities.[8] India suffers from a shortage of quality water.

Water and health safety

The impact on public health due to the lack of availability of safe and clean water has been substantial. According to Water Aid, nearly 140,000 die annually due to diarrhoea, which is a water-borne disease.[9] Additionally, 200,000 are estimated to die due to inadequate or unsafe water. Around 73 million workdays are estimated to be lost due to water-borne disease-causing economic burden valued at US$600 million annually.[10] The Covid-19 pandemic has added a new challenge to India's water security as it demands an additional supply of water to support frequent handwashing for the large population of the country. According to the Centre for Science and Environment, Delhi, around 20 – 40 litres of water will be required daily to facilitate frequent handwashing.[11] To contain the pandemic, it will be important to provide additional litres. The government of the country has to introspect deeply to find ways to tackle the situation.

Water, legal framework and policy

The legal framework for water is spread across multiple institutions. The Constitution of India has listed water as a state subject. The state has been responsible for framing and implementing policies concerning water supplies, irrigation and canals, drainage and embankments, water storage, and water power. The state cannot execute these powers in totality without the support of central government, primarily, in the case of interstate rivers. The role of the centre becomes more crucial in terms of equitable distribution of the resources of the interstate rivers and dispute resolution. Notably, the interstate dispute over water has been one of the major challenges of India's federalism. The Centre has to take care of various items in the lists I and III (Union and concurrent list) of the Seventh Schedule of the India constitution to tackle interstate water issues and protect the interests of all groups. Normally, forestry is one of such items which is often utilised to preserve and protect forest resources in the catchment areas. Central and state governments have formulated a plethora of legislations concerning the management and conservation of water.

Further, India has formulated national water policies to ensure smoother implementation of laws. Policies not only lay down government's visions in relation to some particular issues but also help to iron out the difficulties on the ground that might restrict implementation of the laws.

The national water policy was articulated first in 1987. The policy, primarily, emphasised on the prioritisation of allocation in areas including drinking water, irrigation, hydropower, navigation, industrial and other uses. Given the changes noticed in the water situation in the country, it became critical to formulate a new water policy to address the demands of the changing times. In 2002, a new water policy was introduced. The 2002 National Water policy has been significant as it was the first to emphasise the allocation of water for ecology and the environment.[12] The most prominent water policy, however, has been the 2012 policy. The landmark of the National Water Policy 2012 has been its call for a common integrated approach to govern the planning and management of water resources. The Policy stresses the necessity of water needs to be managed as a common pool community resource that is held by the State under the public trust doctrine to ensure equitable and sustainable development for all. The National Water Policy 2012 outlined the guiding principle for injecting in commonality into the planning, development and management of the water resources. The key principles are presented in the table below.

Table 3.4.1: Key Principles of National Water Policy 2012

1	Planning, development and management of water resources need to be governed by common integrated perspective considering local, regional, State and national context, having an environmentally sound basis, keeping in view the human, social and economic needs.
2	Principle of equity and social justice must inform the use and allocation of water.
3	Good governance through transparent informed decision making is crucial to the objectives of equity, social justice and sustainability. Meaningful intensive participation, transparency and accountability should guide decision making and regulation of water resources.
4	Water needs to be managed as a common pool community resource held, by the state, under public trust doctrine to achieve food security, support livelihood, and ensure equitable and sustainable development for all.
5	Water is essential for sustenance of eco-system, and therefore, minimum ecological needs should be given due consideration.
6	Safe Water for drinking and sanitation should be considered as pre-emptive needs, followed by high priority allocation for other basic domestic needs (including needs of animals), achieving food security, supporting sustenance agriculture and minimum eco-system needs. Available water, after meeting the above needs, should be allocated in a manner to promote its conservation and efficient use.
7	All the elements of the water cycle, i.e., evapotranspiration, precipitation, runoff, river, lakes, soil moisture, and groundwater, sea, etc., are interdependent and the basic hydrological unit is the river basin, which should be considered as the basic hydrological unit for planning.
8	Given the limits on enhancing the availability of utilizable water resources and increased variability in supplies due to climate change, meeting the future needs will depend on more on-demand management, and hence, this needs to be given priority, especially through (a) evolving an agricultural system which economizes on water use and maximizes value from water, and (b) bringing in maximum efficiency in the use of water and avoiding wastages.
9	Water quality and quantity are interlinked and need to be managed in an integrated manner, consistent with broader environmental management approaches inter-alia including the use of economic incentives and penalties to reduce pollution and wastage.
10	The impact of climate change on water resources availability must be factored into water management-related decisions. Water using activities need to be regulated keeping in mind the local geo-climatic and hydrological situation.

Source: National Water Policy 2012, Government of India, Ministry of Water.
Resources in http://mowr.gov.in/sites/default/files/NWP2012Eng6495132651_1.pdf

Despite these guiding principles, hardly any change is noticeable in the water security situation in the country. The problem of the scarcity of water continues to be a routine affair which is compounded by the high degree of contamination and mismanagement of the resources available. The practice of discharging industrial and urban wastes into rivers is carried on without any transformation, which severely contaminates the river water. Similarly, groundwater is considered to be a subject of private ownership; hence, the extraction of the groundwater remains unchecked. Again, the irrigation projects are poorly managed thereby impacting the usage of water for agriculture which causes the highest consumption of water.

New Initiatives

Recently, the government undertook some efforts to improve the water security situation by introducing in reforms to the management of water. In this respect, it established a new integrated ministry called Jal Shakti by merging the former ministries of Water Resources, River Development and Ganga Rejuvenation, and Drinking Water and Sanitation. Some of the other important initiatives are:

Jal Shakti Abhiyan: The aim is to promote water conservation in 256 of India's most water-stressed districts.

Jal Jeevan Mission: The programme is envisioned to provide piped water connections to 146 million rural households by 2024.

Atal Bhujal Yojana: The aim is to improve groundwater management through community participation in seven Indian states.

The government's effort to initiate reforms has been encouraging. Nevertheless, water security to attain its desired level will require the substantial will of the political leaders to reform some of the policies with regard to providing free electricity and water for agriculture which causes unchecked extraction of groundwater in rural areas.[13]

Despite broad-based consensus amongst the policymakers on the need for reducing water wastage, they are hesitant to enact any laws to limit usage of electricity and extraction of groundwater for fear of a political backlash. Any law to alter the provisions of providing free electricity and extraction of groundwater will upset farmers, who command a formidable voter base. Similarly, the issue of privatising drinking and domestic water is a debatable area.[14] Civil society fears that privatising drinking water might deepen inequality in accesses to safe water since economically solvent areas will get priority purely for the reason of commerce.

Way forward

Addressing water security challenges is necessary to enhance the health security of the country. The pandemic has brought forward the need for the authorities to be proactive in improving water security in the country.

Central and state governments should work together to guarantee water security. In this regard, it will be crucial to synergise their efforts by initiating institutional and structural reforms at their respective level to infuse efficiency into the management and governance of water resources. Further, achieving in equity in the distribution of the water across all sectors and communities irrespective of economic status is crucial. The focus should be on inculcating principles of social justice, inclusion and environmental sustainability during the framing of water policies.

Efficient implementation of these policies will be important to chart out positive impact of the success of the reforms. In this regard, drafting of comprehensive laws will be helpful in systematic application of these policies on the ground. The importance of the political will to encourage reforms cannot be overlooked and in this respect the prominence of public opinion in garnering political will cannot be left unnoticed. Shaping of public opinion in support of reforms could be attained by raising awareness. Engagement of civil society could come in handy for raising public awareness. Also, engagement of the communities

will be crucial in the planning and formation of policies concerning water resources since their inputs form a formidable basis for ascertaining priorities. The problem of water security needs a holistic approach and greater participation of the communities could play a greater role in enhancing water security in the country.

Joyeeta Bhattacharjee is Senior Fellow of the Observer Research Foundation in New Delhi.

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5 Maldives

Author: Rasheeda M. Didi

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Introduction

Data from international financial institutions such as the World Bank, on the effects of Covid-19 on economies, predicted that the Maldives would be the hardest hit in South Asia.[1] This is supported by the UNDP's Human Development Dashboard on Vulnerability to Pandemics.[2] This prediction and assessment are not surprising as 80 per cent of the country's GDP is attributed to revenues from tourism and tourism-related sectors of the economy such as transport, communication, and retail.

The Covid-19 pandemic affecting the economy has an enormous impact on water security, as people in some areas are in dire need of acquiring water for drinking and hygiene. In connection with this, the country's helplessness and vulnerability is felt because climate change affecting water security negatively is not due to the fault of the Maldives but, rather, due to the inability of industrialised countries to reduce their greenhouse gas emissions significantly which is leading to further global warming. Although some countries such as the U.K., France and Canada have formally recognised the climate crisis, they spend as much as US$27.5 billion every year in support of coal, oil, and gas. The call for a reduction of CO_2, in 2018, has been ignored, thus resulting in the recent increase of carbon emissions, which India is leading with 6.3 per cent, followed by China at 4.7 per cent, and the USA at 2.5 per cent.[3]

To combat the situation and continue existing, the Maldives became one of the 18 countries that have declared a climate emergency, and committed to action to drive down emissions as an urgent need. However, despite the Maldives claiming to be at the forefront advocating against climate change and its dangers and continuing to foster global consensus on stopping and reversing its effects,[4]

mere rhetoric is insufficient as climate crisis is destroying the country by eroding its beaches and coral reefs that protect the islands, which are disappearing at a much faster pace than gentle advocacy can produce positive results. Actions must be taken fast as freshwater is being contaminated by seawater, and fish stocks, which are an especially important component of inhabitants' staple diet and livelihood, are being lost.[5] Blame cannot be fixed only on others for, in the Maldives itself, carbon emission per capita increased from 0.72 tonnes to 2.99 tonnes between 1990 and 2014, leading to drastic coral bleaching since 1998, and an average of 75 per cent bleaching in 2016.[6] The result of global increase of carbon emissions leads to rising sea levels caused by rising temperatures. This can only be stopped by reducing greenhouse gas (GHG) emissions that drive global warming.

The dangerous extent to which the country's environmental status has reached is indicated by the Environment Performance Index (EPI) which ranked the Maldives 127th out of a total of 180 countries. For sanitation and drinking water, it occupies the 89th position (47.8%), and for drinking water, the 93rd (44.1%).[7] These are extremely disturbing figures for a country with a small population like the Maldives and show its vulnerability to the issue of water.

The Impact of Climate Change on Water Security

Climate change is the biggest environmental challenge for the Maldives as it affects almost every aspect of the country, including its economy, livelihood, habitat, and water and food security. It affects water security as it leads to sea-level rise, warmer sea temperatures and ocean acidification[8] contaminating the groundwater on which the island communities depend on for hygiene and drinking.

Even as recently as June and July this year, swells and severe storm surges such as sudden tidal waves were witnessed across the country. Consequently, several southern and central islands such as Gaafu Dhaalu Atoll Thinadhoo and Kaafu Atoll Dhiffushi sustained damages. The inhabitants of these islands observed that, compared to previous monsoonal weather patterns, these storm surges were of "unprecedented severity" in that the waves reached a height of approximately one metre above sea level.[9]

For a country where the highest elevation is only three metres, this is a very dangerous and scary occurrence because, apart from the possible immediate destruction of the island, the fear of the scientists' prediction of Maldives submergence is always lurking at the back of people's minds.

To overcome the difficulty of drinking water in this emergency, the Maldives Transport and Contracting Company (MTCC) provided clean, drinking water to the residents of Dhiffushi. An important point to note is that once an island runs out of drinking water or is about to run out, acquiring water is unreliable because transporting it would be exceedingly difficult. During cyclones and monsoons which produce strong tidal waves, the water cannot be delivered as quickly as the islanders need.

Government's Efforts at Combating Climate Change

To mitigate the effects of climate change, in an extraordinary emergency meeting on 29 January, 2020, the Parliament discussed the extreme weather conditions being experienced across the country. As a result, on 11 February, the Committee on Environment and Climate Change passed a draft resolution[10] to declare the country to have climate emergency status and continue to maintain its pledge to stand at the forefront of climate change issues. Standing at the forefront means playing an important role in the international arena and urging the international community to recognise the vulnerability of the country to climate change which can lead to complete destruction. Prior to the draft resolution, the President had taken the initiative to introduce the model of

"Climate Smart Resilient Island Initiative" at the UN Climate Action Summit, in September 2019, which would be a replicable solution to combat climate change and sustainable development for all Small Island Developing States (SIDS).

This model comprises a holistic set of pragmatic and feasible measures for the resilience of small islands to the adverse impacts of climate change. The pledges hope to be realistic and achievable, and give priority to building a sustainable society in harmony with the fragile ecosystem of the country.[11] The most important component of this document, with its 11 environment-related key areas, is the one that safeguards food and water. Moreover, the Maldives has embraced low emission growth as a means to achieve economic growth, energy security, reduce emissions and show leadership in tackling the climate crisis. To do this, the budget for 2020 has been significantly increased. Over US$129 million from the public sector investment programme budget for 2020 has been allocated to climate adaptation and mitigation projects.[12] However, contrary to the government's attempt to overcome the climate problem, there is criticism of its slackness in dealing with the issue. Additionally, critics feel that climate change has become overly politicized. This is contrary to the government's view that climate change is less about politics but an "existential threat".[13]

Water Security

During the past decades, due to the negative effects of mainly global warming and over-population, many inhabited islands have faced acute water shortages, especially during the warmer months as the amount of rainfall has decreased significantly and freshwater lenses in many of the islands have been completely depleted.[14] Not only do these events affect water security and safety; they also affect livelihoods, and damage trees and farms due to flooding with salty water or excessive rain falls. In this case, the government faces a challenge as it cannot compensate the loss since assessing the damage is a difficult task.[15]

By the time Covid-19 arrived in the Maldives, there were still some islands without secure and safe water. To address this shortage, the Ministry of Environment (the Ministry) was mandated to supply water. Currently, there are piped water supplies only in 41 out of 200 inhabited islands while 79 are in progress and 68 are planned. Out of the total, 37 islands have Reverse Osmosis[16] (RO) and 16 islands have rainwater purification systems which can produce up to 8,688 tonnes (8,688,000 litres) of desalinated RO water and purified rainwater per day.[17] Additionally, to achieve the targets of water security, the Ministry is developing improved rain water harvesting systems in 25 islands, which are currently in different stages of implementation.[18] The COVID-19 pandemic reinforces the importance of water security as access to clean water for drinking and basic hygiene is of utmost importance. Since the Covid pandemic began in the country, by 9 April this year, 1,529 tonnes of drinking water had been supplied to 30 islands out of 48 that had requested it, after existing supplies were exhausted.[19]

To ease the burden of water bills during the pandemic, in the capital, Malé, the Maldives Water and Sewerage Company (MWSC), which is responsible for providing water, had assured that they will not cut off any water supplies amid the Covid-19 crisis, from April – June. To improve affordability during the crisis, additional compensation was given by the government to subsidise water at the rate of 30 per cent.[20] Contrary to the information from the outer islands, an online survey found that all respondents (100%) had access to sufficient water for their daily needs; 80 per cent drink bottled water and can afford it, but 20 per cent cannot afford it. This will be the percentage that would depend on other forms such as ground or rainwater for drinking. The data also suggest that 98.6 per cent have an adequate supply of water for handwashing at home. However, only 42.7 per cent reported having access to handwashing facilities in public places frequently visited.[21] The conflicting figures are because of the survey's limitations of the sample size (50) and type of sample group, as online users consist of mostly urban youth.

Public Health

Implementing public health in regard to water security and safety is of utmost importance, particularly during this pandemic, as hand-washing is highlighted by the health authorities. Hence, improving water resource management through traditional practices such as rainwater collection and the protection of groundwater supplies, and reducing the dependence on desalinated and bottled water, is critical.[22]

Another practice that can be incorporated into public health is reducing plastic water bottles. The greater Malé area produces about 50 per cent of the country's plastic waste. Of this, plastic water bottles accounts for a significant amount. Educating the public on the benefits of non-plastic bottles is very important as the Novel Coronavirus lives on plastic surfaces for 72 hours or more, having a staying power of much longer than any other surface such as cardboard or steel.[23]

Besides, this will contribute to achieving the country's target of phasing out single-use plastics by 2023, and switching to water filter systems to create economic, environmental and public health benefits.[24] According to the Health Protection Agency (HPA), Ministry of Environment and MWSC, tap water in Male is safe to drink.

The aforementioned survey regarding water security also adds light to awareness. It found that when questioned about how to protect against COVID, 41 per cent mentioned "handwashing" explicitly, while 7 per cent mentioned "hygiene".[25] These data suggest that people are not sufficiently aware of the significance of handwashing because, by now, with all the pandemic-related awareness promotion, more than 41 per cent should be able to understand the importance of handwashing. Therefore, continued awareness and government strategies to highlight hand-washing need to be rolled out more convincingly.

The population particularly vulnerable to Covid-19 has been declared to be foreign workers living in labour quarters, which are congested and unhygienic. Access to water is a much bigger problem for them than others, as some of them must use mosques and public toilets in hospitals to access drinking water and for toilet purposes. The relevant authorities of the government need to examine and monitor these lodgings for the purpose of maintaining them at the required standard.

Additionally, attention should be given to the provision of washing and toilet facilities in public places such as shopping areas where there are no such facilities. Except in mosques, public toilets are only in the local harbour area where inter-island boats are anchored on their visits to the capital. This is because of the proximity of people's residences and the small size of the islands where one can reach home or their place of work quickly and easily. But now, in connection with the pandemic, toilet and washing facilities in the public areas need to be set up for tourists and other visitors to the islands, especially the capital.

Conclusion

It is predicted that global warming is likely to rise by 1.5° Celsius between 2030 and 2052, if it continues to increase at the current rate.[26] This will increase the sea level, and projections of global mean sea-level rise suggest an indicative range of 0.26 to 0.77 metres by 2100 for 1.5° Celsius of global warming, 0.1 metre less than for a global warming of 2° Celsius,[27] which will destroy groundwater completely by the overflowing seawater.

Powerful efforts must be taken by the government to integrate public health into future water policy. This can be done only by way of rigorous training, raising awareness, and imposing public health practices which make it mandatory to follow these practices. Failure to comply by the community should be reprimanded. Otherwise, the situation will be like what the country has been experiencing after the COVID-19 lockdown was lifted. Lack of attention to health advice led to a rapid increase of the Coronavirus infections in the capital island.

Rasheeda M. Didi is an independent lecturer/researcher and Member of Higher Education Council of the Maldives.

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6 Water Security in Nepal

Author: Aashiyana Adhikari

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Abstract

Water security and climate change are intertwined subject matters. In view of the current COVID-19 pandemic, this twin subject has come into the limelight as developing countries are especially vulnerable. UN-Water defines water security as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and social-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability".[1]

Water security is no longer an issue for arid countries but is rather a challenge that has the potential to affect us all in South Asia by intensifying conflict and instability, diminishing food security, accelerating migration, expediting the spread of disease and stunting economic development. Access to clean and adequate supplies of water is the foundation for creating a healthier, safer and more secure world. We ought to keep in mind that South Asia is mired by inter-state and intra-state conflict, currently reeling under a pandemic; therefore, we cannot afford a water-borne crisis.

Addressing the issue of water security is one of the most serious challenges that a developing country like Nepal has to face. Efforts in research, policy and practice surrounding water security are underway — but important questions still remain to be understood and addressed. In particular, Nepal lacks effective institutions and decision-making systems to address the growing uncertainties and risks regarding water availability, variability, and to clarify the roles of state and non-state actors. These

problems become more complex in the context of growing urbanisation, climate change, and persistence of social inequity and conflict at various scales, and weak state capacity in rural areas.

Thus, this research aims to explore the current policy situation and challenges of water security in Nepal, along with the idea of incorporating public health and climate change consideration into water policy in the future.

Introduction

Water security impacts all dimensions of human health and well-being. It plays an important role in both food and energy production. Most industrialised countries have achieved water security, since they invested early and heavily in infrastructure, institutions and the capacity to manage wastewater recycling. But in many developing and underdeveloped countries with low or no investment in infrastructure and water management institutions, water security still remains an urgent priority.[2]

Those affected by water security issues mostly live in underdeveloped and developing countries and suffer the most. Hence, despite having an estimated 7,000 m^3 per person per year of water resources,[3] Nepal's water security status is thought to be among the weakest in Asia and the Pacific.[4] The current period is defined by climate change and extreme weather events, where lack of water security can lead to water shortages, disruption of infrastructure development, and lack of sanitation and hygiene.

As per a report by the Asian Development Bank,[5] inadequate access to water has led to increased disease incidence, health risks and associated economic burdens, which disproportionately impact the poor and vulnerable population of the country. Urban areas of the country are characterised by poor water quality and acute water shortages which have a subsequent effect on public health.

Water scarcity also has a direct link with agricultural production and in a country like Nepal where 66 per cent of the population is directly engaged in agriculture,[6] availability of water resources plays a huge part of their everyday survival.

Additionally, the supply of clean and adequate water is critical for maintaining human health and preventing the spread of disease, and the simple act of handwashing can reduce the spread of infectious diseases by 50 per cent.[7] The pandemic and water security are intricately connected. Recent outbreaks of infectious diseases like Ebola and COVID-19 have shed light on the importance of water for addressing many of the pandemic's challenges and health outcomes.[8]

Climate Change Impact on Water Security

Climate change is one of the most imperative challenges that have been affecting humanity in several aspects for more than a decade. According to the Intergovernmental Panel on Climate Change (IPCC), the impacts of climate change are already being felt in all parts of the world, and the detrimental effects are projected to increase substantially in the years to come.

All aspects of the water cycle are affected by climate change and water is the primary way through which the impacts of climate change can be felt.[9] Climate change has adverse effects on water resources on a global scale. One such significant effect of climate change which leads to warming is the increase in the amount of water that the atmosphere can hold, which in turn can lead to more and heavier rainfall when the air cools.[10] The technical report published by the IPCC on climate change and water mentioned that, despite the increase in global rainfall, many dry regions along with Southern Africa and the Mediterranean will suffer from increased evaporation and reduced rainfall which in turn will affect billions of people living in dry regions due to water scarcity. Hence, there is no escaping the fact that water is a fundamental element of the climate system.[11]

South Asia has become one of the most water insecure regions on the Earth even without the added stress of climate change. Large-scale urbanisation, an increasing demand for agricultural products due to a rising population, poor water management and insufficient maintenance of water conveyance infrastructure are largely responsible.[12] But climate change will definitely multiply this stress through increasingly variable rainfall, river flows and groundwater recharge rates, i.e. the sources of sustenance that South Asian countries rely on. In the case of Nepal, the changes in hydrological cycle and the depletion of water resources are some of the top environmental challenges that the country is facing due to climate change.[13]

In comparison to many other South Asian countries, Nepal has a much lower population density and higher per capita availability of water resources, yet many parts of the country lack safe water supplies and distribution, especially in urban areas.[14] Youths in the country are rapidly moving from rural areas to the cities as prospects for meeting food and livelihood requirements are becoming increasingly difficult through agriculture. This causes the population of urban centres to increase, thus leading to a lack of basic facilities like safe drinking water.

Challenges to Water Security in Nepal

According to the Department of Water Supply and Sewerage Management in Nepal, even though an estimated 80 per cent of the total population has access to drinking water, it is not safe. Many people in rural and remote areas have to rely on small streams running from the mountains or in some cases even spend hours walking just to get water and many times the drinking water available is not safe and is polluted.[15] Apart from the biophysical factors, changes in lifestyles, poor governance, outmoded infrastructure, lack of storage facilities and poor awareness levels are aggravating the problem of water security in the country.[16]

Similarly, despite having a high annual rainfall, Nepal still faces significant challenges in ensuring water security. This is largely as a result of the high temporal and spatial variations in water availability as well as the lack of congruence between locations of water availability and water need[17] but also due to governance issues. It is also found that there is a lack of policy and strategy to promote climate resilient water management practices, and the distribution of governing power across various levels of governance is also imbalanced.

The challenges to water security in Nepal include ensuring improved access to safe drinking water and sanitation, providing sufficient water for irrigation, securing water for urban needs, and generating energy without compromising the water-dependent ecosystems.[18] In addition to this, due to rapid population growth, unsanitary disposal of wastes and other human activities, most of the water sources are becoming polluted. Some practices in rural areas of the country like open defecation, disposal of human wastes around water bodies and harmful agricultural activities have affected the quality of water from streams, springs and ground sources. This creates a huge impact on public health since the water quality is highly degraded by physical and chemical parametres.

Effect of the Pandemic on Water Security

The accessibility and provision of safe drinking water, sanitation and hygienic conditions are essential to protect human health during all infectious disease outbreaks including the the COVID-19 pandemic. However, access to Water, Sanitation and Hygiene (WASH) is very limited across underdeveloped and developing countries. For instance, 7.3 billion people lack basic handwashing facilities[19] which creates a number of challenges for combating transmission of the current COVID-19 virus and preventing future potential pandemics.

People in informal settlements, the poorest and marginalised are particularly vulnerable during pandemics as they often rely on communal water points and toilets, private vendors, and water tankers.[20] The sanitation and hygiene in these kinds of settlements are highly compromised. The

World Bank already estimates that the pandemic is likely to push 49 million people into extreme poverty by the end of 2020, with Sub-Saharan Africa and South Asia being the hardest-hit regions.[21] The socioeconomic and health impacts of this pandemic will worsen the drinking water insecurity of people, who are already at environmental, financial and institutional risks.

Although COVID-19 is not a water-borne disease, the importance of hygiene emphasises that it is related to water. The benefits of WASH to reduce and prevent the spread of respiratory diseases are well-known but in a developing country like Nepal where 52 per cent of people do not have handwashing facilities with soap and water at home,[22] needing to leave home to access communal facilities and queuing for access in close proximity to others make self-isolation and social distancing difficult to implement. This increases the risk of disease contamination and negates the very idea of physical distancing that is being prescribed to deal with the Covid-19 outbreak.

Situation of Various Water-Related Policies in Nepal

Systemic and planned development programmes of public water supply, sanitation and security started from the beginning of the First Five-Year Plan(1956 – 1961), but the sector was only given significant priority from the Fourth Five-year Plan.[23] Kathmandu valley itself reels from water shortages so much so that the Melamchi water project has been ongoing for the past 3 decades. Every new elected government of Nepal has vowed to swiftly implement the project so as to provide people of the capital city with safe drinking water. The main legislation in relation to drinking water in Nepal is the Water Resource Act 1992 which is an umbrella Act governing not only drinking water, but other uses of water and overall water resource management in Nepal.[24]

Since then, various programmes and policies to specifically increase the number of water supply and sanitation projects have been launched. Coverage rather than quality improvement to the water supply has been and still is the main focus of the institutions. One such example is the Ninth Five-Year Plan (1997 – 2002) which estimated national urban water supply coverage at 62.5 per cent, and set a target of 100 per cent coverage, with sanitation for 40 per cent of the population, by the end of the plan.[25] This proved to be an ambitious target and was deemed very questionable as the plan did not take into account the poor operational status and poor quality of water supplied by already built facilities. Looking at the most recent policies, the constitution of the Federal Republic of Nepal, which was promulgated on 20 September 2015, has accorded a high priority to protect, promote and use water resources.[26] Nevertheless, implementing the policy has been considered challenging due to the lack of a clear mandate of regarding climate change.

Although policy, visions and frameworks for water security have aimed at sustainably managing, protecting and conserving water resources, there is a lack of effective implementation. New policies and visions are not linked with new and emerging issues and objectives and actions of the framework are more often than not framed in the context of climate change. According to the National Law Commission of Nepal, expansion of services mentioned in the policies has not been very systematic or effective in the absence of master plans to guide the development of water supply and sanitation systems in urban areas.[27] Many urban areas still have poor sanitation services and suffer from a highly degraded urban living environment.

The failure of local institutions to properly function has increased the vulnerability of communities with regard to water security. Having only water-related policies seems to be ineffective and reached a situation where, climate change is leading to a lot of under-performance in the current water security policies.

Incorporating Public Health into Future Water Policy

It is now increasingly being recognised that water is likely to be a major critical resource issue of the world, and that the social, economic and environmental future of Asia is likely to depend on how efficiently and equitably this resource will be managed in the coming years.[28] Under the current climate change prediction, the capacity to provide safe drinking water to Nepali vulnerable communities will be a big challenge. Part of this challenge is the lack of an adaptive governance strategy that transcends jurisdictional boundaries to support integrated policymaking, regulation, or infrastructural adaptation.[29]

In regard to the high degree of spatial and temporal variability in climate conditions experienced by Nepali communities, new strategies should be developed under existing water resource management policies to ensure safe water policies including policies with respect to public health. Similarly, robust and flexible governance strategies should be developed that strengthen public health input to existing water policy, regulation, and surveillance infrastructure through proactive risk planning, adopting new technologies, and intersectoral collaborations.[30]

One significant knowledge gap in many countries is the burden of disease related to the consumption of water, and how this burden is distributed among the different social groups and water supply systems.[31] Creation of inter-sectoral collaboration is vital for collecting and using data to estimate the burden of diseases. For instance, the health sector must be pro-active in collecting and reporting data about the outbreak of any infectious disease which later can be used to make policy decisions on the type of disease reported.

Conclusion

All South Asian governments at the moment are focusing on controlling the Coronavirus pandemic. But it is important that they do not lose sight of the other crisis brewing over the horizon as the water crisis and water-borne disease outbreak are two such possibilities. Building a post-coronavirus policy means re-imagining how producers and consumers value water and water security, and how the policies will be designed more equitably and safely. While international policies play a vital role in shaping national policies and are important for the protection and management of water resources, it is the policy framework at the national and local level that has direct implications for the provision of drinking water to vulnerable communities.

Climate change issues should be covered, and actions and objectives related to water security policy should be framed in the context of climate change. The government policies and regulations are biased towards formal institutions and have acted as a barrier to the effective functioning of local institutions. Due to such issue with regards to the formal and local institutions, many policies are not functioning properly and have failed to address the risk and impact that climate change can bring to water security.

One of the solutions lies in addressing the challenges by generating an integrated national health system that can provide a solid foundation for reforms. Similarly, the policy framework and decisions that have implications for the water sector should be developed by different departments. For example, policies within the agricultural and industrial sector may influence the quality of water resources because of the discharge of pollutants into the air and water.

Likewise, different sectors might have different implications on water resources. Hence, it is important that policy analysts and decision makers in the water sector have an understanding of the policies in different departments so that they can implement policies and associated regulations accordingly.

Thus, alternative strategies have to be explored rather than rely on with the same policies that do not include climate change and health-related factors. Mainstreaming climate change and public health strategy within the water-related policies can help fill the gap that is present in existing policies.

Aashiyana Adhikari is a Research Associate, Centre for South Asian Studies (CSAS), Kathmandu. The author is grateful to Prof. Dr. Damodar Pokharel for his suggestions on public health to complete this paper.

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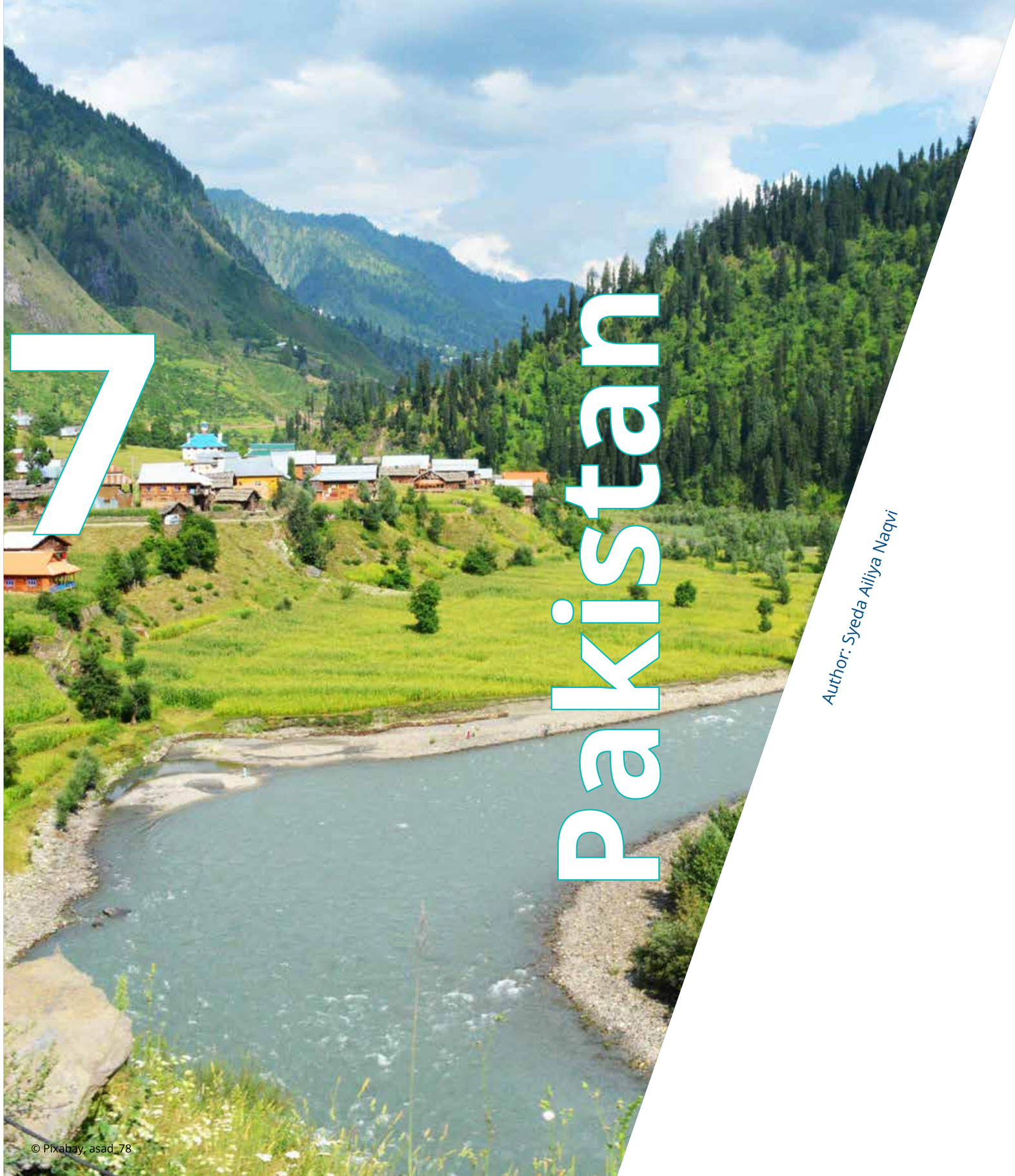
7 Pakistan

Author: Syeda Ailiya Naqvi



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Introduction

Climate change has altered the balance of ecosystems around the Earth. Extreme weather situations have caused loss of biodiversity and natural habitats, and also resulted in animal migration. Similarly, human encroachment of wildlife territory has led to animal displacement. This imbalance has consequently enabled unnatural animal to animal and animal to human interaction, making the transmission of pathogens easier. A study suggests that "3,200 strains of coronaviruses already exist among bats" and are waiting to be passed on to new hosts.[1] Climate change provides favourable conditions for the spread of zoonotic diseases thereby increasing the possible outbreaks of pandemics in the future.

Water plays a key role in combating the spread of infectious diseases. Water scarcity is ranked above infectious diseases and food crises in the Global Risks Report by the World Economic Forum.[2] It is directly related to suppressing and preventing pandemics. Improved sanitation and hygiene, and easily accessible water could decrease the disease globally by 9 per cent and reduce death rates by more than 6 per cent.[3] However, there is not much attention being given to the significant role of water security in disease prevention and subsequently public health.

Water and Public Health in Pakistan

Pakistan is the world's fifth most populated country, catering to the basic necessities and health requirements of approximately 220 million people. Despite being well-endowed with water, serious water mismanagement has significantly lowered Pakistan's water productivity. The usage of water stands at being the fourth-highest globally.[4] The burgeoning population trajectory has also impacted the availability of water per capita which is less than 1,000 cubic metres, making Pakistan a water-scarce country.[5]

Lack of access to clean and safe drinking water, and affordability issues have had grave health impacts. It is estimated that 27 million Pakistanis lack access to drinkable water and that four-fifths of all diseases in the country are caused by untreated and contaminated water.[6] 14 per cent of total deaths occur due to water-borne infectious diseases like typhoid, cholera, dysentery and diarrhoea, etc.[7] Some informal settlements have access to water for only one hour a day, while other poor households spend a significant part of their income on clean water. More than 34 million people live in *kachi abadis* or informal settlements where there is limited or no access to clean water.

The COVID-19 crisis has exacerbated the challenge of water insecurity. The World Health Organisation states the foremost preventive measure as washing hands for 20 seconds, while 40 per cent of the global population lacks access to clean water and soap.[8] This has naturally inculcated a sense of security in an uncertain, perilous environment. A report suggests that domestic use of water in Lahore has risen by 10 per cent amidst the pandemic.[9] According to the Pakistan Council of Research in Water Resources (PCRWR) there are indicators that there is an increase in overall water utilisation throughout the country. People are consciously ensuring the repeated washing of hands.

The question then arises: what happens to citizens who belong to areas where the availability of clean and safe water was already considered a luxury? Also how is it possible to isolate and physically distance if the only source of water is through communal facilities? A report by the Karachi Urban Lab states the additional financial cost per month for washing hands to protect against the virus, which is quite significant for a daily wage earner.[10] With no jobs or jobs at risk, this seems even more burdensome. Even though pandemics are non-discriminatory in their contagious nature, their health and economic impacts are more likely to be borne by the poor than the rich.

In the United States, every dollar invested in sanitation gives a return of USD2.50 "saved in medical costs and productivity"; similarly there is a return of USD3 in an investment of a dollar in safe drinking water.[11] Without strengthening water security, the impact of climate change and pandemics cannot be mitigated. This requires sustainable and inclusive policy frameworks that are integrated in their implementation and cater to the various elements of human security.

Pakistan's National Water Policy

Recognising the emerging water crisis which stems from climate change, a population bomb, water mismanagement and rapid urbanisation, Pakistan's Ministry of Water Resources drafted its first National Water Policy which was approved in 2018. The National Water Policy aims to establish an integrated water management national framework under which all provinces can formulate and implement their individual Master Plans.

Under the broad spectrum of addressing water-related issues, the policy primarily weighs on water management practices including wastewater, water storage, water treatment, water productivity and improved and sustainable availability of water resources. It discusses the development of a sustainable irrigation system and an increase in the production of hydropower. The framework envisioned also incorporates the impacts of climate change and mitigation strategies for natural disasters, as well as the need for the preservation of the environment and ecosystems. It recognises the need to tackle food security and other "large-scale stresses", and underscores the significance for strengthening data, information systems, and water-related instituitions. Additionally, it encourages public-private investments and covers the aspect of public awareness also with regards to water conservation habits.

Several concerns have been identified in the policy pertaining to the country's water sector that fall under the ambit of the stated framework. A main concern relates to the health and well-being of the people of Pakistan that the policy intends to "resolutely attend to particularly because of its implications on food and energy security". Water, Sanitation and Hygiene (WASH) has been given the first priority when it comes to the uses of water.

Under Section 12 Drinking Water and Sanitation, the framework tends highlight the issue of affordable and accessible clean and safe drinking water and sanitation systems. It also prohibits the water quality to fall below the acceptable standards which should be maintained and enforced by Quality Monitoring Plans. Water contamination and pollution is to be kept in check through active legislation. WASH should be aligned with the National Drinking Water and Sanitation Policies and the Sustainable Development Goals (SDGs). The National Water Policy does briefly touch the health aspect of water-related problems however where it falls behind is in its rigorous correlation and reenforcement of public health in water management.

Challenges in Incorporating Public Health in Future Water Policy

The Pakistan Muslim League — N (PML-N) government devised Vision 2025 at the beginning of 2014.[12] The 12-year vision, formulated under the Ministry of Planning, Development and Reform laid the path to achieving certain national goals by the year 2025 which are congruent to the United Nation's SDGs.

Amongst the fundamental components of Vision 2025, "People First" and "Security" relate to SDG nos. 3 and 6, that cover health and water security respectively. Even though health and water security are elaborated separately, in several instances the Vision makes a correlation between the two. It identifies that 70 per cent of all diseases that have had a serious impact on national health are water borne in nature.

The primer issued by the Planning Ministry and subsequent concerted efforts towards the coordination and formulation of an Integrated Water Resource Management Strategy shaped up as the National Water Policy under the same government, just before the Pakistan Tehreek-e-Insaf (PTI) government came to power.

A challenge in incorporating public health into water policy by different governments may be a result of divergent political agendas, or an unfavourable environment to prioritise the subject under discussion. This has led to a lack of consistency in the approach to dealing with health impacts of water-related issues. Therefore, the political will of all the stakeholders is imperative in this regard.

Another problem that is perhaps most significant is the governmental structure of the country and the division of responsibilities between the federal and provincial governments. Pakistan has a federal form of government. Under the 18th Constitutional Amendment, the provinces have been given greater autonomy and some sectors of governance have been devolved to provincial governments. Health is a provincial subject, so likewise, water-related laws can only be legislated by the provincial governments by virtue of the placement of water as a provincial subject since pre-independence times.[13] Therefore, each province is responsible for the water sources within its geography and a consolidated approach to water management across the nation based on equity is very arduous. Inter-provincial fissures have to be dealt with in terms of water resource management, sufficient water availability, acceptable water quality and affordable access to WASH.

Water conflict among the provinces dates back to the 1900s, way before Pakistan became an independent country. The case study of Sindh and Punjab to date demonstrates the lack of trust between the two. The Water

Apportionment Accord of 1991 allocated water sharing between provinces despite having water availability issues. The total renewable water resource availability for each province varies when compared to the total water withdrawals. For example, in the case of Punjab, water withdrawals exceed water availability by 20 per cent.[14]

Contrarily for Khyber Pakhtunkhwa, the total renewable resource is 24 billion cubic metres whereas its total water withdrawals are less than a third of that. In Balochistan's case, climate change and water mismanagement may lead to two-thirds of its population not having access to water of sufficient quality by the year 2025.[15] For a province that lacks an adequate healthcare system, unavailability of safe water will only risk its population further.[16] Contaminated water, be it as a result of industrial waste or human waste, can affect surface and groundwater quality which gives birth to infectious diseases. Additionally, affordable access to sanitation services also helps to both suppress and prevent disease outbreaks.

Conclusion

The perspective planning in the form of Vision 2025 and the National Water Policy 2018 takes stock of the linkage between public health and water. Yet, the operational aspects of this policy have not adequately materialised owing to certain challenges that have to be addressed. The democratic transition has failed to dial up the political will to carry forward the work by the previous government on water-related issues which is in itself a constitutionally contested subject. Beyond that, the re-enforcement of public health in water management is becoming more onerous due to varying levels of affordable access to and acceptable quality of water in all provinces of Pakistan.

Syeda Ailiya Naqvi serves as Managing Editor and Director at the Islamabad-based Centre for Strategic and Contemporary Research (CSCR).

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8 Sri Lanka

Author: Ruwanthi Jayasekara

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Introduction

Water is no more a basic human need. A milestone was achieved by the United Nations by recognising water as a human right in 2010 that water must be "safe, acceptable and affordable".[1] However, we lie ahead of a stark reality that 2 billion people live in water-stressed nations and over half of the global population lack access to safely managed sanitation. According to the World Health Organisation, the minimum amount of water required to satisfy basic human needs is around 1,000 m^3 per capita per year. However, it is estimated that by 2050, 1.7 billion people in 40 countries will have to survive on much below this level.[2]

Living in an era of climate crisis, noncompliance by states on setting and achieving environmental standards has led to high temperatures, melting of glaciers, sea-level rise and droughts, and 90 per cent of natural disasters are water-related. Both over abundance and shortfall of water lead to natural disasters and therefore a drop of water is never to be underestimated. Water security is defined as "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability".[3] Therefore, water is a tool to measure health, socio-economics, politics and climate, and healthy water gives power to reigning regimes. In the same manner, lack of access to healthy water could turn nations into battlefields. This paper will try to prove that the availability of safe water is perturbed by health concerns and adverse effects of climate change in Sri Lanka and the need to pay attention to the environment and health when devising a sound water policy.

Sri Lanka in the Game of Securing Water

According to statistics from the Food and Agriculture Organisation, the total area of the land is 6,561,000 ha, of which 1,300,000 ha of land was cultivated in 2017.[4] Up to June 2020, 2,278,453 people had access to piped drinking water by the Water Board and 2.07 per cent of people had access to piped sewerage.[5]

In terms of access to drinking water, many people still depend on protected wells within and outside their houses, tube wells, bowsers, rivers or streams, rainwater and bottled water apart from tap water. According to proposed parametres, drinking and bathing water should be at pH 6.0 – 9.0 while agricultural water should be at pH 6.0 – 8.5.[6] From 2015 to 2020, the number of water connections has increased, by giving access to safe drinking water, while new water connections have decreased. This indicates that population growth and the increased demand for water lead to access to safe water. However, poverty has compelled many to seek alternative sources, leading to unsafe and unhealthy water, which has caused health issues. Adverse effects of climate change that include droughts, floods and tsunami, etc. have not only led to the displacement of people without access to safe water but also paved the way as a medium to spread water-borne diseases like malaria, dengue and yellow fever. Thus, a plan of action on water security would not be a success without the incorporation of climate change and health policy. It is, therefore, necessary to realise sewerage facilities, access to safe water, water treatment and water for basic development needs.

From Climate Change to Diseases

Since the recent past, disasters have struck the island more often as a result of extreme climatic change. Among the many disasters, floods have wrought the most significant damage to the people. It was after the Tsunami in 2004, facing the worst natural calamity in the history of Sri Lanka, that the significance of disaster risk management became very well perceived.

Next, the 2010/11 floods caused an economic impact of approximately USD1 billion. The number of deaths due to natural disasters has gradually increased with 123 deaths in 2015, 263 in 2016 and 509 in 2017. A total of 3,386,466 people were affected by natural disasters only in 2017; 2,679 houses were completely destroyed while 46,903 houses were partially damaged only in 2017. With the destruction of houses, people lack access to safe water and sanitation at camps and this creates a breeding ground for the spread of diseases.

The malaria epidemic during the period of 1934 – 1935 was the most acute pestilence in the history of Sri Lanka.[7] The cost was very high with 800,000 cases in seven months. It is unlikely that the malaria outbreak was caused by a drought rather than excessive rainfall and two mortality waves were prevalent.

Since 2008, the majority of those infected were the military as they were deployed all around the country in the pursuit of counter-terrorism. Thus, military camps were affected. Since the civil war, the military of Sri Lanka has not only been battling against traditional security threats but nontraditional security threats as well.

The last indigenous case of malaria was reported in October 2012.[8] Currently, Sri Lanka possesses a success story of controlling malaria transmission and the World Health Organisation recognised Sri Lanka as a malaria-free country in September 2016.

"Water-borne diseases account for 80 per cent of all infections in developing countries."[9] In the context of Sri Lanka, the number of Dengue cases has fluctuated. Even though the focus of attention was COVID, patients were treated for Dengue even during the pandemic.

Even though the rainy season creates a breeding ground for the spread of Dengue mosquitoes to lay eggs, during the dry season, cases of dengue are also seen to be prevalent.

Table 3.8.1: Number of Household Water Connections

Year	Number of Household Water Connections by National Water Supply and Drainage Board	Number of New Water Connections
2015	1,804,069	—
2016	1,931,256	127,187
2017	2,045,919	114,663
2018	2,143,276	97,357
2019	2,240,643	97,367
2020 (up to June)	2,278,453	—

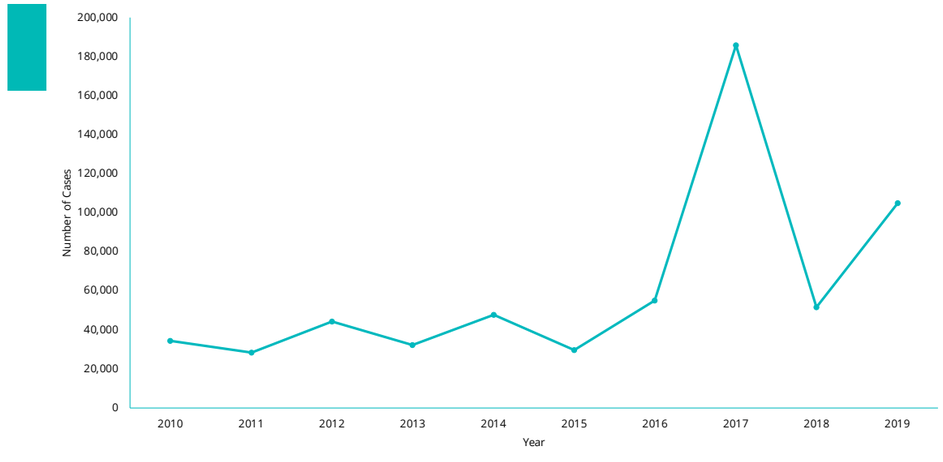
Source: Author

Table 3.8.2: Cases of Dengue in 2020

Month	Cases of Dengue
January	11,607
Feburary	5,365
March	1,681
April	511
May	1,474
June	2,218
July	2,250
August	1,432
Total	26,741

Source: Epidemiology Unit, Ministry of Health, 2020

Graph 3.8.1: Cases of Dengue in 2010 – 2019



Source: Epidemiology Unit, Ministry of Health, 2020

Dengue and malaria can be seen spreading as a result of natural disasters with climatic changes. If these health issues reach a climax, there is even a possibility of chaos at the level of society spiralling over to nations, destabilising national security. Therefore, climate change holds the potential of creating conflicts.

Even though COVID-19 is not a water-borne disease, it has highlighted the urgent need for safe and healthy water. Battling COVID-19 is once again taking everyone back to the urgent need for WASH systems. There have been 3,262 cases and 13 deaths. Fortunately 3,005 have recovered and discharged and the fatality rate remains at 0.4 per cent, which is far below the global average which amounts to 3.17 per cent (updated on 14th September 2020). Sri Lanka's effort in managing the situation has been identified as the best in the region. Sri Lanka used the strategy of 3T. i.e. Testing, Treating and Tracing,[10] to rapidly identify COVID-19 cases and to contain the spread around the country. These efforts would have failed if the country was water stressed. From washing hands to using and handling medicine, and ensuring sufficient food on the table to agricultural produce was able to be consistently done due to the availability of water.

Food Security through Safe Water

Sri Lanka is self-sufficient in regard to rice, tea and coconut, of which tea and coconut are almost rainfed. Vegetables such as potatoes, beans, capsicums, tomatoes and cabbages, etc. and other field crops such as chilis, red onions, big onions, cowpeas, green grams, soy beans, etc. add to the agricultural output of the country. Importantly, rice accounts for 34 per cent of the total cultivated land in Sri Lanka. Growing rice demands tremendous amounts of irrigated water.[11] According to the above statistics, total paddy field cultivation which is rainfed is less than 25.5 per cent of the total paddy fields sown from 2015 – 2018. "Water economists have calculated that to produce a kilogram of rice requires between 1,200 to almost 6,000 litres of water, dwarfing drinking and domestic water usage."[12] In Sri Lanka, paddy fields are cultivated during two main seasons, namely Yala season and Maha season.

The value of the water utilised for the production of rice could be higher than the value of the final product. It is best for countries experiencing water stress to import food from countries with a surplus of water.[13] Scarce resources should not be exploited, as they will be more valuable when utilised once all other alternatives are used up. Water became the guardian spirit in fighting against COVID-19, as washing hands aimed to reduce the spread of the virus to other surfaces. This increased the demand for water during the pandemic. When all services came to a standstill with the imposition of a lockdown, the agricultural sector was in operation, and 3,000 more hectares have been cultivated to ensure buffer stock. Besides, home gardening was boosted by the government even donating seeds. Self-sufficiency in food became one of the top slogans in the country.

As food falls under the basic needs of people, if they are deprived of it, there is a possibility of them resorting to violence. This can even trigger the toppling of governments as in the case of the "Arab Spring". There was a spike in global food prices as a result of extreme weather conditions in 2010 – 2011. According to research, climate change is a critical factor in escalating tensions both within a nation and between nations. Therefore, if sufficient safe water is unavailable due to climate changes, this could ultimately link to not only health issues but political chaos and conflicts.

Table 3.8.3: Paddy: Extent Sown and Harvested by Irrigation Scheme and Season from 2015 – 2018

Irrigation Scheme and Season	2015 (Ha)	2016 (Ha)	2017 (Ha)	2018 (Ha)
Sown (Maha)				
Major Scheme	354,300	345,154	259,734	322,217
Minor Scheme	203,836	203,001	110,937	148,616
Rainfed	214,490	207,850	171,885	196,358
TOTAL	**772,626**	**756,005**	**542,556**	**667,191**
Sown (Yala)				
Major Scheme	302,948	263,704	176,965	242,542
Minor Scheme	123,375	92,199	42,537	84,858
Rainfed	54,339	29,415	29,621	46,363
TOTAL	**480,662**	**385,318**	**249,123**	**373,763**
Harvested (Maha)				
Major Scheme	336,288	340,060	240,860	318,626
Minor Scheme	195,768	201,739	71,535	133,325
Rainfed	202,911	200,925	70,461	167,977
TOTAL	**734,967**	**742,724**	**382,856**	**619,928**
Harvested (Yala)				
Major Scheme	301,587	263,064	174,381	237,645
Minor Scheme	121,802	88,016	38,378	80,590
Rainfed	52,384	28,890	23,720	44,731
TOTAL	**475,773**	**379,970**	**236,479**	**362,966**

Source: Department of Census and Statistics, 2020

The Nuance of Using Fertiliser

Production of agricultural goods and the usage of fertiliser are interrelated. Sri Lanka ranks 26th in the world's fertiliser usage.[14] More than 20,000 – 23,000 kg of arsenic, 40,000 – 50,000 kg of chromium and 20,000 – 30,000 kg of lead are used annually in the agricultural domain. In addition, Sri Lanka imports more than 800,000 metric tonnes of straight chemical fertiliser, even though its efficiency is proven to be low. In reality, only 20 per cent or less than 20 per cent is absorbed by plants and the rest ends up in the soil and water reserves.

Sri Lanka is also over dependent on chemical usage. Since 2015 - 2018, chemical fertilisers have been added to 98.3 - 99.7 per cent of paddy fields cultivated in both Maha and Yala seasons. Chemical fertilisers consist of high proportions of nitrogen which leads to nitrate contamination. Efforts have been taken by the National Fertilizer Secretariat to provide fertiliser cash grant programmes for paddy field cultivation to increase the health of the soil by decreasing Nitrogen (N), Phosphorus (P) and Potassium (K) via the usage of straight chemical fertiliser. The Fertilizer Regulatory Act provides guidelines for assuring the quality of fertiliser and the benefits that could be reaped via natural fertiliser to ensure healthy crops and healthy water.

Industrial waste and fertiliser in water remain the main causes of the increase in water-related diseases. Drops of unsafe water spiral over to the domain of health security. Two major health issues identified as a result of unhealthy water are Chronic Kidney Disease of unknown aetiology (CKDu) and Teeth-colouring. These issues have been prevalent in North Central, North Western, Uva, Central, Eastern, and Northern provinces for more than 20 years. “CKDu has grown to epidemic level in Kurunegala & Anuradhapura districts.”[15]

Children too have become innocent victims and the cost of dialysis remains one of the main issues for CKDu patients. “WHO estimated that every 8 seconds a child dies from a water-related disease and that each year 5,000,000 people die from illnesses linked to unsafe drinking water or inadequate sanitation.”[16] The National Water Supply and Drainage Board and Sri Lanka Navy have engaged in supplying safe drinking water, in addition to foreign-funded large-scale water supply projects which include Greater Kandy Water Sector Development by Japan International Cooperation Agency (JICA), Greater Dambulla Water Development by India, Integrated Water Supply Scheme for the Unserved Area of Ampara District by Australia, Jaffna Killinochchi Water Supply & Sanitation by Asian Development Bank and Thambuttegama Waster Sector Development by the People’s Republic of China, etc.

As at 30th August, 2020, only 2.07 per cent of the population has access to piped sewerage.[17] Water treatment is still being developed in Sri Lanka. One of the strategies used is water treatment via Reverse Osmosis (RO) plants. “Studies show that 55 per cent of domestic treated water could be substituted for rainwater, while 85 per cent of water used for commerce and industry does not need to be of drinking standard.” [18]

Currently, there are sewerage treatment facilities in Colombo Municipal Council Zone, Dehiwala/ Mt. Lavinia, Kolonnawa, Kataragama, Hikkaduwa, Rathmalana, Jaela, Kurunegala and Kandy. Among them, the highest number of beneficiaries from sewerage treatment accounts for 331,500 from the Colombo Municipal Council zone.[19] In addition, sewerage networks presently cover major Housing Schemes such as Mattegoda, Jayawadanagama, Maddumagewatta, Raddolugama, Kuruminiyawatta, Royal park and Hantana and Export Processing Zones. Due to the growth in population and housing density, water treatment has been limited. Despite the fact that water treatment is in the process of being developed, the usage of treated water remains low.

An environment with fertiliser and industrial waste is unsustainable. When fertiliser and industrial waste in water increases, posing threats to safe water, this creates a direct impact on human security. When people are deprived of food and water, they may engage in violence as securing food and water are basic human rights.

Table 3.8.4: Paddy: Extent Sown by Application of Fertiliser 2015 – 2018

Type of Fertiliser	2015 (Hectares)	2016 (Hectares)	2017 (Hectares)	2018 (Hectares)
Maha				
Chemical Fertiliser	492,102	516,162	308,863	417,017
Organic Fertiliser	6,413	1,157	2,955	2,934
Both Chemical and Organic Fertiliser	273,036	236,106	229,663	239,101
None	1,075	2,580	1,075	8,139
TOTAL	**772,626**	**756,005**	**542,556**	**667,191**
Yaha				
Chemical Fertiliser	282,427	212,917	132,086	239,577
Organic Fertiliser	691	467	2,124	2,015
Both Chemical and Organic Fertiliser	186,215	171,609	114,183	130,951
None	1,329	325	730	1,220
TOTAL	**480,662**	**385,318**	**249,123**	**373,763**

Source: Department of Census and Statistics, 2020

Governing Bodies to Safeguard Water

There are several governing bodies in Sri Lanka that are related to water governance. The list incorporates the Central Environmental Authority (CEA) under the Ministry of Environment with responsibility for the prevention of water pollution, National Water Supply and Drainage Board (NWS&DB) for access to safe drinking water and national sewerage treatment, the Department of Agriculture for water management, safe food production and usage of fertiliser, the Water Resources Board for groundwater management and the Board of Investment for industrial wastewater treatment.[20]

These bodies have commenced many initiatives which consist of the construction of centralised treatment facilities, standardising safe and healthy water guidelines by planning and monitoring the quality of water, construction of safe water connections and treatment plant, etc. However, with all these plans of action, there are threats to water security, as a result of climate change and diseases and vice versa.

Recommendations

Diseases and climate change have a profound impact on water security. Although different authorities have launched initiatives for water management, sewerage facilities, access to safe water and water treatment, because of the above-mentioned persisting issues, water security has been disturbed. The following can be considered as a road map for water security.

1. Establishment of a task force — As there is no centralised system, which connects all existing water governing bodies in Sri Lanka, it is best to establish a task force. The National Water Supply and Drainage Board is the central service provider and therefore cannot perform the responsibilities as a regulatory institution. All individual institutions could be connected via one platform which would make it easy to monitor and govern available water resources, sewerage treatment facilities and disaster management as well as share available data and technology. This could easily cooperate with the Health domain of the country to track health conditions due to water-borne diseases, other infectious diseases and unhealthy water usage.

2. Establishment of organic fertiliser production units — There have been various government initiatives to encourage organic farming. However, efficacy remains very low, thereby posing long-term threats to both the health of the people and of soil and the environment. Production of organic fertilisers could create employment for many and one aspect of this could be soil testing, calibration and nurturing. These units could be regularly monitored and made compulsory to adhere to the National Fertilizer Regulatory Act.

3. Practice of rainwater harvesting — As the Water Board has not been able to entirely cover the country with piped water, rainwater harvesting could be a substitute for water used in agriculture, the industrial sector, and conservation of urban water resources. Since the cost of rainwater treatment is low, this would be a better alternative than using drinking water in agriculture and industry.

4. Water Treatment Plants — There are many water treatment plants in Sri Lanka in areas where there are Chronic Kidney Disease patients. This has been successful in controlling the number of CKDu patients. However, water treatment could be expanded to other areas as treated water could be used for commercial and industrial buildings, urban reuse in recreational centres and playing fields, etc.

5. Creation of a water management policy — There is a national drinking water policy. However, it is best to expand its scope and incorporate drinking water, water treatment and disaster management and impact on health. A sound policy could encourage water management and water security in irrigation, industries, power generation and other domestic use and the link with disasters on water and health security.

Conclusion

There is a direct link to climate change-induced natural disasters in regard to both water security and health security. Safe and healthy water lies as a groundwork for health security, a green environment and a country's economic and political stability. Diseases can be controlled via good water management. Water management and water security incorporate access to safe water, water and sewerage treatment, usage of organic fertilisers, etc. It is interesting to comprehend that there is a link between climate change and conflicts.

If disaster risk reduction is not conducted methodically to achieve sustainable goals, factors such as lack of safe water could trigger conflicts, which could even topple governments and disturb relations among nations. As water is a basic need and a human right, water will be a critical component in determining the future of nations and relations among nations. People would rise up for water as it will lead them to Environmental Sustainability and Health.

Ruwanthi Jayasekara is an Honorary Associate Research Fellow at the Institute of National Security Studies Sri Lanka.

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KONRAD ADENAUER STIFTUNG

Konrad-Adenauer-Stiftung e.V.
Regional Project Energy Security and Climate Change Asia-Pacific (RECAP)
Unit 3712, 37/F, Tower 1,
Lippo Centre, 89 Queensway,
Hong Kong SAR PR China

+852 2882 2949
recap@kas.de
www.kas.de/recap
www.facebook.com/kasrecap
www.twitter.com/recapasia
www.instagram/kasrecap

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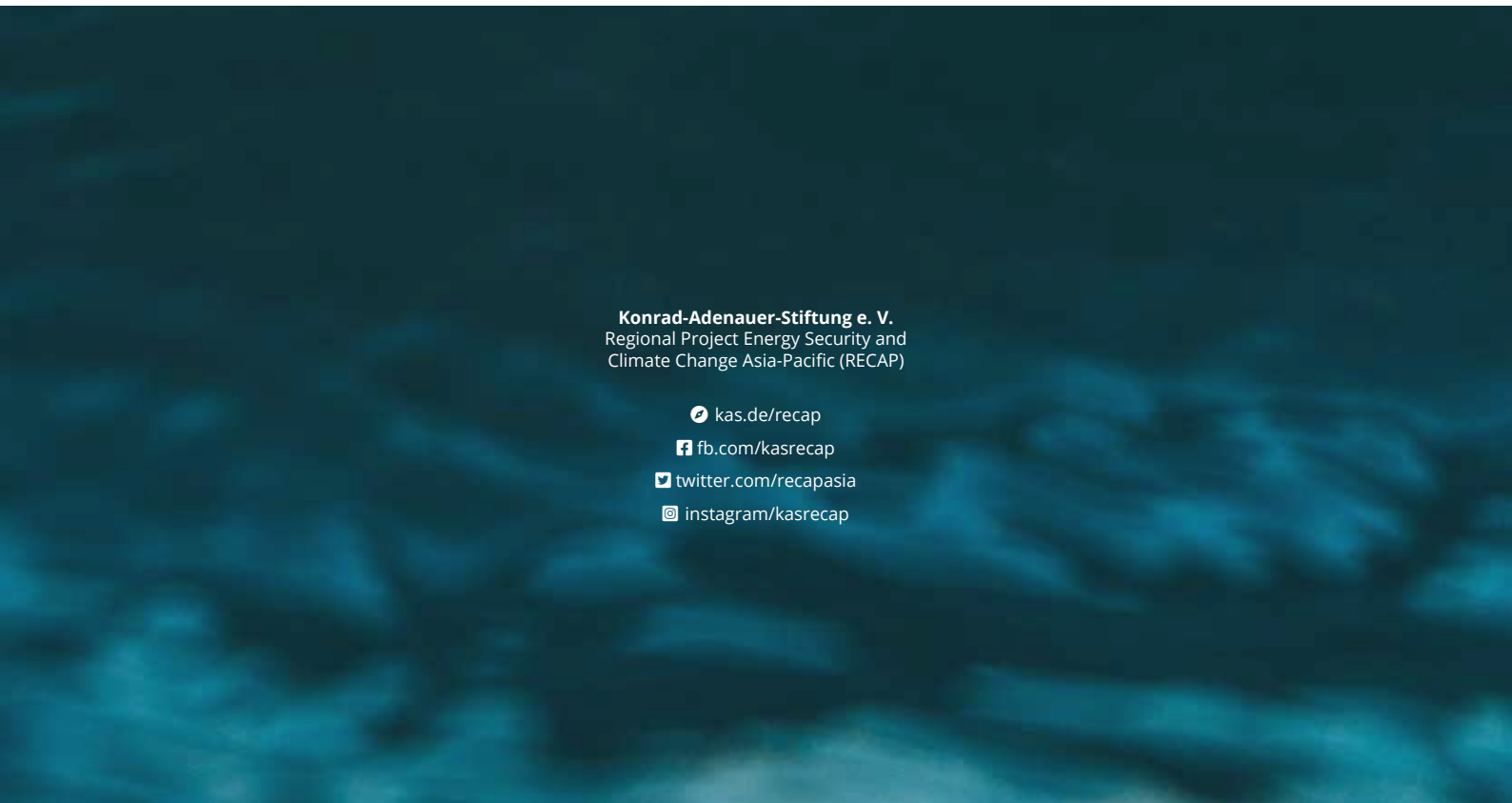

Konrad-Adenauer-Stiftung e. V.
Regional Project Energy Security and
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