upload.wikimedia.org

Sustainable Water Management for Agriculture in South Asia

Population growth and environmental degradation will render water scarcity a much bigger issue in future.

Background

Though South Asia has made a significant stride towards alleviating poverty and strengthening food and nutrition security, it has miles to go to eradicate poverty in all its forms. Poverty continues to persist in the region because of low productivity, especially in the agriculture sector. Nearly 51 percent of the rural population in South Asia relies on agriculture as a principal source of livelihood. But agricultural productivity has been declining due to poor mechanization and various input-output supply bottlenecks. Over time, there has been a growing demand for high value crops that require an assured and efficient water supply to minimize their economic risks. On the other hand, the productivity of cereals, such as rice, that require a substantial amount of water for production has been decreasing in some of the countries in South Asia, thus exerting a further strain on available water resources. More importantly, population growth and environmental degradation will render water scarcity a much bigger issue in future. There will be a greater pressure on the

POLICY BRIEF, NO. 35, 2017

resource for various consumptive purposes including agriculture. Agriculture alone could increase the water demand by over 30 per cent by 2030. The Sustainable Development Goal of ensuring availability and sustainable management of water by 2030 will remain elusive for South Asia if proper, well-planned and timely strategic actions are not designed and executed. There is no doubt that South Asia needs to embrace sustainable water management practices to enhance agricultural production and productivity. This will enable uplifting millions of rural people out of poverty.

Major Issues and Challenges

South Asia's per capita water availability and its quality show a decreasing trend due to a burgeoning population and environmental degradation. Pakistan is already suffering from a severe water scarcity. India's per capita water availability is expected to decrease below 1,000 cubic meters by 2025.

While India and Pakistan hit the water stress mark about a decade ago, other countries of South Asia too are on the verge of facing the brunt of water scarcity. Bangladesh, a lower riparian country, receives a huge volume of water from three mighty rivers, the Ganges, the Bramhaputra and the Meghna. However, the country has recently been witnessing decreasing dry-season river flows and groundwater replenishments, thereby causing a serious threat to agricultural yields. Cereal yield is projected to substantially decline in countries like Bangladesh and Sri Lanka by 2025 (Table 1). Likewise, despite being rich in water resources, Bhutan has experienced seasonal water shortages for drinking and agriculture due to spatial and temporal variation in its distribution. Given its geographical terrain and the nature of the flow of rivers in Bhutan, the practical possibilities for run-off-the river irrigation remain limited. Much of its total annual internal renewable surface water, estimated at 78 km3, flows into its southern neighbour, India.

Despite having major river systems, South Asia has only about 4.5 per cent of the world's renewable water resources. Of late, groundwater has become a major source of drinking and irrigation in the region. Almost 90 per cent of the total groundwater withdrawals in South Asia are used for irrigation, whereas the global average is 70 per cent. Still, water productivity, in terms of GDP contribution, is six times lower than that of the world's top food producing countries. Even water resource-rich Sri Lanka faces water scarcity due to spatial and temporal variations in rainfall.

Furthermore, South Asian farmers rely heavily on rain-fed farming. Approximately, 42 per cent of the land in the region is cultivated, out of which less than 40 per cent has some form of irrigation facility. The rest is rain-fed (Table 2). Except Pakistan and Bangladesh, less than 50 per cent of the South Asian land mass is irrigated. Alarmingly, most of the surface irrigation systems in the region have been operating far below their efficiency, resulting in environmental hazards from waterlogging and inadequate drainage. The inefficient surface irrigation canals and infrastructures in the region have further resulted in water overuse.

Hence, it has become imperative for the region to shift to improved technology for sustainable and efficient use of the available water resources to enhance crop productivity. The region's primary water supply needs to be intensified by using more of the potentially utilizable water resources. Recycling waste water for reuse in agriculture remains a very limited practice. At present, the primary water supply in South Asia stands at less than 60 per cent of potentially utilizable water resources. This shows that there is a growth potential in primary water supply.

Table 3 depicts the projected values for South Asian population, cereal demand, cereal production, primary water supply, water diversions and growth in total irrigated area. Cereal demand is expected to grow by

Table 1 Cereal Yield in South Asian Countries (kg/ha)

Country	2012	2013	2014	2025 p
Afghanistan	2029.6	2048.5	2020.6	2170
Bangladesh	4394.1	4357.3	4405.8	2800
Bhutan	2944.2	2941.7	3130.9	NA
India	3010	2963.4	2981.1	2540
Maldives	2608.7	2638.9	2405.1	NA
Nepal	2714.2	2569.7	2747.9	2180
Pakistan	2645.4	2722.2	2747.4	2970
Sri Lanka	3582.9	3833.5	3801.4	2950

Note: p stands for projection
Source: World Bank: World Development Indicators and Molden et al., (2001) for projected data for 2025

Table 2 Total Land and Irrigated Area of SAARC Countries

Country	Total Area, Sq. Km.	Arable Land, Sq. Km. (%)	Irrigated Area, % of Arable Land
Afghanistan	652,230	78,000 (12)	5.0
Bangladesh	134,000	79, 000 (60)	56.1
Bhutan	38,394	5,630 (15)	31.2
India	3,287,260	1,581,450 (48)	32.9
Maldives	300	90 (30)	-
Nepal	147180	23,570 (16)	47.0
Pakistan	796,100	203,470 (26)	90.6
Sri Lanka	65,610	12,500 (19)	38.8

Note: figures in parentheses indicate percentage of total land area.
Source: FAOSTAT (2011)

1.5 per cent annually, reaching 356 million metric tons by 2025. While cereal production is expected to increase in irrigated areas, it will, however, decrease in rain-fed areas by 2025. The total irrigated area is expected to reach 128 M ha, and the primary water supply to 754 km3 by 2025 (Table 3). Given the competing needs for water across sectors, water diversion is expected to increase in the industrial sector with a miniscule increment for irrigation.

Way Forward: Sustainable Water Management for South Asia

Sustainable water management practices require meeting the different needs of different situations and geographical locations. For instance, the Indo-Gangetic plain (IGP) has a high potential to boost the water availability for millions of poor living in the flood plains. Seasonal variation in availability means that the IGP receives an uneven distribution of water, according to the time of the year. During monsoon, the region has plentiful of water, but at other times of the year, it becomes a scarce commodity. The solution lies in the construction of big reservoirs and large dams to conserve the excess water during monsoon to be used during lean seasons. Alternatively, judicious use of groundwater reserves can enhance water availability for irrigation. South Asian Association for Regional Cooperation (SAARC) Agriculture Vision 2020 rightly envisages promoting the use of resource-conserving technologies for the optimal use of the available water resources. The Vision focuses on harvesting and conserving rainwater, reusing waste water and restoring and renovating traditional water bodies, among others. It wants to improve the overall water governance for a prudent and economical use of the scarce resource. The following strategic options can be initiated for a sustainable water management in South Asia. They are:

- Increasing water use efficiency and water productivity in the irrigated system,
- Rainwater harvesting and management,
- Groundwater management,
- Water institutions and water policies,
- Wise use of wetlands,
- Geography-specific water management practices, and
- Capacity development.

Efficient Irrigation

Water use efficiency basically refers to the value added and welfare derived from each drop of water. It can be achieved via improved agricultural practices and efficient water delivery systems. For instance, farmers in South Asia can opt for crops that consume less water. They can switch to cultivating crop varieties with higher productivity results per drop of water. Deficit, supplemental or precision irrigation that results in higher productivity can also be practised. Reducing evaporation from irrigated fields through agronomic practices such as mulching, decreasing less-beneficial vegetation, controlling weeds etc. are other important practices.

Earthen irrigation canals that are decades old are susceptible to water loss. Cement lining of the canals can prevent this. The deficit irrigation method, a method by which irrigation is made available only for limited periods, can be applied in the system of rice intensification. The method has proven to be useful in saving water. Water-use efficiency can also be achieved via micro-irrigation in the form of overhead or sprinkler or drip methods. A study argues that solar-powered micro-irrigation technologies, including drip irrigation, can be customized to meet the needs of smallholder farmers. It was found that the use of sprinkler and drip irrigation methods in India save 40-80 per cent of water and the efficiency can be further enhanced to 100 per cent with proper design and management.

Table 3 Projected Population, Food Demand and Water Situation in South Asia

Factor	Units	1995 value	2025 projection	Annual growth (%) 1995-2025
Population	Million	1233	1762	1.2
Cereal demand	M mt	227	356	1.5
Cereal production – Total	M mt	229	344	1.3
- Irrigation	M mt	170	289	1.8
- Rain-fed	M mt	58	55	-0.2
Growth in total irrigated area	M ha	101	128	0.8
Primary water supply (PWS)	Km3	615	754	0.7
PWS - % of PUWR	%	45	55	
Water diversions –Total	Km3	866	1117	0.9
- Irrigation	Km3	831	988	0.6
- Domestic	Km3	16	50	3.9
- Industrial	Km3	19	80	4.9

Note: M ha stands for million hectares, M mt stands for million metric tons, PWR stands for primary water supply and PUWR stands for potentially utilizable water resources
Source: Molden et al., (2001)

Rain Water Harvesting and Management

In rain-fed areas of South Asia, crop productivity largely hinges on precipitation. With good precipitation, there is bumper harvest and vice-versa. Moreover, in rain-fed areas, productivity greatly declines due to short-term droughts (15-30 days) during critical growth stages of crops. If the surplus water during monsoon season can somehow be stored

www.allianceforwaterefficiency.org

SAARC Agriculture Vision 2020 envisages promoting the use of resource-conserving technologies for the optimal use of the available water resources.

and applied during those critical growth stages, then crop productivity would be greatly enhanced. Essentially, the harvested water stored in reservoirs is used judiciously in an efficient manner through the drip irrigation method. For instance, Maldives neither has sufficient surface water nor usable groundwater. Here, rainwater harvesting has become an important method of meeting the demands for freshwater. The groundwater gets recharged by rainfall, but it becomes unusable due to seawater intrusion and pollution. Hence, besides collecting freshwater on a small scale, desalination has become another alternative to meet the water requirements in Maldives. In Sri Lanka, the storage of rainwater for irrigation is extremely important, especially in the 'yala' season (April to September) due to seasonal variation in the distribution of water.

Groundwater Management

Judicious use of groundwater is a way to enhance crop productivity in areas with limited irrigation facilities. Groundwater extraction seems feasible in eastern India and the Tarai plains of Nepal, where water tables are found two to five metres below the ground surface. Optimal use of groundwater in the Tarai and inner valleys of the hilly and mountainous regions of Nepal, can make year-round irrigation feasible. The use of shallow tube wells (STWs) has become quite popular in the Tarai plains of Nepal. Similarly, with the introduction of treadle pumps in Bangladesh, groundwater development has gained momentum.

Around 29 km3, i.e. 79 per cent of the total water in Bangladesh is withdrawn from groundwater and the rest from surface water. In Afghanistan, groundwater withdrawal for irrigation is estimated to be 2.8 km3 per year. The extraction of groundwater from deeper and confined aquifers has gained momentum making it a great way of increasing water availability for irrigation in Afghanistan.

Nonetheless, depletion and contamination of groundwater elsewhere in the region have posed a serious threat to agriculture production and productivity. In some areas of Pakistan, groundwater exploitation has reached a point whereby the mining has affected water tables of the Saurashtra coast of the West Indian state of Gujarat. The over-exploitation has resulted in rapid intrusion of sea water in the coastal aquifers, thus negatively affecting farm production there. Moreover, due to sustained over-pumping of groundwater in India, water tables are going down from one meter to three meters per year. Even Sri Lanka has depleted its groundwater resources from rapid extraction for irrigation and various other purposes.

Hence, while groundwater use is essential in areas with deficit irrigation facilities, judicious use of groundwater is crucial. This allows the aquifers to get recharged before further extraction. This is possible by enforcing regulatory frameworks that limit the number of tube wells in any geographic location based on water availability mapping. There is a need for improved land-use planning and designation of groundwater protection zones for its efficient management. Improved sewage treatment and disposal of waste water are needed to maintain and protect the quality of groundwater reserves.

Water Resource Institutions and Policies

Water resource institutions and sound water policies are other instrumental elements needed for integrated water resources management. There is a need to review the existing water policies in the region and craft enabling institutions and policies based on project outputs and experiences. For instance, while drafting water legislation, the water rights of indigenous

metrocebu.com.ph

Relevant stakeholders need to be trained periodically on the sustainable use of water and increasing water productivity through modern water-saving technologies.

communities should be protected to avoid any future socio-ethnic tensions. An institutional mechanism can be developed for participatory water management. Water pricing needs to be institutionalized in the region so that farmers value each drop of water and utilize it efficiently. Specific policies and measures can be enacted in the region to incentivise the private sector for adopting water conservation and climate smart practices. Public-private partnership can be encouraged for effective water management and efficient water pricing mechanisms.

While some countries of South Asia have well-defined national water policies, others have yet to adopt them including effective institutional mechanisms for a sustainable management of water resources. Bangladesh formulated National Water Policy, 1999 and National Water Management Plan, 2001 to address the issues pertaining to water resources management. The Plan has emphasized the need to expand private STWs irrigation in slow-growth regions. It also addresses arsenic pollution and salinity in coastal areas. Similarly, Bhutan enacted Water Policy, 2003, but has yet to incorporate mechanisms for prevention and control of pollution and flood management. India adopted National Water Policy, 2012 with the objective of achieving food security, supporting poor people dependent on agriculture for their livelihoods and preserving the ecosystem, among others. Nepal's Water Energy Commission Secretariat (WECS) has formulated the National Water Plan, 2005 that looks into river basin management for sustainable water resources development. Pakistan formulated its Water Vision, 2025 envisaging the need for providing adequate water resources for all users. It wants to do so through conservation and development of natural resources and promotion of good governance. Sri Lanka has yet to formulate a comprehensive water policy to preserve its freshwater ecosystems, provide clean water for drinking and irrigation and prevent soil erosion and floods, among others.

Wise Use of Wetlands

South Asia has a number of identified wetlands. India alone has 25 Ramsar sites and Pakistan has 19 of them. Nepal has designated 10 sites as wetlands. Other South Asian countries have also identified their Ramsar sites. The wetlands, or Ramsar sites, provide provisioning, regulating and cultural services that directly benefit the livelihoods of millions of people dependent on them. The Secretariat of Convention on Wetlands has even published a handbook detailing the concepts and approaches to use wetlands wisely. The wise use of wetlands, as defined by the Ramsar Convention, 1987, refers to sustainable utilization for the benefit of mankind while preserving the ecosystem. Sustainable utilization refers to utilizing the services from the wetlands without undermining the needs and aspirations of future generations. Community-based management practices can be a sustainable way to use wetlands, as such practices create a sense of ownership among the communities. This helps protect and use wetlands in a sustainable manner.

Geographic-specific Water Management Practices

Given the vast variation in geographical topology, ranging from the high-altitude Hindu-Kush Himalayan belt to low-lying riverine beds and coastal areas, geographic-specific domains need to be identified for piloting best water management practices in the region. For instance, a specific set of water management practices can be adopted in arid and semi-arid areas. Given the difficulty of developing canal based irrigation, suitable water management practices can be initiated in the hills and mountains of the region. Likewise, a separate set of water management practices can be designed and implemented in rain-fed areas, coastal and wetland areas.

Capacity Development

To sustainably manage water, capacity development of the relevant stakeholders is required in the region. Farmers, grassroots NGOs, water activists and other field-based practitioners need to be trained periodically on the sustainable use of water and ways of increasing water productivity through modern water-saving technologies. Training manuals and practical guidelines for water management practices need to be developed. Water resources institutions need to update their data on annual river flows, both into and out of the country. They need to have reliable data on the number of desalination plants, groundwater aquifers and other relevant subjects. Such information is crucial for sustainable water resources management. There is a need to enhance their capacities in data collection and analysis.

Out-migration of male youths for foreign employment has led to feminization of the agriculture workforce in some parts of South Asia. The issue is increasingly gaining prominence. South Asia's traditional farming practices are laden with unsustainable use of water resources and drudgery in agriculture, especially for women. To reduce agricultural drudgery, women farmers need to be trained on the use of modern agricultural implements and ways for sustainable use of water resources. Capacity development of women farmers should be one of the key priorities when designing agriculture and water related interventions. Capacity development, moreover, is also needed for water resources institutions, individuals, farmers and associated stakeholders. It is essential for the promotion of sustainable water management in South Asia. ■

References

Babel, M.S. and S.M. Wahid. 2008. *Fresh Water under Threat: South Asia.* Kenya: United Nations Environment Program.

Bates, B.C., Z.W. Kundezwicz, S. Wu and J.P. Platikof. 2008. *Climate Change and Water* Technical paper of the Inter-Governmental Panel on Climate Change (IPCC). Geneva:IPCC.

BWP (Bhutan Water Policy). 2003. Summary cited in ADB (Asian Development Bank) 2014 Review and compendium of environmental policies and laws in Bhutan— Input to the Asian Judges. Manila: ADB.

Choowaew, S. (n.d.). *Wise Use of Wetlands.* Faculty of Environment and Resource Studies, Mahidol University.

Foresight. 2011. *The Future of Food and Farming.* London: The Government Office for Science, United Kingdom.

Kumar, A. and Gurung, T.R., (Eds). 2015. *SAARC Outlook on Water-Energy-Food Nexus in SAARC Countries.* Dhaka: SAARC Agriculture Centre (SAC).

MHHDC. 2003. *Human Development in South Asia 2002: Agriculture and Rural Development*. Published for The Mahbub ul Haq Human Development Centre by Oxford University Press

Molden, D; A. Upali, and H. Intizar. 2001. *Water for rural development: Background paper on water for rural development prepared for the World Bank* Working Paper 32. Colombo: International Water Management Institute.

MoWR. 2001. *National Water Management Plan*. Dhaka: Government of Bangladesh.

NWP-India (National Water Policy-India). 2012. *National Water Policy 2012*. New Delhi: Ministry of Water Resources, Government of India.

Palanisami, K., M. K.Kakumanu, and S. Raman. 2011. "Spread and Economics of Micro-irrigation in India: Evidences from Nine States." *Economics and Political Weekly Supplement (EPW),* Vol XLVI No 26 and 27.

PDF (Pakistan Development Forum). 2013. "Pakistan's vision of water resources management". A presentation by Pakistan's Minister for Water and Power at Pakistan Development Forum, May 14.

Rosegrant, M. W., C. Ringler, and T. Zhu. 2009. "Water for Agriculture: Maintaining Food Security under Growing Scarcity." *The Annual Review of Environment and Resources 34:205-222.*

SAC (SAARC Agriculture Centre). 2015. *SAARC Agriculture Vision 2020.* Dhaka: SAC.

SAEO. 2014. *South Asian Environment Outlook 2014.* SAARC/ UNEP/Development Alternatives

SAWI. 2016. "South Asia Water Initiative". www.southasiawaterinitiative.org/SAWI/about. Accessed: 12 December 2017.

SSAF. 2013. *Solutions for Sustainable Agriculture and Food Systems.* Sustainable Development Solutions Network.

©2017, SAWTEE. This policy brief is prepared by Mr. Manbar Khadka, Senior Researcher at SAWTEE, under the project titled *Strengthening the Role of SAARC in the Sustainable Intensification of Agriculture in South Asia* funded by the International Fund for Agricultural Development (IFAD), Rome. Views expressed are of the author and do not necessarily reflect the position of SAWTEE and its member institutions.

www.sawtee.org

P.O. Box: 19366, Tukucha Marg
Baluwatar, Kathmandu, Nepal
Tel: +977-1-4424360/4444438
Fax: +977-1-4444570, E-mail: sawtee@sawtee.org
Design: Bipendra Ghimire
Printed at Variety Printers, Kathmandu

South Asia Watch on Trade, Economics and Environment (SAWTEE) is a regional network that operates through its secretariat in Kathmandu and 11 member institutions from five South Asian countries, namely Bangladesh, India, Nepal, Pakistan and Sri Lanka. The overall objective of SAWTEE is to build the capacity of concerned stakeholders in South Asia in the context of liberalization and globalization.