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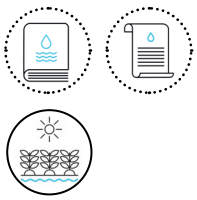
"Catch the Flood Before it Catches You": Spate Irrigation in Arid Regions of Pakistan

Karim Nawaz
MetaMeta

Floods wreak chaos and destruction in many places, but for people in arid regions using spate irrigation, the floods that emerge from ephemeral rivers symbolize life, livelihood and prosperity. Communities pray for floods as they are the only source of water. Pakistan has the largest amount of land under spate irrigation in the world. Spate irrigation is a unique 1000-year-old system. Yet despite its many environmental, social, cultural, managerial and economic benefits, it is not widely known among academics, researchers or practitioners. The practice is based on indigenous knowledge learned from elders and passed down from one generation to the next, with enthusiasm and interest, as part of culture and heritage. This article explores the innovative aspects of this system, which is crucial as a sustainable means of livelihood. It explains how the system lets people effectively manage the spate flows, protecting them against the havoc caused by floods, and allowing land to be developed to meet the needs of future populations.

KEY THEMES



< Fig. 1 Field-to-field irrigation in Pakistan (Source: Karim Nawaz).

Introduction

Spate irrigation is a unique system of water management used in arid regions. Its historical traces are found some 4000 years ago in the Arab Peninsula, where Queen Shiba's spate irrigation structure, known as Marib Dam, still exists in present-day Yemen (Frank et al. 2010). This system prevails in all four provinces of Pakistan. Although there are many different languages in Pakistan, spate irrigation is referred to as "naeen" everywhere. The famous spate streams and ephemeral rivers are Naeen Gaajin in the province of Sindh, Sanghar Naeen in the province of Punjab, Loni Naeen in the province or Khyber Pakhtunkhwa and Narri Naeen in the province of Balochistan. Pakistan has about 8.9 per cent of its total irrigated area (1.4 million ha) under spate irrigation system, the largest amount in the world (fig. 2).

Historic Water Management

Each ephemeral river or stream, despite its size, has its own unique water rights and management practices, which are well documented in the governmental land record of 1872. Floodwater (spate) is used for agriculture, rangelands, forestry, livestock, drinking, and recharging groundwater, making its economic importance vital in harsh climate conditions, thus in accord with SDG 13. Spate agriculture is purely organic in nature and meets local needs; its products are also used in commercial sectors.

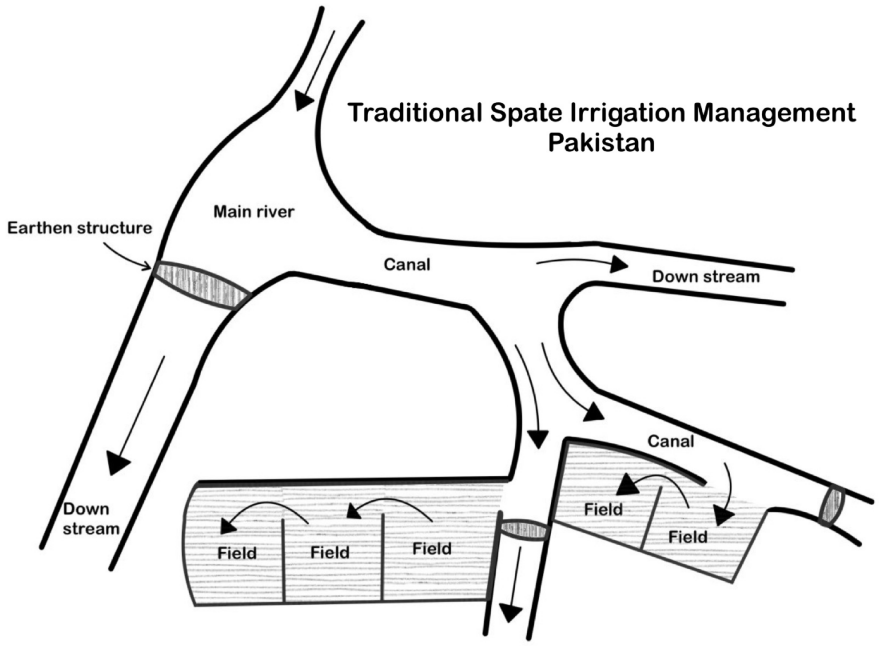
The spate irrigation system provides a unique case of social and cultural dynamics in dealing with climate change and variation. Two extreme ends of the spectrum are drought and extraordinary floods. With spate irrigation, the shocks of both extremes, drought and flood, are absorbed using socio-cultural strategies. Flash floods are used to produce specific crops and surplus floodwater is spread over wasteland used as common pasture equally by local people and nomads. Fields are farmed jointly by owners and others whose land did not receive floods, and nomads also work as field laborers. These socio-economic and cultural arrangements

Spate Irrigation - globally

Country	*Year of Irrigation*	*Total Irrigated Area (ha)*	*Spate Irrigated Area (ha)*	*Spate Irrigated as % of Total Irrigation*
Algeria	1992	555,500	110,00	19.8
Eritrea	1993	28,124	15,630	55.6
Libya	1987/1997	470,000	53,000	11.3
Morocco	1989	1,258,200	165,000	13.1
Pakistan	1990	15,729,448	1,402,448	8.9
Solamia	1984	200,000	150,000	75.0
Sudan	1997/1987	1,946,00	280,000	14.4
Tunisia	1991	385,000	30,000	7.8
Yemen	1987/1997	485,000	193,000	39.8

^ Fig. 2 Table showing spate irrigation in global perspective (Source: FAO Aquastat; Hadera 2001; Kohler 1999).

^ Fig. 3 Earthen diversion structure at Bhaati Spate River, DG Khan, Pakistan. The site is more than 250 years old (Source: Karim Nawaz, 2006).



^ Fig. 4 Traditional spate irrigation management, Pakistan (Source: Karim Nawaz, 2022).

help to keep the population residing in the area, with emigration as the last resort.

Current Approaches

In Pakistan, some of the ephemeral rivers discharge 100,000 cusecs of water and can irrigate more than 200,000 acres; such robust targets can only be achieved through effective social organization and partnerships, as in SDG 17. Floods of ephemeral rivers are diverted by constructing a temporary structure across the river and flow is conveyed to fields by a network of canals (fig. 4). A flash flood lasts a few hours to a few days only and users manage the water within this extremely short duration. Financial contributions from shareholders of the water for the construction of new diversion structures is determined according to their respective allocated shares in the water and the size of a landholding. During spate flow diversion and application, a community guard (Raakha) continuously patrols and monitors sensitive sites, so that floodwater is distributed properly. These local water user associations of spate irrigation are cost-effective, easily approached by members of the community, and socially accountable as there is neither governmental involvement nor remuneration involved. Older generation farmers encourage the youth saying, "Don't be afraid of flood, catch it before it catches you."

Spate irrigation works with gravity so no energy is required, making it an affordable clean energy technique (SDG 7). The water distribution system has evolved over centuries to cope with local conditions such as culture, communal relationship with heritage, and environment. Deeply rooted socio-cultural values contribute to ensuring the equity and efficiency

of this system in an "unkind" environment. The unique system of water rights and associated socio-cultural background are points of pride narrated to young children in village assemblies and storytelling events. Over time, farmers have learned to adjust their growing seasons by applying different types of seeds according to the time of year that floods occur and their relative size. Spate irrigation is an excellent version of climate change adaptation and farmers elsewhere need to learn from this local model.

For centuries, local populations in Pakistan had certain rituals and customs pertaining to this system. Rituals related to rain take place in many cultures but here the rituals are intended to make floods (spate) occur. When floods are late, a donkey is kept under the sun for a longer time during the day than usual; people believe that the animal's prayers will bring rain and floods. In another ritual, a person of religious background is brought to a dry riverbed and bathed in order to receive floods (Personal communication, 2006). Children color their faces black and go around the village, singing for rain and floods to come and collecting grains and chickpeas to prepare a dish which is fed to both villagers and birds. It is believed that the birds' prayers and requests will cause the rain and floods to come. People say special prayers for rain called "Salat e Estisqa."

Challenges

Unfortunately, floods retain connotations of negativity in many circles. There is also a lack of human resources, expertise and experience in dealing with floods as an opportunity. Heavy earth-moving machinery may not be available in time to exploit floods effectively. Currently, the response from the government of Pakistan to floods is to focus on rehabilitation rather than prevention. Yet, these floods are "life" for millions of inhabitants living in these harsh climatic conditions. Spate irrigation systems lack institutional support from the government, donors and international agencies. Local communities see floods as an opportunity while the government sees them as a disaster. Consequently, both respond differently. The government's strategy is to save the infrastructure by allowing floods to flow downstream and join major water bodies, while local communities want to mine the floods for numerous benefits. Recently, the government has started to store spate flows through the construction of dams. This has resulted in violating the rights of downstream users and, moreover, the heavy loads of sediment coming through the spate flow are filling the storage reservoir quickly and most of the modern designs have failed to work adequately.

The spate irrigation system is increasingly affected by climate change. Record-breaking rains and floods are beyond the capacity of the local population to cope. In addition to climate change, additional factors affecting the survival of this traditional irrigation system include population pressure and a lack of support from the government and international agencies. Also, traditional irrigation systems are not part of educational curricula so relevant professionals have not learned about this environmentally friendly and low cost system.

Way Forward

In the devastating floods in Pakistan in the year 2022 half the affected areas were dealing with water from spate rivers and the other half from the inundation of perennial rivers. Perennial rivers in Pakistan are mostly fed by melting glaciers, and their discharge is steadily declining. In such situations, spate irrigation systems

^ Fig. 5 Field-to-field irrigation in Pakistan (Source: Karim Nawaz, 2006).

can play an important role in food security and climate change adaptation. Spate irrigation has inbuilt disaster risk reduction and resilient approaches to disasters (floods) in ways that encourage sustainable human settlements (SDG 11). Spate flows need not be blocked in reservoirs: instead, they should be allowed to flow downstream to allow downstream users to benefit and to avoid the problem of siltation in reservoirs. Rather than storing flood water in reservoirs, we should make use of flood diversion strategies that have been practiced for centuries and that are based on the experience of farmers, in line with SDG 17.

After the floods of 2022, when one-third of the country was badly affected, an innovative strategy was recommended by Flood-Based Livelihoods Network (FBLN, based in the Netherlands) to capture the moisture created by floods before it is too late. Government and donor agencies welcome this approach and as a result, an immediate response was proposed to supply seed and sowing machinery to farmers. This resulted in one of the best examples in contemporary history of a considerable area used for crop cultivation in the wake of a flood.

It is important to involve local people and water user associations in further developing the system. Also helpful will be researching and developing drought resistant varieties of crops and finding ways of avoiding and minimizing the shock of dry years through off-farm activities.

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Karim Nawaz is country coordinator of the Pakistan Spate Irrigation Network. He holds bachelor's degrees in economics and engineering and a post-graduation degree in human settlements and development. He is advisor to the research organization Metameta in the Netherlands and is also a member of various civil society groups engaged in community development and member of Pakistan Engineering Council. Karim has served in FAO-UN as a National Expert on Community Development, Coordinator for Global Environment Facility/Small Grants Program of UNDP and Advisor to Department of Political Affairs (UN) in New York. He has been engaged nationally and globally in traditional water resources and irrigation systems, indigenous knowledge and local institutions, policy formulation in land tenure and water rights, human resettlement, political affairs, refugee issues, relief and rehabilitation sectors. He has served as a resources person for various training programs with universities in Afghanistan, Pakistan, Kenya, Tanzania, Ethiopia and the Netherlands. He is co-author of three books on traditional irrigation systems (spate irrigation) and water as culture and heritage.

Contact: knawaz99@yahoo.com