

Pakistan must update its water policy

It's time to end decades of complacency, as Ramtanu Maitra and Susan B. Maitra report from New Delhi.

The need to grow more food to meet future demand of a growing population will pose a grave security threat to Pakistan in less than a decade. This threat is due to large-scale erosion of the soil, the increasing salinity of agricultural land making it less productive, increasing shortages in meeting the demand of urban and rural water supply, lack of sanitation for the growing millions, and depletion of forest land. All of these factors have worsened public health and caused the aggregate production of wheat and cotton crops to stagnate. If Islamabad continues to ignore this impending crisis, it may prove to be the detonator for another level of social chaos in the country.

In the past two decades particularly, Pakistani authorities depended wholly on the country's already-developed canal network of the Indus River plain and, thankfully, managed to survive a major water crisis. But the days of such complacency should be considered over. Unless the authorities act urgently to mobilize existing water resources and find new ones, the fertile lands of Punjab will be producing less and less foodgrains. Any further tampering of the Indus River water system simply to prop up Pakistan's agricultural production may lead to serious land salinity problems and degradation of fertile land elsewhere in the country. It is distressing to note that a country which possesses highly competent agro-engineering manpower has been pushed to the brink, its fertile land living on borrowed time. Agricultural crops have become increasingly dependent on the mercy of natural rainfall. The attitude in Islamabad at this point seems to be to simply wait for a major environmental catastrophe to occur.

Geographically, Pakistan can be divided into three main regions: the mountainous north, where three mountain ranges meet—the Himalayas, the Hindu Kush, and the Karakorum; the vast but sparsely populated plateau of Baluchistan; and the Punjab and Sindh plains of the Indus River and its five tributaries. The Indus River aside, Pakistan is mostly mountainous deserts and arid plateaus.

Natural layout

Since its founding in 1947, Pakistan has depended on the Indus River for agricultural production. The multipurpose Tarbela and Mangla storage reservoirs, built in the period after the founding of Pakistan, and some 40,000 miles of existing canal network have served the country well, particularly in light of the fact that during these 52 years, Pakistan's

population grew from about 50 million to close to 130 million. Pakistan did not face any famine, thanks to the surface and groundwaters of the Indus River. But, now, seasonal agricultural production, particularly of wheat and cotton—the two most important crops in Pakistan—is much more unreliable than ever before. Since Pakistan's economy still depends heavily on cotton and cotton-related products, and the country has no surplus foreign exchange to import food on a regular basis, to ignore the danger signals is akin to calling for destruction of the very pillars of the economy.

In order to survive in the long run, Pakistan needs to look for ways to augment its overall water supply and to make the coastal areas of Sindh and Baluchistan habitable and productive. If these areas cannot be made productive agriculturally, they can nonetheless be productive industrial centers. Under the present setup, however, these areas have no future, due to the lack of freshwater supply. How careless the authorities have become is evident from the fact that Pakistan's most important commercial center and only port, Karachi, gets less than 50% of the freshwater it needs. According to one estimate, the port-city, which is a major industrial and commercial hub of Pakistan, requires close to 800 million gallons of water per day (mgd). However, it receives less than 350 mgd, incurring a shortfall of more than 450 million gallons daily.

As a result, Karachi is presently experiencing an infrastructural nightmare, which is getting worse every day. By making it increasingly difficult to live in the city, the authorities have greatly helped encourage terrorist activities there. Little effort has been made to rectify the water shortage, although many have suggested that the problem could be solved through desalination of seawater and recycling of wastewater. But the authorities, whose decisions are heavily influenced by Pakistan's handful of elites and feudal lords, have chosen to ignore such pointers.

The Indus River: Pakistan's lifeline

Since its inception, Pakistan's integrity and unity have depended less on the orders and decrees issued from Islamabad, and more on the condition of the Indus River plain. The 40,000-odd miles of irrigation canals, almost all of which are located in the Indus plain, and the building of the Tarbela and Mangla dams, were what made Pakistan a promising nation in the 1960s and early 1970s.

The Indus system of rivers consists of the main river, the

FIGURE 1
Pakistan's river system



Indus, and its major tributaries, the Kabul, the Swat, and the Kurram from the west, and the Jhelum, Chenub, Ravi, Beas, and Sutlej from the east (**Figure 1**). The Swat joins the Kabul before the latter empties into the Indus, but the Kurram has an independent confluence opposite to the town of Mianwali. The five tributaries from the east combine into one before joining the Indus about 960 kilometers from its mouth.

The waters that the Indus brings in to irrigate the plains of Punjab and Sindh begin their journey in Tibet, rising near Mansarovar Lake at an elevation of 5,180 meters, passing through inaccessible mountain ranges in northern Kashmir and Gilgit, and finally emerging out of the hills near Attock. From Attock to its mouth in the Arabian Sea south of Karachi, the Indus traverses the plains of Pakistan for about 1,610 km. The total length that the Indus traverses is close to 2,900 km.

Irrigation efforts in the previous century, and the construction of the Tarbela, Chashma, and Mangla reservoirs by Pakistani authorities, have created a vast network of irrigation canals which provide water to almost 10.5 million hectares of arid lands in Punjab and Sindh—the largest irrigated area of any one river system in the world.

The Indus River and its eastern tributaries in Pakistan—Ravi, Jhelum, Sutlej, and Chenub—have contributed enormously to Pakistan's survival and growth in more ways than one. According to experts' reports published over the last two decades, Pakistan's hydroelectric potential is around 40,000 megawatts. Except for about 10,000 MW which can be generated at various mountainous sites along the Jhelum, Kunhar, Swat, Chitral, and Gomal rivers, and along the smaller tributaries of the Indus in Kohistan and the Northern Areas, almost 30,000 MW can be generated in at least eight dam sites upstream of Tarbela on the main gorge of the Indus River, up to Skardu. So far, Islamabad has not exploited even 25% of the potential.

The objectives of water management plans

The focus of Pakistan's water management plan should be to make water available not only to meet the demand of its agricultural sector, but also to restore the depleted topsoil and meet the growing water demands of the domestic, industrial, and commercial sectors. In all these areas, a water supply shortage is holding back their growth potential. According to a report by the National Commission on Agriculture, the total geographical area of Pakistan is estimated at 87.98 million hectares, about 75% of which is covered by uncultivable mountains and arid tracts. Hence, it should be considered a matter of added urgency that Pakistan make proper use of its available water and develop new sources of freshwater supply. Pakistan's long-term future depends significantly on how the present authorities deal with this serious issue.

In the agricultural sector, ironically, the abundant availability of irrigation water in Punjab has led to widespread misuse of canal water. No concerted attempt has been made so far to improve the country's soil and water management, and to seriously take stock of the damage the absence of a

competent water policy has caused. In most irrigated areas, a high percentage (in some places as high as 50%) of available water supply is lost. Due to spillage and the careless use of water over the years, the water table in vast tracts has risen dangerously close to the root zone of crops. This phenomenon not only impedes crop growth, but also makes the cultivated land saline and, eventually, water-logged.

As a result of increasing waterlogging and salinity, productivity has dropped in almost 50% of Pakistan's cropland. This is one of the reasons why Pakistan's wheat production has remained virtually stagnant during the 1990s, and why the country is becoming dependent on wheat imports to make up the shortfall.

Obviously, the problem that Pakistan faces is neither unique nor unsolvable. But the sheer neglect by the authorities to improve the drainage system and to adopt horizontal, as opposed to vertical drainage systems, has taken its toll. Agro-engineers point out that by adopting technically sound crop rotation, in addition to developing horizontal drainage systems, much of the less-productive agricultural land can be made fully fertile again. But such sound technical advice has been ignored by the authorities, most of whom are too eager to cater to the interests of the rich and all-powerful landowners of the country.

Finally, in 1997, after years of discussion, the Punjab Irrigation and Drainage Authority (PIDA) was set up. The task of this group is to regulate and administer canal and other water sources in the province. According to available reports, the formation of the PIDA was held up for years because of opposition from powerful farm lobbies, represented by the rich and politically powerful feudal lords of Punjab. This lobby has often been accused of over-use of water, which has resulted in the rise in the groundwater table and the increase in salinity in canal management areas, rendering the cropland less and less productive. This lobby's arrogant attitude has also deprived the small farmers of their right to water use, and has caused misery to the downstream users of the canal water.

Punjab's provincial government has reportedly selected the Lower Chenub Canal, which has three major distributories—the Rakh, Jhang, and Gojera branches—for a pilot project to promote the small and medium-size farmers' interests and thus realize the true potential of Punjab's vast irrigational canal network. The success of this pilot project will help, but will not solve the widespread water shortage problem.

While there is abundant availability of water in Punjab, the lack of it is evident in other provinces. For future agricultural and industrial production, ensuring an adequate water supply to Sindh province is crucial. According to available data, the total water availability of the Indus River Basin region in Sindh is close to 142 million acre-feet (maf). Out of this amount, 50 maf drains into the Arabian Sea and about 30 maf is lost between the canals and delivery to the cropland. This occurs due to the existence of water courses which drain away water, seepage through unlined canals, canals over-



A nuclear facility in Pakistan. The development of nuclear power generation is especially critical for desalination, in order to develop the arid regions of the country such as the Mekran coast of Baluchistan.

flowing, and so on. Another estimated 40 maf goes to waste due to water-logging and salinity. As a result, only 52 maf out of 142 maf of water are actually utilized, the estimate claims.

However, in Sindh province, in addition to the Indus River water system, there exist some 40,000 additional small water courses. Almost half of them are part of the Sukkur Barrage. These water courses are without proper alignment and pass through undulated terrain. They have no lining and, as a result, most of the water flowing from these water courses ends up going nowhere. Some work has been done during the last decade in the Nawabshah, Sanghar, and Tharparkar districts, where some 920 water courses have been lined.

Floods and the Kalabagh Dam

In addition to the seasonal water shortage, which is a five- to six-month phenomenon, Pakistan also periodically suffers, for brief periods the hazards of excess water. Floods usually occur in the later part of the monsoon season. Some experts in Pakistan routinely blame India for releasing vast amounts of water into the Chenub, Ravi, and Sutlej rivers during monsoon season to prevent the flooding of Indian towns. Such release of additional water during the monsoon, when the rivers are already running high, the experts claim, causes flooding. That may or may not be the entire reason why floods occur in Pakistan, but the fact remains that Pakistan has done little to utilize the surplus floodwaters, when hundreds of thousands of acres of Pakistan's land remain fallow for lack of water. In addition, the vast areas in the desert-like environment in Cholistan, Thar, and Thal continue to be waterless throughout the year.

In Punjab, construction of the Tarbela and Mangla dams, and a number of diversions and flood protection works, have lowered the frequency of flooding. However, more severe

losses are experienced when the flood protection works fail and adequate warnings are not issued in time. The riverbeds have become higher because of accumulation of silt, a natural phenomenon when the velocity-flow of a river is reduced by the regulatory mechanisms of the dams and canals. As a result, though the floods have become less frequent, they are more severe when they occur. These floods cause not only income losses through disruption of normal life for weeks at a time, but they also cause loss of life and machinery and equipment, which often require immediate replacement.

Another problem that has diverted attention in discussions on water management is the controversial Kalabagh Dam. Construction of this dam, which has been under consideration for decades, has not been undertaken, but the mere mention of it unleashes a political tug of war in Pakistan. Every politician in Pakistan speaks on this issue, jumping onto one bandwagon or the other, either supporting or vehemently rejecting it. Even the self-exiled Muttahida Qaum Movement leader in London, Altaf Hussain, who has been repeatedly accused of terrorist acts in Karachi and some other cities of Sindh, has proclaimed his opposition to the Kalabagh Dam.

The Kalabagh Dam is scheduled to be built in Punjab close to where the Kabul River flows from the North-West Frontier Province (N.W.F.P.) into the Indus River. Supporters of the project point out that building a reservoir and a dam at Kalabagh will help Pakistan to utilize more of the Indus River water to irrigate the arid agricultural land. The urgency to build this dam, experts point out, is due to the fast silting of the Tarbela reservoir, which is now holding much less water than it was designed for. If hard measures are not taken in the near future, the Tarbela reservoir's capacity will drop significantly, leading to further waste of river water and an increasing threat of seasonal flooding. They point out that a

reservoir and a dam in Kalabagh will alleviate these problems.

Opponents of the dam claim that it will usher in a host of new and worse problems. The Kabul River flow will slow down due to the backflow in the river when the reservoir becomes full, and it will raise the groundwater level in the N.W.F.P.. That may cause increased salinity to the soil in the province, and even pose flood threats to cities such as Peshawar and Nowshera, they claim.

Even stronger opposition to the Kalabagh Dam exists in Sindh province, which receives the downstream flow of the Indus River. The leading Sindh-based national party, the People's Party of Pakistan, held demonstrations against the dam. The critics, challenging the water availability figures of the Water and Power Development Authority released to justify the building of the Kalabagh reservoir, point out that any further upstream tapping of water will cause further degradation of soil and increase aridness in both Sindh and Baluchistan.

The unfortunate part of this debate is that it has turned highly chauvinistic. Many people in Sindh and N.W.F.P. claim that the dam is being pushed through by the powerful landlords of Punjab, who are not only inordinately wealthy, but politically omnipotent. The protesters claim that the project would benefit the province of Punjab, but would do little to improve the situation for the other provinces. Due to the ethnic differences among these areas, the debate has become highly charged and emotional. The project has also become a rallying cry for forces who accuse Punjab of overlordship, and who allege an Islamabad-Punjab alliance to undermine other provinces.

It is, however, evident from looking at the pros and cons of the project that if Islamabad is serious about building this dam for conservation and improved utilization of Indus River water, it must undertake a number of measures, which would concretely help the people who have genuine reasons to question the efficacy of this project. More importantly, authorities in Islamabad must realize that the Kalabagh Dam may alleviate the food situation temporarily, but the project would do precious little to secure Pakistan food self-sufficiency in the longer term.

More use of nuclear power

The greater challenge to Islamabad, however, lies in how to resolve the long-term water shortage problem and at the same time to make the vast virgin landmass of Sindh and Baluchistan habitable. It is evident that the Kalabagh Dam project cannot address this problem. Clearly, the solution lies in finding and developing new water sources.

To begin with, Pakistan, in addition to developing the water courses in Sindh, must quickly undertake in a big way a plan to recycle every possible drop of wastewater, and to develop a broad-based program to desalinate seawater. A large-scale program to desalinate saline waters of the Arabian Sea would be a boon to the people of Pakistan, particularly to the residents of Sindh and Baluchistan. Desalination plants

located along the southern coast of Sindh and the Mekran coast of Baluchistan would provide freshwater to thousands of hectares of land, besides providing the vital electrical power for setting up industrial facilities, commercial and trade centers, and new cities with educational, scientific, and technology development centers.

Because Pakistan already has the capability to operate and maintain nuclear power stations, the program to desalinate seawater must be based upon building small modular nuclear power stations which can provide ample heat energy to a host of multi-stage flash (MSF) type of desalination plants. In MSFs, each flash evaporator has a heat recovery system. The saline water passes through all the flash evaporators and is drawn off after it passes through the last one. This hot freshwater is then passed through a heat recovery section, where it heats the seawater entering the flash evaporators. The process is reliable and easy to operate and maintain since it contains very few moving parts.

Because of the high volume of energy required to generate billions of gallons of freshwater per day over the years, Pakistan must develop high-temperature reactors (HTRs). HTRs were originally developed in Germany, but now China is in the process of developing the technology independently for large-scale commercial use. The special advantages in using the HTRs lie in their capability to produce high levels of heat and in their built-in safety features.

These reactors can be designed in such a way that the possibility of a serious accident, which might release a large amount of radioactive gases into the atmosphere, is ruled out by basic physical mechanisms. In this type of reactor, thousands of spherical fuel pellets imbedded in prism-shaped fuel elements make up the core of the reactor. In essence, the encapsulation of the nuclear fuel within multiple layers of special high-temperature ceramics prevents the release of radioactive fission products even under most extreme conditions. In addition, these reactors can be standardized modular reactors, with powers ranging from 50 to 300 MW thermal output.

The HTR is ideally suited to supply power to cities and large towns, integrated agro-industrial complexes, and extraction and processing of certain raw materials. The HTRs produce significant amounts of waste heat, which is ideal for operating multi-stage flash evaporators.

A large-scale program to desalinate seawater will not only help the southern coast of Sindh province, but will also provide water to the Mekran coast of Baluchistan. One major reason why the Mekran coast has remained underdeveloped is the acute shortage of freshwater. The port towns of Gwadar, Jiwani, and Ormara have failed to flourish and prosper, and today they still resemble sleepy fishing villages. The area has also become a major transit point for Afghanistan narcotics, posing a security threat to the country. The coast is flush with fish and has all the potential to become a large and modern fishing harbor. Yet, the authorities have shown little interest in making anything of the Mekran coast.