

## Taming Nature is Counterproductive

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Tunisia is a progressive country on the North African Mediterranean coast. The country has developed a remarkable system of harvesting, storing and distributing water. Virtually every drop of water that is brought into the country by rivers coming from Algeria or as falling rain is harvested and used for agriculture. Mr Fethi Lebdi, Director General, National Agronomic Institute of Tunisia (INAT) explains that the country has built an intricate network of pumps, canals and riverbeds to transport water from one part of the country to another. For example, the northwestern coast of the country gets much rain which mostly went into the sea previously. This water is now harvested and pumped to 600 meters height to irrigate the northeastern parts of the country. INAT distributes water between different users according to a preset priority. Urban needs are met first, followed by trees, vegetables and wheat respectively. INAT engages in negotiations with Farmer's Organizations each year to inform them about the amount of water available and guides them to grow only the specified crops for which water will be available. For example, in a year when less water is available, INAT will communicate to the farmers that they should not plant vegetables which consume a lot of water; and only focus on preserving the trees. A number of dams have been built to protect the cities from floods. Water that would have damaged the city is held behind dams and let out gradually.

This beautiful system is confronting a problem of managing sand, however. The dams are getting filled with sand, also known as silt or sediment, with time. The Mallegue dam on the border with Algeria has got mostly filled with sand in the last 50 years. It cannot hold much water now, INAT is looking for sites to make new dams to replace old ones but not finding them. The dam-based water system thus becomes a one time gain of 50-odd years. After the dams are filled with sand they do not hold water but they cannot also be decommissioned because that will release a huge torrent of sand smothering the downstream areas. Similarly, the dams have been successful in preventing cities from getting flooded by holding flood waters till the riverbeds were clean. But the gradual release of waters in the rivers is not flushing them of the accumulated sand. Previously, when the river flowed freely, there would be gush of water during floods that would remove the deposits of sand and carry it to the sea. Now this sand stays put. In fact, more sand is deposited every year because waters are released from dams in a regulated way at low velocity leading to more deposits of sand. In the result, the lesser flow of water is yet leading to higher vulnerability to floods. The third problem is that sand is not reaching the coasts leading to their erosion. Normally the rivers bring sand to the sea and counteract the erosion from the waves hitting the coasts. With sand trapped behind the dams, the waves are having a free run. At the harbour of Ghar el Melh, a row of houses on the seaside is now touched by the sea. One can see broken edges of homes. A passerby said that 100 metres land has eroded in last 13 years. At Sidi Ali el Makki beach, Mohammed Ghommidh said that previously he was putting up 6 umbrellas between his shop and the beach.

Now he is able to put only 2 umbrellas. He says that about 50 metres of beach has got eroded in last two years.

The intricate system built by INAT is focused mainly on management of water. This benefit occurs in the 'short run'-first 50 years after making the dams. But the sand leads to less capacity of dams, more sanding of rivers and erosion of coasts in the 'long run'-hundreds of years thereafter.

There exists a tradeoff between water and sand; or between short- and long run. Building of dams and harvesting of water provides benefits for the first 50 years in terms of irrigation and flood control. But after this period, sand becomes more important. The water cannot be stored and floods and erosion of coasts become more important.

These problems could yet be managed with some luck. It is conceivable that new dams may be made at new sites though less favourable. The cost of construction may be reduced due to technological improvements. So people may have a system of 'shifting dams' just as tribal people engage in shifting cultivation in the dense jungles of Asia. They will cultivate a patch of land for three years, and then leave it fallow for 15 years to regenerate with trees and shrubs. They will come back to this patch in the fifth 3-year rotation. Similarly, it may be possible to make a series of dams that are filled with sand for 50 years and then cleaned up in next 150 years or so. But where the huge amount of accumulated sand will be taken remains an unresolved question. Perhaps it could be transported to make new agricultural fields. The problem of cities getting flooded due to sanding of the rivers downstream dams could perhaps be managed with stricter regulation of water flows. The erosion of coasts could be managed by bringing in sand from the nearby hill sides in huge trucks and reinforcing the coasts. Of course, these efforts will involve a huge cost.

Tunisia may enter a fearful situation if these technological solutions do not deliver. It is possible that new sites to make dams may not be found. In that case water management will regress. The situation will become worse than even free natural flows. The rivers will bring down sands accumulated in the dams, deposit it on the river beds and lead to more devastating floods. The effort to save cities from floods by building dams can boomerang too. Smaller discharges of water, howsoever regulated, can lead to more floods due to deposits of sand on the river beds and absence of waters for flushing them. Any effort to flush them of the sand will lead to huge floods and wreck havoc. Remaking the coastline by reinforcing it with sand brought from the nearby hillsides may or may not work. The sea may not accept this 'artificial' deposit of sand as it accepts the sands brought by the rivers. Tunisia may face a terrible situation if it fails to successfully develop technological solutions to these daunting problems.

The great Bronze Age civilizations of Egypt, Mesopotamia and Indus Valley similarly focused on short term gains and ignored the long term costs leading to their collapse. The pyramids of Egypt, Ziggurats of Mesopotamia and communal bathing were all engineering marvels of their times. Yet, they did not help survive these civilizations. Same may happen with the remarkable water harvesting structures of Tunisia if the problem of management of sand is not addressed promptly. The lesson for India, of course, is this: don't ignore the sand while making dams. Indian coasts may get eroded and rivers get silted just as in Tunisia. □□□