

## Natural disaster and ecological dilemma: Flood affected areas of Barmer, Thar Desert, Rajasthan

The erratic and heavy rainfall last year has turned a large part of the deep desert country into a vast submerged landscape. Barmer District, Thar Desert, Rajasthan has an average rainfall of 280 mm annually, but during the monsoon of 2006 it received about 600 mm of rain within 2–3 days. Several hamlets and small villages have been wiped out after the 19–21 August rains<sup>1–4</sup>. The region experienced one of the worst floods in a hundred years. The damage was grave in different villages of Barmer District, specially Kawas, Malva and Bhadaka, with a combined population of about 10,000. These villages have been submerged under water for more than 4–5 months. There were also reports of large-scale damage to houses and property and about 47,000 cattle have perished in the floods. Some areas of Kawas village remain submerged under 3–4 ft of water even 7 months after the rains (Figure 1). A thick layer of gypsum in Kawas, the worst hit area in the district, prevented the floodwaters from percolating, as there were thick layers of clay–bentonite and fuller's earth (Tertiary) and gypsite (Quaternary) at a depth of about 1–1.5 ft in the area<sup>5</sup>. To drain this water is a major problem<sup>6</sup>.

After the stagnant rainwater had receded, a rapid assessment of the changes in ecological values of the area was made. Water samples were also collected from the flood plains, and later these were analysed for limno-microbial parameters to ascertain the presence of pathogenic bacteria. The limno-microbial quality estimation revealed that the water was soft in nature, as it was primarily rainwater. But with respect to bacteriological quality different bacteria were reported, including pathogenic ones. Apart from the coliform group (*Escherichia coli*, *Klebsiella* spp., *Enterobacter* spp. and *Citrobacter* spp.) of bacteria, which are indicators of sanitary quality, various other pathogens were also isolated. *Pseudomonas*, the ubiquitous bacteria was isolated in large number. *Staphylococcus aureus*, frequently living on the skin or nose of an healthy individual, which can cause a range of diseases from minor skin infections was also found. *Salmonella enterica*, a bacterium causing gastrointestinal diseases, was also observed in

low number. The pathogenic *E. coli*, 0157:H7 was present only at Kawas village. All these pathogenic bacteria reveal that the water was of no more use for humans and livestock. If water had remained stagnant for a longer duration it would have got enriched with bacterial load and will lead to epidemics. However, the conditions did not worsen because of the timely action taken by the Government health supervisors. Cattle carcasses in the floodwaters raised concerns regarding

outbreak of diseases<sup>3</sup>. There were also reports of marginal increase in gastroenteritis and other water-borne diseases<sup>4</sup>. Health experts warned that there could be an outbreak diseases like typhoid, jaundice and malaria in the flooded areas. However, only diseases caused by mosquitoes like malaria and chikungunia were reported.

As water was drained out by various methods, the area turned into saline wasteland. The flora of the submerged



Figure 1. Large part of Kawas village submerged under 6–7 ft of water.

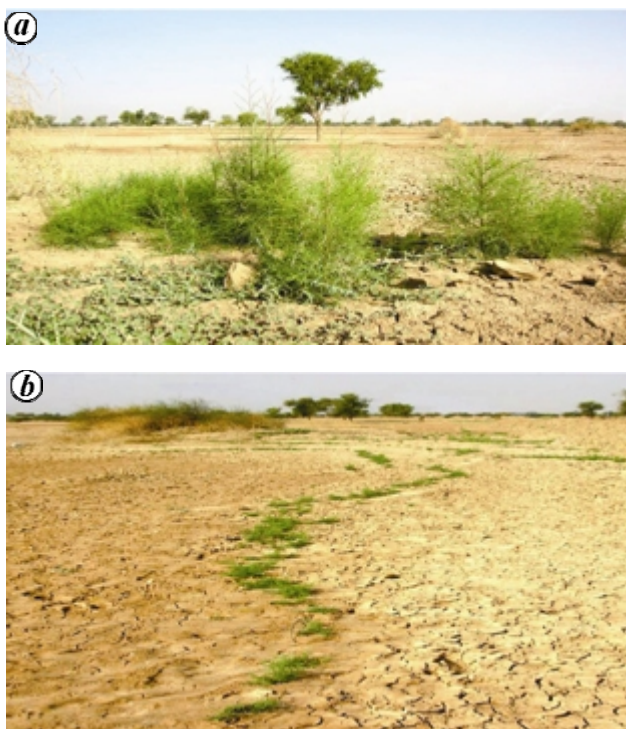


Figure 2. a, New, emerging plants of *Temarix* spp. in flooded area of Barmer region. b, Long lines of *Temarix* spp. plants after the water drained out from the region.

area is scanty, due to changes in the soil and water quality. Various marshy and water-loving plants started growing; *Tamarix* spp. (specialized plant of saline and revering area) was dominant over all other plants, including *Glynex* spp. and *Bergiria* spp. (Figure 2 a and b). Further efforts are needed to understand this ecological succession. A variety of bird species were also present in that flooded swampy area of Kawas, like the large population of resident birds like coots, little grebe, little cormorants, little egrets and cattle egrets. Additionally, various types of migratory birds were also noticed like Northern Shoveler, Ruddy Shelduck and White Wagtails along with other waders. These copious migratory birds were first visitors to the area. The subterranean habitat of these aquatic birds

clearly implies that the water is still 8–10 ft in depth.

The problem of flooding in desert areas does not seem feasible, but the geology of the areas is varied in nature. Geological and geomorphological observations indicate that Jurassic shales, Tertiary clays and Quaternary gypsite, which turn into water bodies after the rains, underlie several depressions and plains in the desert. Proper planning well in advance is essential in these areas, especially the drainage system for excess run-off to reduce loss of life, property, agricultural products and materials in future.

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4. [http://www.unicef.org/india/media\\_2284.htm](http://www.unicef.org/india/media_2284.htm)
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