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India's Arid Region and the Current Drought

We recently surveyed some of the drought-affected areas (Figure 1) in the Indian arid region in a publication entitled "Strategy to Combat Drought and Famine in the Indian Arid Zone." This article is a summary of the report.

The present drought in the arid and semiarid regions of India is due to the cumulative effect of inadequate rainfall during 1997–99. Twelve states in India are in the grip of severe drought, with Rajasthan, Gujarat, Andhra Pradesh, and Madhya Pradesh (Table 1) being the most affected. The Indian arid zone encompasses 32 million ha and is highly prone to droughts and famines. During the 20th century, the region experienced agricultural drought an average of once every two or three years (Table 2).

Often droughts persist continuously for 3 to 6 years, such as the droughts of 1903–05, 1957–60, 1966–71, 1984–87, and 1997–99. When the monsoon rains do not occur, the region is totally dependent on buffer stocks for food and fodder to sustain its 19.8 million people and 28 million livestock. Migration in search of fodder, food, work, and water is a common feature, causing hardships for desert dwellers, livestock casualties, and famines during extreme drought situations.

During the 1999 monsoon, a cyclonic storm originating from the Arabian Sea passed over extreme western parts of Rajasthan and Gujarat, but the early rainfall received from this storm could not be used for sowing. The regular southwest monsoon was three weeks late during 1999 (its normal occurrence is the first week of July), but after sowing, there was a 35-day break in rainfall that caused the failure of most of the crops. The 1999 monsoon rainfall departures from normal in various districts are given in Table 3. The other arid parts of north, central, and south India also received below-normal rainfall.

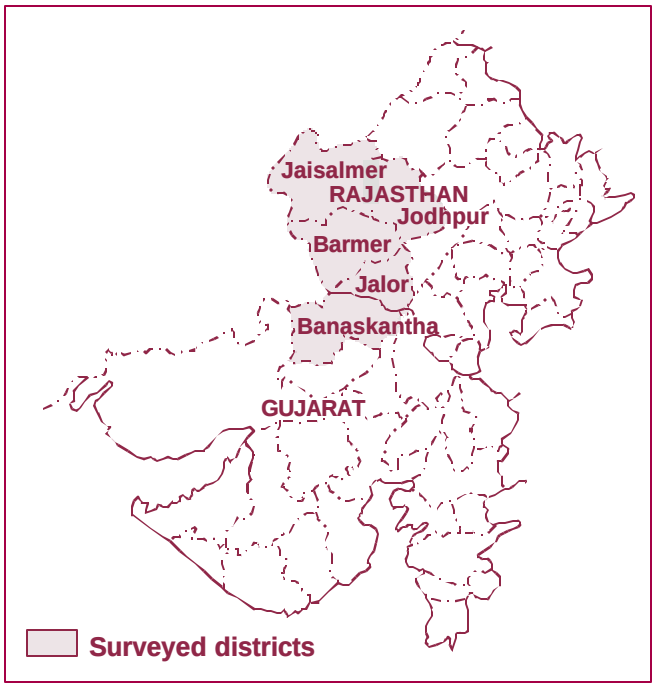

Figure 1. Drought-affected districts of Gujarat and Rajasthan.

The major causes of agricultural drought in the Indian arid zone, besides failure of the monsoon, are increased pressure of both human (400%) and livestock (127%) populations during the 20th century; this has put tremendous pressure on land and also surface and ground water resources. A large number of rainwater-harvesting systems like Nadi (ponds) and Tanka (wells to collect rainwater) have been developed in each village, but during drought years, the surface water resources are reduced significantly. The

State	Number of Districts: Affected	Total	Population Affected (million): Human	Livestock	Rainfall Deficiency in 1999
Rajasthan	26	32	26	34	-25%
Gujarat	17	25	25	7	-38%
Andhra Pradesh	18	23	40	-	-26%
Madhya Pradesh	7	17	3	3	-20%

Table 1. Impact of current drought in selected states of India.

District	Severe Drought	Moderate Drought	Total
Barmer	18	30	48
Bikaner	23	23	46
Jaisalmer	25	12	37
Jodhpur	26	16	42

Table 2. Frequency of agricultural droughts in western Rajasthan (1901–99).

ground water table is declining at a rate of 0.2–0.4 m per annum, and deep wells have become deeper. The quality of the ground water is deteriorating, and sometimes the concentration of undesirable substances such as fluoride and nitrate increase to harmful or toxic levels. With the present rate of increasing demand for water, western Rajasthan is likely to face a deficit of about 2,500 million m^3. Grazing herds of animals quickly remove the scanty grass cover that comes up with the meager rainfall, thus aggravating the problems of soil erosion and desertification. Because most of the people of this region depend on agriculture and pastoralism, drought leads to a decline in income and employment opportunities.

To minimize the suffering of people and livestock, large-scale relief measures are undertaken by the respective state governments and social organizations. These measures center on provision of drinking water supplies and foodgrains through public distribution systems at subsidized rates; feed and fodder for livestock and subsidies to approved Gosalas (cattle campus); and human and livestock health care. Efforts to create direct and indirect wage employment through food for work barely provide sustenance for the rural people, who suffer the most because of drought. Long-term measures are also undertaken, such as early warning and drought monitoring and advising farmers and others involved in drought management. Suitable alternate land use systems, water harvesting, soil and water conservation, contingency crop planning, adopting approved technologies for dry lands, efficient irrigation methods, and enrichment of cereal straw as fodder are also under implementation.

Location	Rainfall in 1999 (mm)	Departures from Normal (%)
Barmer	129	-51
Bikaner	152	-38
Churu	181	-47
Jaisalmer	171	+13
Jalor	146	-56
Jodhpur	250	-24
Jhunjhunu	251	-23
Pali	368	-4
Sikar	231	-42

Table 3. Rainfall amounts during the cropping season and their departures from normal.

The desert dwellers have their own traditional water-harvesting structures. The Central Arid Zone Research Institute at Jodhpur developed improved designs for Nadis, Tankas, Khadins (water ponds), and other structures. The Institute has conducted research on integrated farming systems; identification of suitable fuel and fodder trees; arid-horticulture, silvo-pastoral systems; rainwater harvesting techniques; and watershed development. Using flash floods/surplus rainwater for artificial recharge of ground water to augment the dwindling water table is the need of the hour.

With the increased pressure on land, marginal lands are being brought under cultivation, which is a disastrous trend. Concerted efforts have to be made to adopt suitable land use systems, keeping in consideration the rainfall, soil type, and needs of the people. Growing crops, fruits, trees, and grasses in various combinations minimizes the risk of crop failure. Suitable combinations of these for each of the agro-climatic zones have been evolved by the Institute. Lastly, besides improving water and crop/fodder resources, the biotic pressures on the Indian arid zone also need to be controlled to protect the fragile Indian arid ecosystem.

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