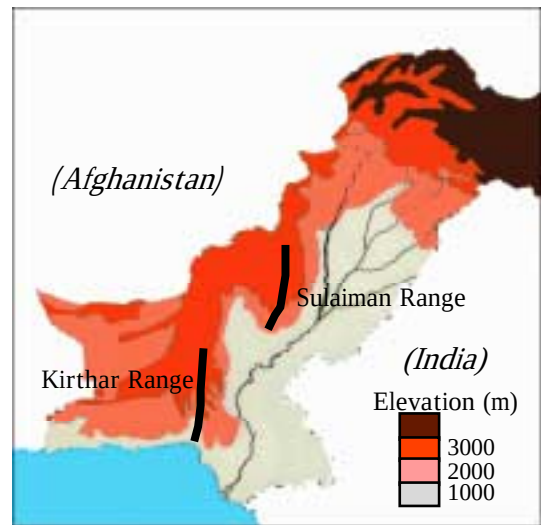


Agriculture and irrigation in arid lands: From a viewpoint of sustainability (2)

Part 2: Floodwater irrigation in Pakistan

Water harvesting is an important and traditional method of water utilization in arid regions. At the same time, the method has environmental advantages, as it is able to prevent soil erosion and salinization. It is therefore a sustainable method for agriculture which is perfectly suited to arid conditions. There are many different water harvesting methods, likewise their classifications vary. By and large though, they can be classified into two methods: 1) Rainwater harvesting that utilises ground surface water flow caused by rain; and 2) Floodwater harvesting that uses the temporary water that accumulates in wadis. The former method literally entails collecting water as rain falls on the ground surface of both agricultural and non-agricultural land. The latter method involves the collection of the water that flows in wadis by using barrages and channels, and then using this to irrigate crop fields.



In Pakistan, the main areas that undertake water harvesting reliant farming are located on the gently sloping areas at the feet of the Sulaiman and Kirthar Ranges to the west of the Indus River. Water harvesting also occurs in the western part of Balochistan province. Of these various regions, we would like to focus attention in this essay on the D.G. Khan area which is situated almost in the center of Pakistan. The D.G. Khan area is part of Punjab province and is bordered to the north by the North West Frontier province. Balochistan province borders it to the west and Sind province lies on its southern border. In the western portion of D.G. Khan the Sulaiman ranges rise to heights of over 2,000 meters and on its eastern side flows the Indus. Natural vegetation in the mountain areas is sparse and rocky terrain is exposed. The wadis that lead down from the mountains to the alluvial fans of the plains, and which only flood during heavy rains, vary in size.

This area's water harvesting technique is called *khase irrigation* which is a flood-water harvesting method. This method diverts water flow in wadis, which is created by rain fall in catchment or mountain areas, just before the water reaches alluvial fans. It involves the construction of stone barrages. The water then feeds downstream farm land. Choices of crops are dependent on the potential amounts of water that can be utilized. Generally, since floods occur between June and August, sorghum and millet are planted. When the rain is late and it is possible to farm in winter, wheat is planted. Sometimes in winter months, oil bearing seeds and pulses are planted using the residual moisture for sustenance. The problem with this water harvesting method is that because it is totally dependent on unreliable flood waters, harvesting times, areas that can be cultivated and agricultural production are unstable. Also, since the comparatively recent completion of irrigation channels drawing water from the Indus, a population shift from water harvesting agricultural areas to irrigated areas began in the 1960s. Moreover, after the 1970s, population flow to countries in the Middle East prompted changes of social structure in this area. Due to these reasons it has become difficult to maintain water harvesting barrages made of mud and stones to divert wadi water into farm land, and many facilities are damaged and have lost their capacity to function. As a result, floods are sometimes causing serious damage to irrigation channels, crops and roads downstream.

