

Extent of Mountain Irrigation in Pakistan

Small-scale irrigation systems dominate the developed irrigation potential in the mountainous environments of Pakistan, meeting the irrigation requirements of small farmers in the country's least developed and, heretofore, most isolated areas. In a real sense, they constitute the "veins" whereby greater productivity potential of irrigated agriculture is made available to the extremities of the national agricultural system. In addition to their comparatively small command or service areas, these systems commonly reflect characteristics that contrast sharply with those characterising the large-scale irrigation systems of the Indus Plains. Typically, they are farmer-constructed, often have articulated forms of group ownership and management, and usually possess cooperative mechanisms for distributing water and minimizing conflicts.

In the rugged mountains of Pakistan's Himalaya-

Karakoram-Hindu Kush, nearly all irrigation is done through *kuhls*, small, often lengthy channels usually constructed and maintained through the collective efforts of farmers and villagers. *Kuhls* carry water directed through a crude intake 'structure' from mountain streams fed by snowmelt, glacial melt, and/or springs for distribution through watercourses to clusters of small, often terraced fields, planted with food grains, vegetables, fodder, orchards, and trees. In basic physical appearance and characteristics, these *kuhl* systems differ little from thousands of others encountered throughout the Indian and Nepalese Himalayas.

As one moves south-west, from the Karakoram-Hindu Kush along the mountain periphery of Western Pakistan into Chitral, the Tribal Areas, and the NWFP, elevations decline; the terrain is interrupted by larger valleys drained by such rivers as the Swat, Kabul, and Kurram; and annual precipitation diminishes significantly. Changes in the physical environment and accessibility are mirrored in variations in irrigation development. Larger government-constructed canal systems, such as the Upper Swat Canal and the Warsak Canal, sustain the agricultural economies of the larger intermontane valleys. Smaller "civil canals" - older systems, usually farmer-constructed and managed, but now maintained by public agencies - are also found there and in other lesser valleys. The familiar *kuhl* systems are increasingly restricted to higher elevations and the upper ends of those favorably exposed tributary valleys where small perennial water sources are most likely to exist.

Further south into Baluchistan, the mountains of Pakistan's western borderlands - the Toba Karar, Sulaiman, and Brahui Ranges - continue to decline in elevation and conditions of greater aridity are encountered. Here, the indigenous *karez* systems of irrigation are found. Shafts are sunk in the alluvial fans, linked by galleries to form a tunnel that may tap a spring or more commonly collect sub-soil water which is then delivered to fields at a lower elevation. Increasingly, tubewell development threatens the continued viability of many traditional *karez* systems here.

How extensive is the irrigated agricultural area in the mountains of Pakistan? What, collectively, is the command area of irrigation systems in this region? The answer to these questions would seem to be anyone's best estimate, considering the fact that formal surveys to assess cropped irrigated area or the command area of irrigation systems in this environment have never been

done. Irrigation in Pakistan is dominated by the large canal systems dominating the Indus Basin, and readily available irrigation and irrigated agricultural statistics mirror this dominance. WAPDA's (Water and Power Development Authority) **Irrigation Directories** for the provinces give detailed service area data for the Indus Basin systems, but completely omit any reference to irrigation outside that region¹. The most comprehensive review of irrigated agriculture in Pakistan in the past decade: the Revised Action Programme for Irrigated Agriculture, makes no mention whatsoever of irrigation systems or irrigated agriculture in Pakistan's mountain zones in either the main or supporting reports². Regrettably, the recently published (1988) Report of the National Commission on Agriculture is equally silent on the subject.

The absence of reliable data on irrigated area, system type, and other relevant irrigation statistics for mountain agriculture in Pakistan, virtually defines one priority research issue for this workshop, *viz*, an accurate inventory survey of irrigation systems and their command areas in the mountain periphery of Pakistan. In the meantime, we must fall back upon existing partial data from a variety of sources, supplemented by estimates of experienced observers, to gain some measure of insight into the extent of irrigated mountain agriculture in Pakistan. We must keep in mind, however, that our data are limited, occasionally contradictory, and subject to unknown error.

For example, in Gilgit District, in the Northern Area, nearly 19,000 ha were classified as cultivated area by the 1980 Agricultural Census, virtually all of which can be assumed to be irrigated. More than 9,000 ha of irrigable area apparently has been added to this figure by the irrigation system development activities covering 166 irrigation schemes supported by the Aga Khan Rural Support Programme (AKRSP) initiatives throughout 1987 (AKRSP 1987). Investigations recently carried out by WAPDA identified another 30 feasible irrigation schemes with potential to add a further 4,000 ha to the irrigable area in Gilgit (WAPDA 1988).

In Chitral District, more than 1,000 small, communally owned irrigation channels reportedly irrigate more than 18,000 ha and larger NWFP Irrigation Department Schemes command another 1,500 ha. The proposed irrigation development activities over the next 10 years, through the Chitral Area Development Project, target the addition of 11,000 ha to this total (IFAD 1986). AKRSP is assisting 105 small-scale irrigation projects already underway and their completion will bring about 8,000 ha of cultivated land under irrigation command (AKRSP 1987).

In Baluchistan, the area irrigated by *karez*s and springs is reported to be 58,800 ha and wells and tubewells command an additional 113,000 ha (Kahlowan et al. 1988). At least 50 per cent of this total irrigated area lies within the mountain environment of the province. If the more than 30 small systems, to be developed through Baluchistan Minor Irrigation Development Project in the mountainous districts of Zhob, Loralai, Quetta, and Khuzdar are implemented, over 15,000 ha of new irrigation command area will be created. The total area irrigated by private canals in the North West Frontier Province is reported to be 360,000 ha (GOP 1986a). Again, an assumption that 50 per cent of this area is in the mountain regions of the province would not be unrealistic.

Federally Administered Tribal Areas were reported to have slightly more than 62,000 ha irrigated in 1983, and the Sixth Plan targeted an increase in the irrigated area to nearly 101,000 by 1988, through small surface system and tubewell development (GOP 1986b). The irrigated area in Azad Kashmir in 1983 was 10,000 ha, estimated at about 6 per cent of the cultivable area; several new irrigation schemes were expected to be developed through the Sixth Plan, adding perhaps 8,000 ha to the irrigation command area (GOP 1986b).

In sum, we can tentatively conclude that the existing irrigated area in Pakistan's mountains is about 380,000 ha. This is probably an underestimate, insofar as we know that the area irrigated

by small-scale, farmer-managed systems in other countries in the Himalayan zone is poorly demarcated and surveyed, and there is scant reason to assume a different condition for Pakistan. Irrigation development activities planned or already underway would seem likely to increase this total by at least 55,000 ha in the next few years. True, this extent is dwarfed by the nearly 15 million ha of area commanded by the Indus Basin systems; nevertheless, in absolute terms, the amount of irrigated area in Pakistan's mountain region is not a trifling sum.