Rapid Tubewell Development versus Sustainable Farmer-Managed Irrigation in Baluchistan

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Irrigated Agriculture in Baluchistan Province, Pakistan

Baluchistan is the largest of the four provinces of Pakistan, with an approximate area of 350,000 km. But it is the smallest in population, with some seven million people. The province lies completely north of the tropics.

Climatic conditions are arid, ranging from dry to hyper-arid, and temperature regimes vary widely from cool to hot, allowing, in the presence of the scarce irrigation water, an amazing variety of crops. Only about 2% of Baluchistan is cultivated at any time due to scarcity of water.

Most soils in Baluchistan have a homogeneous porous structure conducive to plant growth. Some of the younger soils, however, have a laminated subsoil, somewhat hampering plant root penetration. All the soils are invariably calcareous, with lime content ranging from 5 to 30%. Much of the surface (about 70%) of the mountain and hill slopes is bare rock without soil cover.

Most water resources in Baluchistan are derived from precipitation falling in the area. The precipitation on the eastern fringe of the province is mainly monsoonal summer rain, which is erratic and usually does not exceed 30 mm. Winter precipitation occurs as rain or snow and is the dominant form of water resource in the rest of Baluchistan.

Irrigation and Environmental Concerns

The resulting water resource in Baluchistan is extremely limited and consists of:

1) groundwater: (500 to 800 cusecs) representing the sustainable exploitation;

2) base flow of small perennial rivers, also originating from groundwater; and

3) flood-flow of permanent and ephemeral river channels.

Groundwater is an essential renewable natural resource in most of Baluchistan. The most important income generating activities, irrigated horticulture and pastoralism, depend for their water requirements mainly on groundwater. The province has a cultivated area of an order of 1.5 million ha, with a little over 500,000 ha believed to be under irrigation, or approximately 35%.

Population pressures are leading to unsustainable forms of intensified land and water use. Electrification combined with tubewell technology is changing agricultural development in Baluchistan. From 1964 onwards there has been a steady decline in water levels which is attributed to increased groundwater withdrawals for irrigated agriculture. The water level decline accelerated much faster in the '80s and will continue to do so in the '90s, due to the continuing expansion of tubewells.

Canal Irrigation

Although the Indus river does not flow through Baluchistan, the province has a water allocation of approximately 500,000 hectare-meters/year. Indus water is diverted to lowland Baluchistan in the Nasaribad District. These systems are organized in the same manner as found in other provinces and are operated by the Provincial Irrigation Department (PID). Irrigation water is derived by gravity to feeder canals; they are supply-driven and water is distributed through the traditional "warabandi" method of area-based fixed turns. There are no formal water users' associations except those created for purposes of watercourse lining. These WUAs normally disintegrate once the lining is accomplished.

Flood Irrigation

While canal irrigation still accounts for the lion's share of irrigation water supply in the province, the area that is being brought under irrigation through tubewells has been expanding rapidly. During the last twenty years, the area irrigated under Karezes (indigenous systems) has declined by 72 percent; while that under tubewells has increased in the order of 400 percent. A special case is "flood" irrigation. It is estimated that up to two-thirds of the total irrigated area of the province is subjected to irrigation by flood flows of hill torrents. These areas generally overlap those where different irrigation methods are practiced and therefore do not necessarily increase the total area. "Flood" irrigation takes different names according to the area. In Baluchistan, it is generally referred to as "Sailaba," while in the adjacent Northwest Frontier Province it is known as "Rod Kohi" (see table below).

Irrigation in Baluchistan, Pakistan

TYPE	AREA (ha)	TOTAL %	REMARKS
Canals	340,000	66.7	Indus and Tahlab basin
Wells	19,000	3.6	Dugwells, unlined, indigenous
Tubewells	93,000	18.2	Drilled with rig
Kareze	58,000	11.5	Indigenous system
TOTAL	510,000 ha	100%	
Flood Irrigation			
(Sailaba)	200,000 ha	----	(Sailaba irrigation overlaps with other sources)

With the exception of canal-based irrigation systems, as described above, all other types of irrigation systems in Baluchistan fall under the category of farmer managed irrigation systems (FMIS). A brief description of each type present in the province follows:

Well Systems. These are organized around dugwells of 1 to 5 meters in diameter. These are normally shallow, between 5 and no more than 20 meters deep, and usually unlined. They are constructed by manual digging and water is pumped by rope and bucket, or occasionally it is provided with a centrifugal pump. Each dugwell irrigates between 1 to 15 ha. There are thousands of these in the province, mainly for domestic purposes.

The majority of wells are privately owned but occasionally are dug through communal efforts. Thus, the number of farmers involved varies from a single owner to two dozen farmers bound by family or village ties. There is no formal farmer organization and the systems are operated mostly through family-led decisions. Conflicts are normally solved by elders.

Tubewell systems. These are organized around wells constructed by a rig-drilled borehole. A steel pipe of 20-30 cm diameter is inserted and water is pumped through a screen from the end of the pipe. In the province their depth is between 30 to 75 m. They are provided with vertical turbine pumps, although sometimes they are fitted with electrical submersible pumps. Each tubewell can irrigate between 15 and 30 ha.

In general, these systems are owned and controlled by individual families and therefore their management requires relatively less organizational input. Although there are laws restricting the number and location of the wells, these are largely ignored, given the difficulties in enforcement and as a result of widespread collusion with government authorities. As a consequence, this new technology is destabilizing the indigenous systems and their corporate management capacity.

Karez Systems. These represent one of the oldest gravity irrigation systems in the world. They have provided irrigation water to small farmers for centuries. In Baluchistan they had remained as the leading type of irrigation system until the recent introduction of modern tubewells. The Kareze is an underground tunnel, typically 1 to 5 km long, sloping from the underground watertable downwards to the outflow points, where the water is further distributed by surface canals. It consists of a yielding well (known as the mother well) and a series of open wells which gives a surface appearance of a row of low crater-like earth bunds 20 to 30 meters apart, with excavated materials, surrounding each shaft opening, to prevent flash floods from damaging the shafts and silting up the tunnel. Kareze maintenance is continuously required and is a highly skilled, tedious and dangerous job, and hence is expensive.

The Karez systems are communal enterprises, and are managed by traditional laws and customs which emphasize social justice. In practice, shareholders devoid of influence and wealth do not receive an equitable share of water. No formal water users' associations are found in Kareze systems although they could play an important social role. Many believe that a disruption of the traditional organized labor groups for maintenance of the systems is responsible for their drying-up.

Flood Irrigation Systems. Flash-flood and run-off irrigation are collectively known as "flood irrigation." The difference between the two is the distance between field and catchment. In the former, the field and catchment are apart and connected by a natural drain ("Nullah"); in the latter, the field and the catchment are adjacent. A particular type of flood irrigation is the Sailaba system in which flood flows occurring in ephemeral stream channels are diverted to irrigated bunded fields.

Concrete or masonry diversions are sometimes installed in the "nallah" but, more commonly, streams are diverted using temporary dams that are washed out in each storm and must be replaced. The conveyance channel often fills with silt and upper fields are no longer irrigated. Fields are laid out in random fashion with no system for water distribution among them. Bunds are allowed to breach so that water moves to the next field; thus there is no water depth control.

The very random utilization of these systems does not allow for the establishment of formal farmers' organizations. However, there is a need for strong interaction among farmers at the construction stage, in the distribution of water when floods occur, and in the repair and maintenance of structures. These systems are communal in nature and are managed accordingly.

The Environmental Challenge

The province has a very fragile environment that could suffer serious deterioration if the exploitation of its scarce water resources is not conducted in a coordinated manner. Modern irrigation, represented mostly by the swelling number of wells that are being installed, if unchecked, could cause irreparable damage, making irrigated agriculture unsustainable.

Conclusion

Striking a balance between centuries-old indigenous irrigation systems and tubewell development could be the key to environmentally sound and sustainable development of irrigated agriculture in the province. The importance of the role played by farmers in this context is undeniable. The reduction of formal or informal farmers' groups with the increase in individual ownership of the systems poses an additional threat to the sustainability of irrigated agriculture in the province. In this fragile environment even modest increases in population and competition for water and land use patterns can destabilize traditional resource management regimes. It is becoming increasingly apparent that new institutions and management and information systems are needed at the river course and/or aquifer levels to ensure the integrity of the water resource. It is here that the challenge lies for policy makers.

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Wurno Farmers Learn from Kerfi Farmers: An Example of a Farmer-to Farmer Training Experiment in Nigeria

Prachanda Pradhan

Participatory irrigation management is one of the policy thrusts that the Nigerian government is promoting for improved performance of its irrigation systems. In this management approach, beneficiary farmers play a very crucial role up to certain levels of large-scale, public sector irrigation systems. This is realized through formation of water users' associations (WUA) in the irrigation system. To be more effective, we assert that WUAs should be self-supporting, self-regulating and semi-autonomous units within the larger system. This would help strengthen the farmers' capacity and motivations for self-management.

The farmers of Wurno Irrigation Project (WIP) in Sokoto state, impressed by the positive results of WUA activities in the Kano River Irrigation Project (KRIP), decided to pay a visit to KRIP pilot sites on the 25th and 26th of May, 1993.

Background of Wurno Project

Wurno Irrigation Project is one of the oldest irrigation systems of Sokoto State, in northern Nigeria. It is located in the south of Kano City in Kano State. The system was non-operational for several years. The Nigerian government mobilized funds from the European Community for the rehabilitation of the system and then extended it to 1,500 ha.

The project aims at generating farmer participation right from the beginning of the project. The land within the command area, however, belongs to the government. The land has been allocated to the individual cultivators each year. Hence, there is no permanent land tenure. This provision for land allocation has implications for the functioning of water users' associations and the participation of farmers in the system. The project management and the government of Sokoto agreed to allocate the land to the cultivators for a period of seven years, instead of the previous one-year term. After every five years, a review as to whether the land is properly cultivated or not would be undertaken.

Lessons from KRIP

Hadejia-Jama'are River Basin Development, in collaboration with IIMI, undertook a research program in order to introduce participatory irrigation management in KRIP. Three pilot sites were selected for experimentation. The results were positive and indicated that farmer WUAs could be formed. The farmers could be given the responsibility of irrigation management up to the distributary channel level of KRIP. The distributary channel level consisted of a command area of about 150-200 ha, with 15-25 field channels and about 250 to 300 farmers.

The KRIP went through the following process in forming water users' associations:

1) The units within hydrological boundaries are determined,

2) Membership of the association is granted to the landowners,

3) Facilitating the formation & functioning of WUA by catalysts.

4) It is a single-function WUA, based on water-related activities, in the initial stages, and

5) The association evolves through catalyzing efforts,