

MITIGATING THE EFFECTS OF DROUGHT THROUGH TRADITIONAL AND MODERN WATER SUPPLY SYSTEMS IN BALOCHISTAN

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Introduction

This paper analyzes the relationship between drought and poverty in Turbat, southwestern Balochistan². Balochistan borders eastern Iran and southwestern Afghanistan areas, which have also been severely affected by the drought. To convey an idea of the magnitude of the problems caused by the drought, the paper first outlines some of the effects of the drought on Pakistan. It then moves to an intensive study of the *karez*, an ancient water system that has made survival and prosperity possible in the perennially arid region of Balochistan³.

The *karez* warrants attention because it has provided sustained supplies of water to communities for hundreds of years. The focal argument of the case study is that this traditional, community-based method of harvesting, transporting and utilizing water should be restored to full functionality. Although *karez* restoration is not a *panacea*, it offers the best chance of restoring economically marginal communities to a condition in which livelihood sustainability can be achieved and future vulnerabilities reduced. The question is how to ensure that the *karez* are restored effectively, and also how to ensure that the *karez* is integrated into a comprehensive plan of drought mitigation and prevention.

Drought is defined differently, and has different effects, in each of Pakistan's agro-ecological zones. As one expert has put it, "... drought is a relative, rather than absolute condition that should be defined for each region".⁴ These specificities must be taken into account when analyzing the effects of drought, establishing drought mitigation efforts and planning for drought in the future.

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² A number of people have given generously of their time and resources in the preparation of this case study. These include Mr. Akhter Hussain, NRSP's Regional Programme Manager in Turbat, Usman Qazi, who allowed us to include data from his study of two districts close to Quetta and our colleagues in NRSP's Monitoring, Evaluation and Research Section, who helped in numerous ways.

³ Wilson (2002) describes the spread of the *karez*, called a *qanat* in North Africa where they originated, westward to Spain and the New World, and eastward to Iran, Afghanistan and Balochistan. He notes that the problems currently facing South West Asia have recurred throughout history. With sufficient rains, water delivered through the *karez* has provided prosperity, through agriculture, livestock and trade, to large and stable populations. However, throughout history, the over-use of water, coupled with periodic droughts, has sometimes reduced economies and populations to almost nothing.

⁴ Environment Foundation Balochistan

Although drought is essentially a climatically induced phenomenon, its actual effects in a given eco-zone, and the viability of responses to it, will be mediated by ecological, social and infrastructural factors, as well as by the relevance, efficacy and timeliness of responses from governments, NGOs and the private sector.

Vulnerability to drought exists on a continuum in Pakistan. The basic eco-agricultural distinction in terms of normal rainfall is between irrigated⁵ and *barani* (rain-fed) areas. A further distinction differentiates semi-arid from arid areas, and desert areas from semi-arid. All have suffered from the drought, as the graphs in the extended version of this paper make evident.

The following figures give an idea of the scale of the problem:

In a normal year, some 32 million acre feet (MAF) of water from the Indus river flows into the sea. This was reduced to 2-5 MAF in three years preceding 2001. Extreme drought conditions and global warming are cited as the reasons for the decrease. (Irrigation Department GoB). Increasing water shortages are predicted: in 2000, the shortfall was 40 MAF – this will reach 108 MAF in 2015, if present rates of water use continue⁶.

“Total rainfall in Balochistan and Sindh in 2001 was 50-60 percent below average”, according to the Ten Year Perspective Development Plan 2001-11.

Drought is a conceptually and operationally complex phenomenon. In addition to the climatic factors, communities’ history of coping with reduced rainfall, people’s settlement patterns and economies (e.g. degrees of reliance on agriculture, livestock and horticulture for subsistence) will affect their ability to respond to drought. The nature of the mechanisms they have adopted over the years in response to drought is also important. People’s access to power structures (political, governmental, community and household) will also affect their ability to respond. For these reasons, a close examination of a specific region yields insights not available otherwise.

The drought has severely taxed the capacities of communities in all eco-agri zones to sustain themselves economically, ecologically and socially. The current drought reveals the stark effects of many years of increasing demand due to rapid population increases, enhanced demand for water-intensive cash crops, and increasing technological capacity to access water.

It must also be said that the drought reveals some degree of active and passive mismanagement, lack of foresight and poor governance in water resources management. Restoring eco-systems, infrastructures and communities to a state of health will require the kind of concerted approaches and interventions, which have not been evident so far. Qazi states the problem well when he says that the lack of a shared vision about the

⁵Pakistan has one of the world’s most extensive irrigation systems. Unfortunately, its maintenance has not kept pace with the demand for water. Wastage through leaks and silting is also a problem. According to the Irrigation Department, Government of Balochistan “the Indus river and its tributaries provide about 147 MAF of water during the flood season. Of this, nearly 106 MAF is available for agriculture ... 32 MAF flows into the sea, and over 8.6 MAF is [lost to] evaporation and seepage losses”. Irrigation Department, Government of Balochistan. 2001

⁶ Comments on Draft Framework for National Water Policy prepared by the Ministry of Water and Power, Government of Pakistan, April 2001, p.3.

nature and magnitude of the problem and longer term sustainability of the resource, amongst the various stakeholders, has prevented the formulation and implementation of an appropriate strategy to arrest the process of rapid degradation and eventual depletion of the resource.

The actual shortage of water is only part of the problem. The over-use of irrigation water and fertilizers has resulted in hundreds of thousands of hectares of land being taken out of production through salination. Cash cropping, while providing good returns, typically requires large amount of water, and contributes to resource depletion. Wastage by urban elites, tubewell owners and industries, is also part of the overall problem. Despite the length and severity of the present drought, many people still do not conceptualize water as a finite resource that needs to be conserved. The idea that the ability to pay for water somehow guarantees the supply of water is part of the problem. As a man in Turbat said: “The rich wash their vehicles with sweet water but water is not available for the poor to drink. Are we not human beings? What are the facilities for poor? Nothing! Look at my clothes, I have not taken a bath for the last month and many times we do not wash our face. We are human beings. We need basic life necessities.”

The Government of Pakistan has identified the following lengthy list of ‘Sectoral Issues’ that it considers critical to water management and, by extension, drought mitigation⁷:

- lack of water storage facilities
- inefficient use of water, some of it leading to waterlogging and salinity
- non-availability of irrigation water and/or its timely delivery
- excessive pumping of water
- inadequate operation and management (O&M) funding and poor cost recovery
- water pollution (effluents entering the water supply)
- inequitable water distribution
- lack of private sector participation in water sector
- deteriorating institutional capacities of key water sector institutions
- absence of integrated river basin development and management approach
- poor and isolated implementation of flood sector schemes
- poor linkages among water, agriculture and rural development policies and strategies
- interest burden during construction
- inadequate reflection of poverty alleviation issues and gender concerns

This list of shortfalls and impediments is alarming for the scale and depth of structural problems and inadequacies that it reveals. It is also the case that an equally lengthy list of imaginative and potentially effective strategies is included in the Ten Year Perspective Development Plan. However, it remains to be seen that to what extent these strategies are implemented.

The economic costs of drought and mismanagement are manifested in lost income, lost livelihoods, reduced crop yields, livestock losses and the cost of relief. The complement of these costs is the lack of growth and development arising from reduction in Human Development Indicators and the loss of opportunities for advancing the state of human and economic development.

⁷ Government of Pakistan, Planning Commission, September 2001.

In the year 2001, the macro-economic impacts of drought on Pakistan's economy were starkly clear. According to a United Nations report⁸, "The State Bank has calculated the effect of the drought to the tune of \$927 million in the third quarter. As a result ... the anticipated GDP growth rate of 4.5 percent will not be achieved, rather, the GDP growth rate will fall to less than 3 percent". The report goes on to note Pakistan's dependence on agriculture, and the resultant "increase on imports thus adversely affecting the Balance of Trade of the country." Furthermore, the drought reduces the country's ability to produce electricity, meaning that oil must be purchased for this purpose (IBID). This fact alone has caused an additional loss of nearly \$1.2 billion (IBID).

According to figures presented by the Chief (Environment) Planning Division, Government of Pakistan, the overall economic impact of the drought in 2001 was a reduction in real GDP growth from a projected 4.8 percent to an actual 2.6 percent in 2000–2001. This means that governments and international donor agencies must reserve large amounts of revenue and development funds for drought relief and mitigation. It essentially means that drought and its direct and indirect effects have impeded every aspect of economic growth.

The full social costs of the current drought will never be completely known. Some communities have been forced to disband altogether, as they migrate in search of fodder for their animals or paid work for adults. Children have been forced to leave school to help support their families. Families have been disrupted as male members have left in search of work. Elderly parents have been forced to beg. The effects of short-term and long-term malnutrition on infants, children, women and men will be felt for years to come.

Drought and Poverty

Those who are already poor are the most vulnerable to the effects of drought. They have few resources for subsistence and fewer resources or assets to sustain households through the shocks that drought entails. Their social support systems are dominated by people who are also poor, and therefore, unable to help except in limited ways. Many of the poor are rendered dependent on shopkeepers, middlemen, local influential people and the government, when their limited social safety systems are exhausted.

Drought also forces more people into poverty and debt as their resource and asset bases shrink. This is especially alarming given that some 35–40 percent of the total population, and even higher percentages of rural populations, are already living below the national poverty line (Human Development in South Asia Report 2000).

When poverty and malnutrition co-exist with lack of water, poor to non-existent sanitation and polluted water supplies, the health situation enters a crisis. When gender biases are considered, it is evident (a) that the health situation in Balochistan has reached this level of crisis, and (b) poor women are particularly vulnerable.

There are also, what might be called, technological costs of drought. Here the best example is the tubewells that provide artificial and unsustainable prosperity, while contributing to lowering the watertable. Anecdotal evidence of this was provided during a site visit to the Noshki area in Balochistan by the Relief Commissioner in 2000. It was

⁸ Drought Update No. 12, 8 June 2001 www.un.org.pk/drought/rcreport12.htm

estimated that a single tubewell pumped out 600–800 gallons of water per hour, and that the pumps ran 24 hours a day.

Drought in Balochistan

Drought is a recurrent feature in Balochistan but the current drought has lasted longer than most (7 years in the hardest hit places). ‘Negligible’ amounts of snowfall in the early 1990s⁹ were a harbinger of the current crisis.

Balochistan is Pakistan’s poorest province. 85 percent of the population of 7 million live in rural areas and depend on agriculture and livestock for their livelihood. The province has an annual population growth rate of 2.8 percent. Communication and transportation infrastructures are minimal outside Quetta and few other towns. Of the entire area of Balochistan (34.720 Mha), 58.6 percent is non-arable, forests cover 5 percent, 6.5 percent is lying fallow, and the ‘net sown’ area is only 4.8 percent (1.528 Mha). The area classified as ‘culturable waste’ (waterlogged, saline, or un-irrigated for 2-3 years, but potentially reclaimable) amounts to 25.10 percent of the total¹⁰.

As of October 1999, the following amount of water (in MAF) was available in Balochistan¹¹. It is abundantly clear that flood water amounts greatly exceed those of perennial water supplies.

	Available	Utilized	Balance
Surface Water (Indus)			
Perennial	3.87	3.049	0.821
Flood	2.5	-----	2.5
Surface Water (flood runoff)	10	3	7
Groundwater	0.87	0.49	0.38
Total	17.24	6.539	10.701

According to the Social and Economic Development Ranking of Districts of Pakistan¹², of the 25 districts in Balochistan, only one (Quetta) is ranked high in both social sector and economic development; three districts (Sibi, Ziarat and Lasbela) ranked high in economic and low in social sector development; none ranked low in economic and high in social sector development, and the remaining 21 of Balochistan’s districts are ranked as low in both economic and social sector development. 92 percent of the population of Balochistan reside in districts categorised by low economic and social development (IBID: 38). “The Government of Balochistan had declared 22 out of 26 districts calamity stricken due to the prevailing drought situation” (Qazi).

The Balochistan Board of Revenue figures for the year 2000 indicate how devastating the province-wide effects of the drought were then:

- no crops could be grown on 95,506 hectares of land

⁹ IBID

¹⁰ Agricultural Statistics of Balochistan, 1996-97, in *Brief on Development Activities of Irrigation and Power Department*.

¹¹ Brief on Development Activities of Irrigation and Power Department, 2002, citing the *Balochistan Conservation Strategy 1999*.

¹² Social Policy and Development Centre, 1998.

- wheat sown on 17,200 hectares produced no crop at all
- 60% of range lands produced nothing
- 10 million animals (mostly sheep and goats) died
- 250,000 livestock farmers were rendered destitute

The situation in 2002 was even worse, as there had been no substantial rainfall since those figures were published.

The current drought has devastated entire eco-system as water supplies for human use, agriculture, livestock, wildlife and vegetation recede or vanish altogether. By all accounts, the amount of available groundwater in Balochistan is decreasing every year. According to one source, in Balochistan underground aquifers are dropping at 3.5 metres annually and will be extinguished in 15 years¹³. Another source claims that the rate of depletion is accelerating from 0.75 feet per year prior to 1989 to the present rate of 3 to 5 feet annually¹⁴.

Groundwater levels are being reduced at an increasing rate: “... in the decade from 1983 to 1993, the amount of potential groundwater in Balochistan decreased from 936 million cubic meters per year to 619 million cubic meters per year”. The same source says that “depletion of groundwater estimates for the period 1989-96 indicates a continuous decline of [the] watertable from 0.2 to 3.5 meters per year”.

A number of the pathogens that flourish in a drought - for example when animal corpses decay on the surface or when they contaminate water supplies - have been identified in Balochistan. There is no comprehensive data on the depth of diseases associated with poverty (TB for instance) or those related to poor sanitation and lack of potable water. However, sources¹⁵ note that some life-threatening viral diseases, such as viral hepatitis and, alarmingly, Crimean-Congo haemorrhagic fever have also broken out in some of the drought-affected areas of Balochistan.

Nutrition level in poor men, women and children is inadequate in normal times; drought reduces the availability of food and compromises its quality. Maternal and infant mortality and morbidity rates rise, as do stunting and wastage. The effects of diseases which are not otherwise life threatening are intensified by malnutrition. A study by experts from UNDP, carried out from 16 to 21 April 2001, found that some 36 percent of the people they surveyed were suffering from malnutrition, as measured by Body Mass Index (BMI) figures. This figure is all the more dismal, as it is stated to be ‘no worse than the national average’. This study also notes that the absence of data, and the inability to correlate co-existent factors, such as drought and poverty, makes analysis difficult.

The Karez

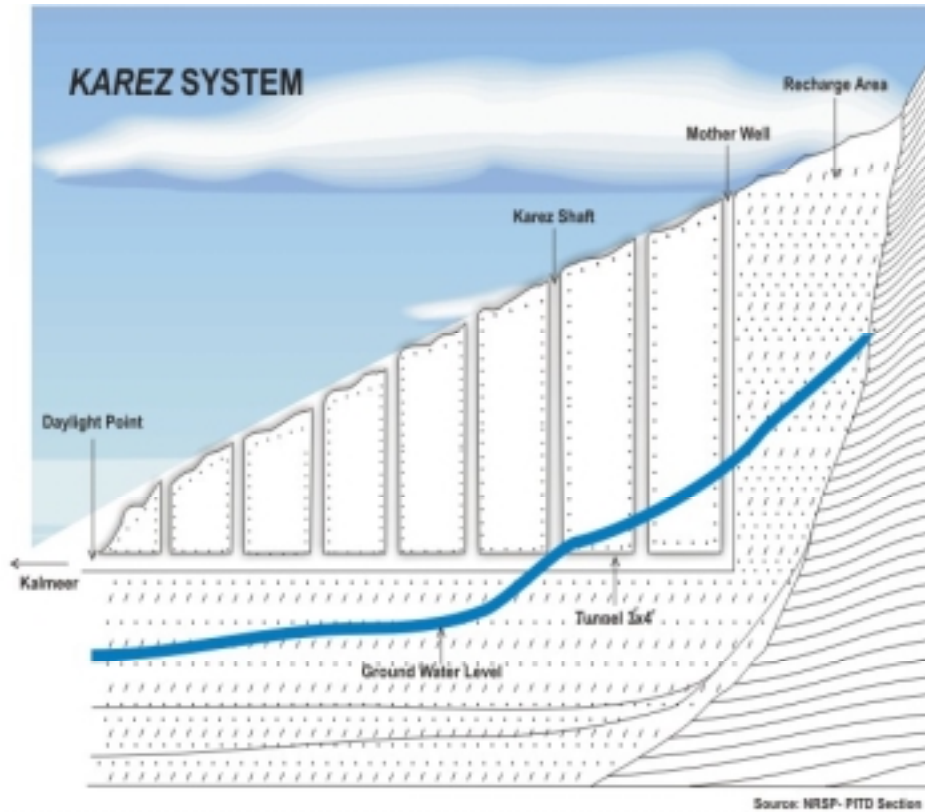
In 1996-97, karez irrigation accounted for nine percent (78,550 ha) of all irrigated land in Balochistan. This figure is a reduction of 62 percent from the 1971-72 figure of 208,000 hectares (43%). The karez is a traditional, egalitarian system of water, land and

¹³Pakistan 12/10/02 and Irrigation Department Balochistan 2001.

¹⁴ M.E. Khan, *The News*, Internet Edition, Wed. July 24 2002.

¹⁵Non-Food Assessment of Drought: Balochistan and Sindh

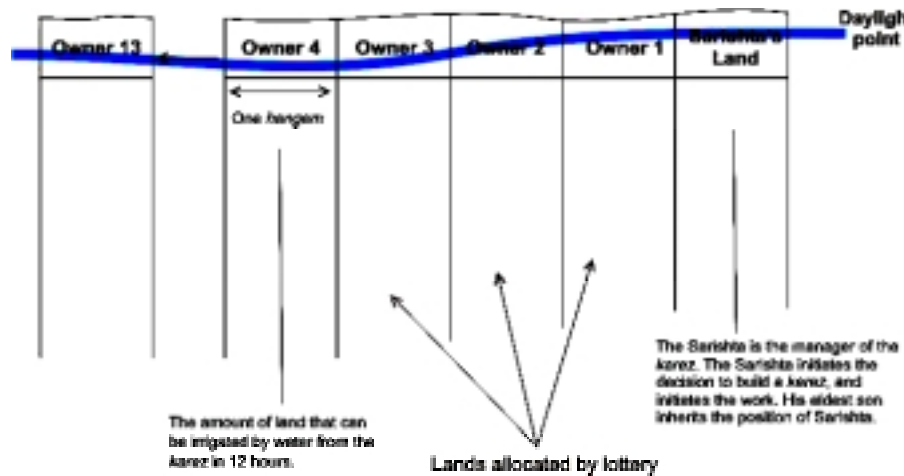
labor distribution and management. A karez consists of a series of hand-dug wells and tunnels that collect rain and groundwater and discharge it onto farmers' fields (see Figure 1). In an area entirely dependent on rainwater, and with very little capacity for surface-level water harvesting and storage, the karez is the primary water-harvesting mechanism available to the poor.



The advantage of the karez is that it delivers water year-round, even in years when rainfall is below average. According to some of the residents of Turbat, when the current drought began, the karez continued to deliver enough water to meet people's needs for about two years. Clearly there are limits to this capacity, but the karez offers a far more conservation-focused method than the tubewells which contribute to lowering the watertable, encourage wasteful water use and operate at the expense of the poor, in that they reduce the amount of water available to the karez.

The land closest to the 'daylight point' is owned by the manager (*sarishta*) and the remainder is divided by lottery.

Figure 2: Shows the distribution of land irrigated by the karez outflow.



90 year old Abdul Rehman, a valued source of knowledge on the karez, had this to say about the karez that when a new Karez is to be dug, local, knowledgeable people assess the direction on the basis of the amount of land to be cultivated, the elevation of the nearby mountains and the direction of water flow in the streams. A well is dug at the centre of the proposed course. If water is found, digging of more wells upward toward the hills and down towards the fields begins. Normally it takes 2-3 years to dig a karez. For a new karez, approval from the AC/DC or concerned authorities is sought.

There are usually 80–100 partners on each karez. Usually a sarishta is also the head of the village, *biraderi* or tribe. So he is relatively better in terms of financial position as well as his moral and political position. If the karez partners are not satisfied with his performance, they can replace him. However, based on his (and his father's forefathers') services for the karez, he enjoys half the facilities. There has been a change in the role of a sarishta. Previously, he was a very important person who was also involved in resolving social and political conflicts. Now he is considered important only for karez work. Previously, he could fine anyone who did not work on the karez. This fine was usually in kind. If a partner did not participate in karez work, he had to pay some portion of his date production. Previously, people were more interested in karez work. Now due to changes in life facilities, they think it is very hard work.

Despite the perennially arid conditions the fact that only 5-6 percent of the land in the area is arable, the deposits of alluvial soil irrigated by the output from the karez are capable of producing high yields if sufficient water is available. Per hectare production of many crops equals or exceeds than in canal-irrigated areas in other parts of Pakistan. This is the case for staples such as dates, rice, sorghum, pulses, onions, garlic and some vegetables, as well as grapes and pomegranates (NRSP Turbat Annual Report 2001). The date palms, capable of producing ten tons per hectare in good conditions, could also form the basis of a revitalized economy, if sufficient water were available (IBID). However, the drought has severely damaged even the hardy date palms, as the survey results described below makes clear.

Case Study: The Role of Karez Rehabilitation in Restoring Sustainable Economies and Communities in South Western Balochistan

In 2002, the Global Water Partnership commissioned the National Rural Support Program (NRSP) to conduct a small-scale study of the relationship between drought and poverty in drought-affected areas in Pakistan. NRSP has a reliable base of information, a record of involvement in water-management here and elsewhere in the country, and the institutional capacity, in concert with its partners, (Pakistan Poverty Alleviation Fund, for example) to affect some of the drought and poverty alleviation measures necessary. For example, funding is in place to expand the karez rehabilitation initiatives in the area. In the next two years, NRSP plans to rehabilitate another 60 karez annually, with funding from the Pakistan Poverty Alleviation Program.

Turbat ranks 86th of 94 districts in the country according to the Social and Economic Development Ranking of Districts in Pakistan in economic development and 92nd in terms of social sector activities¹⁶. Thus, it is not the worst-off district; nor is it the worst affected by drought. However, it has suffered greatly, as the case study shows.

The arid climate, harsh terrain and lack of transportation and communication infrastructure mean that life can be difficult here at the best of times. The word Turbat means ‘grave’, in eloquent testimony to the difficulties of sustaining life here. Temperatures can reach 50 degrees in summer. The average annual rainfall “varies from 50 to 150 millimeters in southern and western Balochistan and the annual potential evapo-transpiration exceeds rainfall throughout the year in many basins or sub-basins”¹⁷.

The journey from Turbat to Karachi takes over 12 hours. Many services, including health and education services, are unavailable or available only intermittently. These factors contribute to the difficulties of establishing long-term improvements and make it difficult to plan and deliver relief. Outside the few urban and peri-urban areas, there is almost no employment, which not land or resource based. Literacy rates, especially among women, is extremely low.

The economy of Turbat depends on trade, agriculture and livestock. Some 80 percent of the population depends on farming and livestock¹⁸. Remittances and savings from money earned while working abroad are also important. Trade across the Iranian border flourished for many years and made some families prosperous. However, this means of livelihood vanished when the events of September 2001 led to the border being closed.

From 1960s to 1980s, many men from Turbat and southern Balochistan went to work in the Gulf states. At one time, up to 30 percent of households had a family member working in the Gulf. These men sent their wages home and many bought a share in a karez when they returned. A few invested in tubewells, but very few could afford to do

¹⁶ Social and Economic Development Ranking of Districts of Pakistan. Social Policy and Development Centre, Karachi, Table 4.

¹⁷ (Board of Revenue, Balochistan).

¹⁸ Drought Hit Communities of Mekran Division, Balochistan: Brief on Crisis Situation in the Drought Hit Areas. Commissioner, Mekran Division. May 2000.

this. Also, the karez met their needs for irrigation water. Some new karez were built with these earnings but most of the investment was in karez extension.

A flood devastated Mekran division (adjacent to Turbat) in 1998, with the total damage (lives lost, houses destroyed, agricultural losses) estimated at Rs. 10,30,00,000 (10 crore, 30 lakhs). Communities are now coping with the after-effects of the flood and severe drought.

The flood caused extensive damage to the karez, filling the tunnels and wells with silt and debris. Economic distinctions determined the kinds of responses made to the drought: the relatively affluent were able to clean and repair their karez quickly, and also, restore the supply of water. Deciding against collective effort to rehabilitate the karez, some families installed tubewells, increasing the number already in existence. Thus, the flood created a widespread demand for massive rehabilitation of the karezes but majority of the villagers – most of whom were poor - were unable to muster the economic resources for this. Some were able to buy water from the tubewell owners, which made them reluctant to rehabilitate their karezes. Some of the poor expected government grants for karez rehabilitation but these did not materialise.

Now, all of the effects of the previous years - high population growth rate, increasing demand for groundwater and climatic changes - have culminated in a desperate situation.

Case Study Methodology

A household survey was conducted, covering 108 households in 10 villages. All respondents belong to NRSP-organised Community Organisations (COs). In addition to the household survey, information was collected through interviews with a small number of District Government officials, a former Minister of Agriculture, the District Nazim and a number of councillors and community members. Several sarishtas, who recalled the time when the karez were functioning at full capacity, were also interviewed. Focus group discussions were also held.

The interviews provided a window on the contemporary social organisation of water supplies and land use in the area. They also provided retrospective and current understanding of water supply issues, and a sense of local people's perceptions of the most effective means of restoring water supplies to the area.

75 responses to the household survey were from men and 33 from women. Women were asked to explain the specific impacts they had faced because of the drought, but only a small number responded to that. However, a number of interviews with women did elicit some useful statements about the effects of the drought. These are described below.

Of the 108 households surveyed, 107 were landowners, owning an average of 12 dagars (1 dagar = approximately $\frac{1}{2}$ acre¹⁹) of land. Landholding size ranges from 1-64 dagars. 72 families owned land in one piece, while the fields of 32 households were spread out. 68 families had inherited their land while 39 families had purchased it.

¹⁹ A *dagar* is not a fixed amount of land: its size varies according to local criteria of land availability and crop yields.

All 107 respondents were members of a karez—i.e. they owned a share of the land irrigated by a karez; they had contributed cash and/or labor to building or extending a karez and depended on the output of karez-irrigated agriculture for the majority of their household income and subsistence. 77 respondents ranked this drought as ‘the worst ever’ and another 27 ranked it as ‘very bad’.

Karez Infrastructure

The average length of the karez, owned by the households surveyed, was 4 kilometers (The range is 1 Km to 9 Km). The average depth of the mother wells was 54 feet (range: 9 – 96 feet). Well depth was measured in a man’s height (i.e. six feet). 89 of 108 respondents reported that there was some water in the wells, although 59 said there was far less water than they required.

72 households had contributed cash to karez building/maintenance or extension, with an average expenditure of Rs 4,284 per household (range Rs 30,000 to Rs 300). However, only 36 households reported contributing labor to karez maintenance. This was partly because the above-ground labor was arduous, and the underground labor required was quite specialised. 93 households reported using karez water only for flood irrigation. i.e. they utilised no other technologies for carrying or distributing karez water to the fields.

The average value attributed to the land by the owners was Rs. 748,250 (80 responses), although these values were not necessarily congruent with market prices, in the absence of a viable market. The fact that only four families reported that they had sold land or water rights in the last five years also indicates the lack of a viable market. All the respondents mentioned that they would take up other work if they could sell their land.

Most respondents were living as one would expect, in extended families, which constitutes the social safety net for most people. Average family size is 15 (range = 3 to 43). The largest family in the survey had 50 members. Many families had a large number of dependent children (i.e. under 10 years of age). Only one household had no male members.

Speaking about the effects of current drought the respondents said that this was the worst drought with no rain in the last 4-5 years. The livestock has diminished by disease. People were dependent on cutting down and selling types to buy items for daily use. Before drought, they could sell fodder, vegetables and other crops in Turbat but now they were buying fodder from rich people near Turbat who had installed tubewells. Also, they were getting drinking water from a well which was 150 feet deep. A 180 foot deep well was also being dug, but water was not suitable for drinking purposes. The pond near the mosque, which they used for washing clothes and bathing, was always full round the year but since drought it was dry.

Sources and Amount of Income

The average reported monthly household income²⁰ (103 ha) was Rs 6,210, derived from the sources listed in the following table.

Reported sources of household income (averages)		
Source	Avg. value per response (Rs)	No. of Responses
Crops (excluding dates) per season)	10,350	40
Daily wages (per month)	3,021	14
Trading (per month)	3,933	9
Service/employment (per month)	13,210	36
Date production (per season)	26,403	70
Other sources ²¹ (annual)	133,265	34

Remittances from family members working abroad or, in a few cases, in Karachi, supported 34 households. These provided the highest proportion of income, as the above table shows.

Dates were the most valuable item produced by the farmers in the survey, providing the highest yields and highest income per maund (40 Kg). 106 households in the survey owned date palms, owning an average of 278 trees. (Range = 20-2000 trees). Of the two households who did not own date palms, one was sharecropper and the other did not respond to the relevant questions. A household owning 2,000 trees was facing economic ruin. The head of this household was one of the people who had returned from Dubai and purchased land and a share in a karez. The family owned 20 dagars of land, on which they reported raising some vegetables, in addition to dates. They said that drought had lasted for seven years and their income had been reduced to zero because of it. In 1998, each of their trees yielded 50 maunds (2,000 Kg) of dates but in 2002 they yield was nothing.

Date production has both consumption and cash value. Amongst 105 households, an average of 48 maunds were sold and 16 maunds consumed. The average annual income (70 households reporting) from dates was Rs. 26,403, with the range of income being Rs 800 to Rs 300,000.

The drought has reduced the yield of every crop, in some cases to almost nothing, as the following table makes clear.

Source	Average Yields Reported		
	1998	2002	% Decrease
Dates (maunds)	77	34	56%
Wheat (maunds)	30	3	90%
Fodder (dagars)	92	75	18%
Pulses (maunds)	11	1	91%
Vegetables (maunds)	19	2	89%

²⁰Legal activities, and excluding barter/in-kind exchange

²¹The majority of this category comes from remittances

Some households reported zero yields in their crops: of 81 respondents who grew dates and reported yields in 1998, 7 (9%) reported that their date palms produced nothing at all in 2002. Since dates are an extremely important cash crop in Turbat, this is particularly significant, and has negative implications for restoring the area's productivity.

Some of the very poor people had begun eating koosh, the inner edible portion of the date palm. The koosh from one tree provides a single meal for half a dozen people. The average value of a date palm, two to three years ago, was Rs. 1,000, but now there is no market for the wood and the trees are dying.

Reported Health Effects

Both women and men consider running water better for health than standing water. The water flowing in the karez is filtered through the soil, which is thought to kill bacteria. Water standing in a well is thought to cause health problems. For example, many people in Dagari Kahan village have kidney problems, which they attribute to well water.

Previously, all human waste flowed into the fields or was disposed off away from the village, where it became a natural fertilizer. Now, however, some human waste is placed outside the houses, leading to bad smell and air pollution. Similarly, people have begun to wash their clothes and bathe within their houses, thus increasing the amount of wastewater. This is creating sanitation problems, and in some villages, the streets are full of wastewater and human and animal waste.

Specific Effects of the Drought on Women

Unfortunately, women's reluctance to be interviewed, even by other women, coupled with the assumption that knowledge about assets was the domain of men, limited the number of women's responses in the survey. Other than discussing the problem of inadequate water supplies and the problems caused by water-related concerns, majority of women's responses concerned selling their animals and jewellery to pay doctors and buy medicines. The sale of other assets was not reported.

Lack of food, poor nutrition and poor sanitation typically resulted in decreased resistance to diseases and increasing rates of miscarriage. Slight increases in miscarriage rates were reported in Turbat, although this finding probably does not accurately reflect the situation because of the reluctance of women to be interviewed. It is also possible that these issues were not articulated in the relatively brief time, which the interviewers had to spend with respondents. A number of women did cite increased difficulties in meeting the needs of sick household members because the drought had reduced their income and asset base.

Before drought, women in Turbat used water from the karez for every purpose: drinking, bathing, washing clothes and so on. They had access, day or night, to the karez water that flowed through their lands. It was counter to their privacy and dignity to use water from tubewells. With drought, however, it was no longer possible to rely on karez water. Some of the tubewell owners had begun to harass or abuse the women verbally, which caused conflict between families. The result was that some women were being accused of having a 'bad character' i.e. behaving immorally with a tubewell owner. Once blamed for this, a woman might be judged negatively for the rest of her life in her community.

Another problem was reported that the women had to wait until the tubewell owners ran the motor. In a very few cases, the tubewell owners had physically punished the women for using their water. Except for a very few comparatively rich families, all of the women were facing these problems.

The drought increased the installation of motorised pumps in the houses for drinking water. Very poor women fetched water from homes of their neighbours who had these pumps, but if they ran out of water late at night, then they were sometimes verbally abused by the owners when they replenished their supply. Some electric motor owners too take advantage of the situation and demanded free labor from women. It was again both insulting and caused their reputation to suffer.

The need to carry water increased women's labor. When a karez was in good order, they did not have to carry water but now due to drought, the situation has changed. On average, a woman was carrying more than 200 litres of water every day, which created enormous burden on her time and physical capacities.

When asked to comment on water problems, especially lack of water, women made the following stark and eloquent statements:

- They have no water and are facing great difficulty. The livestock is dying. Women alone are totally responsible for fetching water from a well more than 200 feet deep, located about half a kilometre from their houses.
- The supply water comes after 15 days for only 10-20 minutes and the quality is poor. Some private tanker owners sell water but the women have to fetch water from the airport tap located more than 2 kilometers from their houses. In many houses, there is only one woman responsible for fetching water as her daughters are grown up and cannot be sent out of the house for fetching water, the reason being someone may accuse the young girls of immoral behaviour with men.
- Women have no option except to fetch water. In such communities, even if men do nothing the whole day and sit in the house, they do not fetch water. It takes more than one hour to bring about 10 litres of water and they have to make five or more journeys every day.
- Where the poor should go? Should they die? There is no water for the poor. The rich can get water easily but it is difficult for the poor, particularly women.
- Wherever these women go to fetch water, they are told there is no water. The women are busy all day fetching water and can not do anything else. There is no electricity, no water, and no food. When the poor women come to fetch water, the officials abuse and push them away.

Previously, water was available in the houses through piped water supply scheme. Now women are compelled to go out of their homes by 9 am to fetch water and do not return till 3 in afternoon. Then they cook and do all the other household work. Men are always out of the house and in their absence and the women are responsible for looking after the house. Sometimes men are away for weeks and months at a time, looking for work.

Coping Mechanisms

Households responded to the drought and attempted to marshal financial resources, in different ways, according to their financial and social abilities. For example, 70

respondents had installed supplemental water supplies. 25 had installed tubewells at an average cost of Rs. 41,000; 12 had installed electric motors on existing wells to draw water from deeper in the ground, at an average cost of Rs 4,827; and 33 had dug new wells, with an average cost of Rs 300, for household and animal use.

Some of the hand dug wells were extremely deep and women reported great difficulty in drawing water from as far as 200 feet below the surface. The wells had the positive effect of saving some women the indignity of being accosted by tubewell owners, which many women reported, and of saving women the arduous journey in search of water every day. However, it required great expenditure of energy to draw the water. Especially when women are weakened by pregnancy or by lack of food, drawing water exerts a tremendous physical burden.

Many respondents reported they had been forced to purchase drinking water. This imposed tremendous difficulties on the poor, as the following examples indicate.

- The private water tanker owners charged more than Rs.50 for one day's water. This was enough only for drinking and cooking and not washing or bathing. A women's husband earned nearly Rs. 70 per day if daily wage work was available. If not, then they had nothing. In such a situation, how could they spend money on water?
- There was no water supply. The water tanker charged Rs.2 per gallon. Many households needed at least 25 gallons every day for drinking and cooking.

Although migration is a common response to the effects of drought around the world, only 12 of 96 respondents in Turbat reported that family members had migrated in search of work as a result of the current drought. However, since migration for work is a normal event here, it is possible that respondents did not connect this specifically with the drought. It is also likely that most of the migration would have taken place earlier in the current drought. Those people who had moved in search of pasture were not included in the survey.

It is often the case that severe shortfalls, and the kinds of conditions resulting from drought and proto-famine situations, lead to conflict.²² According to many respondents, Turbat was formerly a place where people trusted each other and crimes were almost unheard of. Now, social stresses resulting from the drought have increased; incidents of theft, robbery and smuggling of food and drugs were reported. One example is the theft of wood: some people cut down the remaining trees to sell wood.

It is evident from the Turbat survey and from other sources that a new category of poor people is created by drought. Although some of the people surveyed were at one time relatively secure financially, many had now reduced almost to destitution after five years of unrelenting drought. Some people, especially the elderly and the chronically poor, were now forced to beg for food.

There were some people who were able to have invested money and other resources – some saved, others borrowed – in attempting to provide water for agricultural, livestock and household use, but many of them have passed the limits of those resources. Their

²² There is a body of academic literature on coping strategies in time of drought and famine. Amartya Sen, for example, has written extensively on the subject.

land is exhausted, and soils have been rendered infertile. Their livestock holdings are reduced to almost nothing. Even when the rains return, they will have no resources with which to build up their asset bases. Families will 'recover' to different degrees from the loss of productive members. The after effects of illness suffered as a result of drought can also be very costly.

It would be shortsighted to imagine that once rainfall resumes at 'normal' level, the problem of drought would be over. It will probably require several crop cycles to restore the soil to full fertility and restore yields to optimum levels. For the very poor, it will take several years of hard work to restore household finances to sustainable levels and re-build economic and human resource such as livestock and agricultural assets.

Devising Effective and Integrated Responses to Drought: Doing More with Less

The point has been made in numerous studies that drought and its related effects have an impact on every aspect of natural and social environments. It is equally clear that drought requires integrated responses that account for as many aspects of the situation as feasible. Although expertise is necessarily discipline-specific - focusing on health, agriculture, technologies, and on poverty itself - the expertise must be brought into a common forum so that the effects of drought can be addressed and comprehensive responses implemented. Each of these complex issues, and the interactions between them, must be taken into account in a comprehensive response to drought.

Karez Rehabilitation

Rehabilitating the karez is a significant means of restoring the water supply to communities, once rainfall returns to normal. An important consideration in karez rehabilitation is that the infrastructure and decisions concerning its upkeep and the allocation of water and land remains in the hands of karez members. This essentially integrates the social and economic systems with each other, which helps to ensure that sustainable commitments are made and maintained.

At present, close to 400 karez are supplying irrigation water to almost 40 percent of the cultivated area in Turbat. During the last decade, nearly 200 karez were restored (i.e. new wells dug, and channels deepened and lengthened) by government departments, the National Rural Support Program and other NGOs working in the area. As of July 2002, NRSP and its community organisations (COs) had rehabilitated 112 karez in Turbat, benefiting over 13,000 households. Funding for NRSP's efforts came primarily from UNDP, the Pakistan Poverty Alleviation Fund, and contributions of labor and cash from the COs. The combined budget for the 112 karez was Rs. 21.5 million. Of this, the COs contributed Rs. 7.5 million, which is 35 percent of the total (NRSP-PPAF Annual Report 2002). Government of Balochistan is also engaged in karez reconstruction and rehabilitation. Karez rehabilitation is supplemented by the installation of hand-pumps, drinking water supply schemes and sanitation schemes.

The Government of Balochistan has spent Rs 40 million extending and improving 100 karez in Balochistan. Most of these, 23 in all, located in Turbat/Panjgur, were

rehabilitated at a cost of Rs. 8.28 million²³. The government has also recently built a number of water storage bunds, which are linked to the karez system²⁴.

Efforts must be made to increase the efficiency of the karez rehabilitation process. The rehabilitation methods used at present are extremely time-consuming, as all work above and below ground is done with very basic implementations and technologies.

Integrated water conservation strategies must be devised, once the rainfall resumes. This should begin with the collection and storage of every drop of rainwater in household cisterns, wells and check dams. Reforestation to hold the soil in place and to generate humidity where a water supply does exist will also be necessary. Developing alternative methods of drawing water, perhaps including such innovations as solar rather than diesel or petrol pumps²⁵ will contribute to minimizing the amount of non-renewable fuels required to draw water.

Research is needed on growing crops that do not require large quantity of water, hold the soil in place and would be appropriate for subsistence and marketing in southern Balochistan. Some of the work done in barani areas here in Pakistan and elsewhere in South Asia could usefully be extrapolated for this purpose.

Using water more efficiently is clearly necessary. One means to this end, that is relevant to the karez as well as to other domains, is the introduction of water delivery mechanisms including “modern irrigation application techniques (trickle, sprinkle, etc.) that have potential to improve water distribution and ... efficiency”²⁶. The overarching point, as it relates to the karez, is that any new technology, which has the potential to conserve supplies and increase outputs, should be tailored to the karez-supplied irrigation. Methods of making such systems financially attractive to farmers and available to the poorer farmers will need to be devised and implemented.

Conservation, i.e. maximizing water usage and reducing water losses, must be the key to a stable and sustainable effort to ensure that the effects of future droughts are less devastating. The conservation of every resource utilised for subsistence and cash cropping must be encouraged through public awareness campaigns and enlightened policies that reward efforts to conserve water and impose negative sanctions on those who waste it. It should be made clear to farmers that the water used for crops has a cost that should be factored in to the market price.

All of these potential actions will require a skillful integration of social, scientific and technological research and action. Commitment by government (i.e. ‘political will’, the commitment of resources, and good governance) is also critical. To put it another way, the knowledge that, although periods of drought vary in severity and frequency, water shortages are a recurrent feature in many parts of Pakistan must be incorporated into all development and resource-use planning and policies.

²³Irrigation Department Government of Balochistan

²⁴Mirani Dam Project Report, WAPDA, August 2001.

²⁵A solar pump has been installed by NRSP staff in the Fateh Jang district of Punjab. Although these are expensive at present, it should be possible to lower the cost if a large scale programme is implemented.

²⁶Comments on Draft Framework for National Water Policy Prepared by the Ministry of Water and Power, Government of Pakistan, April 2001, p.7.

Part of a long-term, integrated response, i.e. ‘management’ in the widest and best sense, should include analysis of successful efforts to integrate social, economic, scientific and scholarly research in other parts of South Asia as well as in Pakistan itself.

It seems inevitable that the effects of water shortage will increase in the foreseeable future because of the effects of at least 20 years of over-extraction for subsistence crops, livestock and industry, coupled with increased demand to meet human needs. Projected increases in temperature due to global warming will also have an effect. It is also the case that each successive occurrence of drought makes it harder to respond in human, financial and political terms, to the next occurrence, as resources are diminished.

The need for an integrated response requires that local, regional, provincial and federal policies be integrated with – or at least congruent with - each other. It also requires the optimizing of all water-use practices including water harvesting and storage techniques and small and medium scale irrigation mechanisms. Efforts to reduce water wastage and schemes for re-using water could also be integrated into mitigation efforts. Some of the initiatives devised by NGOs, including the National Rural Support Program, in educating farmers and household members on water conservation strategies will be useful here.

The need for accurate meteorological data, both local and regional, is critically important for understanding longitudinal climatic trends, and for predicting normal and abnormal rainfall patterns.

Wilson’s study (2002) points out that communities have flourished in the fertile deposits of alluvial soil found throughout North Africa, the Middle East and Pakistan, for thousands of years. Some of these fertile areas have enabled the existence of large populations and indeed entire civilizations. Many, however, have not been sustainable, usually because of climatic factors (typically increased aridity) combined with pressures on water supplies and water-delivery technologies that have outstripped the available water supply.

It is tempting to think that current, sophisticated technological capacities to access water will provide solutions to the problem of water supply in Balochistan i.e. a technological and scientific response to the drought will suffice. However, as the recent situation and its effects demonstrate, comprehensive, far-sighted and integrated water supply management systems – systems that also take careful account of local people’s knowledge and skills - must be implemented, if southern Balochistan is not to enter the historical record as one of the ‘failed’ examples of community survival.

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