Chapter 3

Water Policies and Local Water Harvesting in the Hindu Kush-Himalayas[1]

Prachanda Pradhan

Introduction

Water stress is being experienced in many countries. Hindu Kush-Himalayan (HKH) countries have severe problems because of scarcity of water. Harvesting rainwater and water from other sources by people and agencies for different purposes is in practice in the region. Over a period of time, different methods of water harvesting, ranging from collection and use of rainwater to groundwater, stream to river water, and even flood water storage, have been developed in different parts of the HKH. It is proposed to focus in this paper on policies relating to rainwater harvesting.

In some areas, deliberate efforts are made to harvest rainwater; in other areas, it is difficult to find specific efforts to harvest rainwater. In the absence of a specific policy on water harvesting, traditional water-harvesting technologies have been neglected in some countries, resulting in added hardship in getting sufficient water. In other cases, specific policies were introduced to support rainwater harvesting and make water easily accessible for domestic use as well as for economic activities. Hence, it is important to understand both the existing traditional technologies for water harvesting and the involvement of local institutions, people's organizations, and civil society in promoting water harvesting within the broader policy context of addressing the challenges of water stress in the Hindu Kush-Himalayan Region.

This paper is a synthesis of the policy papers prepared by country experts from China, Bhutan, India, Pakistan, and Nepal and presented at a workshop in March 1999 (Changming Liu and Li Cheng 1990; Sarvanan 1999; Zia and Husnain 1999; Tshering 1999; IIDS 1999). In this synthesis paper, the focus is on water-harvesting issues in these five countries of the Hindu Kush-Himalayas. These policy issues include the specifics of policies for water harvesting in hardship areas and by the poverty-stricken population of mountain regions where there is a close relationship between water scarcity and the high incidence of poverty. The other component of the policy aspect is the promotion of new technologies and preservation of traditional water-harvesting technologies. Financing the implementation of water-harvesting systems and methods of implementing water-harvesting

[1] Changming and Cheng 1990; Sarvanan 1999; Zia and Husnain 1999; and Tshering 1999

programmes are other aspects of policy issues. Policy formulation on water harvesting by the governments of the HKH is now to be oriented towards poverty alleviation in these areas. In this context, the role of the government is to be reviewed.

The policy aspects in the papers presented at the workshop will be examined from four perspectives. They are the (a) overall policy aspect, (b) technological aspects, (c) financing aspect, and (d) implementation of the schemes.

FOCUS OF THE AREA AND DESCRIPTION

Populations in the mountain areas of the region are growing rapidly (Table 1). Water, like land, is becoming a scarce resource in the Hindu Kush-Himalayan Region. The distribution of precipitation is uneven: high concentrations during monsoon with a prolonged dry season for the remaining period. Water shortages have increased proportionately with agricultural intensification, and the problem is so pronounced that water-harvesting methods have to be explored. Micro-catchment storage systems have been used successfully in several countries. Water scarcity is widespread throughout the high mountains, because of their low capacity for water retention. So water harvesting is necessary to solve the problem of providing sufficient water supplies for human consumption, farming, and livestock. The need for water harvesting is growing rapidly in the whole arid and semi-arid areas of the region.

Table 1: General Description of the Study Region

Name of the Country	Total Pop. (in millions)	Total Area (sq.km.)	Mountain Area (in %)	Pop in HKH Area (in millions)	Density of Pop (per km^2)
China	1232.1	9607000	70%	30.45	13
Bhutan	0.6	40500	100%	0.6	15
India	939.42	3287263	14%	41.16	89
Pakistan	134.15	796095	61%	31	63
Nepal	21	147181	60%	12	147

Sources: Changming Liu and Li Cheng 1990; Sarvanan 1999; Zia and Husnain 1999; Tshering 1999; IIDS 1999

The sources of water in these regions are rainwater, glaciers, rivers, and groundwater. However, easily available water resources are only glaciers and rainwater. The important task is to adopt a technology that can harness these resources for the benefit of the households in the region. In the HKH countries, there are experiences of promotion and preservation of water harvesting. These experiences can be learned from and their relevance in the context of the overall rainwater harvesting policy assessed.

POLICY ASPECTS

Water harvesting and conservation have to go together. Water harvesting and protection of water bodies should become important components of national water policies. National water policies along with specific water policies for areas where there is hardship caused by water stress should be evolved through national-level dialogues and debates involving NGOs, local-level communities, national experts, and stakeholders. The following section will highlight the evolution of water-harvesting policies in the HKH. The following table (Table 2) gives an overall picture of the scope of water-harvesting policies.

Table 2: Policy Aspects of Water Harvesting in the HKH Countries

Items \ Country	China	India	Pakistan	Bhutan	Nepal
WH Policy	*	-	-	-	-
General Water Policy	*	*	*	*	*
WH at HH level	*	*	-	-	-
Policy with Investment	*	-	-	-	-

* Policy exists
- No specific policy exists

In Bhutan, there are no specific policies on water harvesting. However, there are guidelines for water harvesting for irrigation and drinking water.

Regarding irrigation development, the Land Act grants permission to harvest water for irrigation provided that the person doing so does not cause damage to others' land, house, or plantation. Use of water, which is jointly harvested, is to be shared among the beneficiaries of the system either by mutual understanding or by existing practice. There is no formal policy to guide the development of the drinking water policy. However, the rural water supply and sanitation unit of the Health Division has provided several guidelines to facilitate their activities. The overall goal of this programme is to improve public health by reducing the incidence of water borne and filth borne diseases through provision of safe drinking water and adequate sanitation facilities.

Mountain regions in China account for 70 per cent of its territory. Water scarcity is prominent in these areas. Water scarcity coincides with a high incidence of poverty as well. The Chinese Government places importance on water harvesting and has introduced many relevant policies for water harvesting.

Water harvesting in mountain areas received priority. Investments were made in water-harvesting projects. The national policy of China addresses the problem of poverty through water harvesting and ensures that water is supplied for domestic use as well as for agricultural purposes. Since 1984, a specific policy on poverty alleviation was introduced and one of the methods of addressing poverty is water harvesting.

In India, the National Water Policy of 1987 is a landmark in water sector development. The policy for the first time aimed at planning, developing, and conserving scarce water resources on an integrated and environmentally sound basis. However, there are different policies on rainwater harvesting among the mountain states of India. The National Water Policy is a general one and it does not focus on water harvesting in any specific area. Since the water sector belongs to the state list, different states have provided specific water-harvesting policies. The government of Himachal Pradesh has recently decided to make rainwater harvesting for drinking and domestic use mandatory for all new constructions and existing buildings in the state. Tamil Nadu has a similar policy.

In Nepal the Ministry of Housing and Physical Planning published a National Policy on Drinking Water Supply in 1998. There is no separate policy for rainwater harvesting and use. It is mentioned in the 9th plan of Nepal that, in every remote area of Nepal where alternative viable sources of drinking water are not available, rainwater harvesting and use will be practised. However, there is no specific policy as such for rainwater harvesting.

In Pakistan, there is no specific policy for water harvesting. However, in Balochistan the promotion of one type of water harvesting technology by means of a substantial subsidy on pumps and electricity caused an adverse impact on groundwater because of contradictory government policies. This situation refers to the case of Balochistan. There is a national water development policy, but it does not specifically highlight the policy on rainwater harvesting.

TECHNOLOGIES FOR WATER HARVESTING

The review shows that the technologies adopted by these countries are varied. Hence, attention is given to new, efficient technologies for water harvesting. In the meantime, it is also necessary to preserve already proven, traditional technologies for water harvesting. The following section describes the different types of water-harvesting technologies found in the HKH countries studied.

In Bhutan, gravity conveyance of water for agricultural use is common. The use of sprinkle irrigation and drip irrigation for water conservation is a recent innovation in some places.

In the past, the technology used by local people to collect drinking water consisted of split bamboo pieces laid end to end and supported on wooden stakes to form an open pipeline drawing water from a stream or a spring and carrying it to the settlement or to the households.

Another common technology was to simply dig a ditch in the ground and collect water from it for drinking. These days, polyethene pipes carry drinking water a long distance without loss of water.

In China, around the Yaluzabu Jiang River in Tibet, more than 5,000 water-harvesting stuctures were built.

In the Alpine region of Southwestern China, water harvesting technologies included (a) collection of rainwater from very small or small catchments, (b) extraction of subsurface flows, (c) digging wells to draw subsurface water or spring water, and (d) catchment of rain from the rooves.

Roof catchment collection in two cisterns or tanks known as the (1-2-1) rainwater-harvesting project was quite popular.

By 1996, rainwater collection cisterns numbered 5,25,600 units, bringing about a tremendous iimpact on the lives of the people, farming, and livestock productivity. The rainwater harvesting technology also included the pond construction, storage tanks, and sub-surface and surface water harvesting.

In Quinghai province , China, rainwater was collected in clay cellars. Later on, the clay cellar was replaced with brick cellars. Rainwater collected from the roof was used as drinking water. Rainwater collected from roads and the ground was used for irrigation. It is estimated that there are now about 400,000 cellars with a collective storage capacity of 11 million cubic metres.

Underground cisterns are suitable in the climatic conditions to overcome uneven distribution of rainwater. The cistern system is suitable for irrigating scattered farmlands and for

provision to scattered households. It is suitable for investment from different sources. Users can also make provision for most of the construction of underground cisterns.

In India, rainwater tanks are used for collecting water in Himalayan villages, and they are used extensively.

- The people also practice roof-top water harvesting technology.
- The government promoted designs for water-harvesting structures that are based on permanency, and financial returns are being promoted.
- Moisture conservation through vegetative barriers is in practice on agricultural farms.
- Check dams and stream bank protection for water recharge are used in both mountain areas and the plains of India.
- Storage structures to capture runoff are used.
- Tree plantations to recharge groundwater and watershed management are other technologies.
- Small water ponds are constructed in the villages to capture rainwater.
- *Gul(s)* or irrigation channels to irrigate terraced fields are common in Himachal Pradesh.
- *Zing(s)* are common in rain shadow mountain areas.
- Man-made glaciers are used in Ladakh for agriculture and for drinking water.
- Bamboo drip irrigation is common in Meghalaya.
- Rooftop water harvesting is a community-evolved technology in Mizoram.
- *Kul* irrigation is common in Himachal Pradesh. The community-evolved technique is to divert melting water from glaciers to a village tank. This tank water is shared among the users through allocated water rights.

In the hills and mountains of Nepal, ponds were dug in the past to collect rainwater mainly for livestock use. Recently, different technologies were tried out to evaluate their use. They are being tried out by both government projects as well as by NGOs.

- Plastic-lined tanks for small irrigation activities (SAPPROS) and (INSAN) are being promoted.
- At household level, ferro-cement jars with a capacity of two cubic metres are used to collect water harvested from corrugated, galvanised iron sheet (CGI) rooves in Gulmi and Palpa districts.
- Ferro-cement tanks for use in rural water harvesting are being promoted by Peace Corp Volunteers

In Pakistan, the water-harvesting methods developed for agricultural purposes in the mountain regions are the diversion and dam systems. The diversion system is a long channel diverting floodwater to plantations adjacent to the valleys. The dam system is a large reservoir behind the dam filled with floodwater. The reservoir water is then pumped through pipes to numerous sprinklers that spread water to the winter crops.

In the *Rod Kohi* system, flash floods of short duration and greater magnitude hit the area generally during monsoon, some of the water is used by the local people in a traditional method of irrigation called *Rod Kohi*.

In Northern Balochistan, two of the main water-harvesting techniques used include building embankments and bunds to divert the stream and floodwater during the rainy season. It is called the *Sailaba* system in Balochistan. Another system is known as the *Khushkaba*

system, and this depends upon the direct rains. The farmers develop a small catchment area on the upper side of the field and rainwater is harvested for farming on the lower side.

In the mountain region of Pakistan, the main sources of drinking water in the districts are wells, springs, rivers, streams, and ponds. Three quarters of the population use these sources.. Only 15 per cent of households have access to piped drinking water.

Karez is a centuries' old system developed by the local people. The system consists of underground waterways linking water from various wells and bringing the water to elevated places. Both *karez* and tubewells are used. Neither tubewells nor *karez* are now able to meet agricultural and domestic needs.

FINANCING FOR IMPLEMENTATION OF WATER HARVESTING SCHEMES

Among the different components of policy on water harvesting, ways of financing the water-harvesting programmes are important. This component is about questions of resource mobilisation for the programme. Should financing be from government sources alone? What should be the share of the government subsidy and what contribution should users make? If it is an economically viable proposition, should there not be provision for credit for users? Should the users contribute a 100 per cent? Who should support technology development and testing? These are important questions in relation to the promotion of water-harvesting schemes. This section attempts to look at the experiences in the HKH (Table 3).

In Bhutan, farmers are obliged to share in the costs of infrastructure and for maintenance.

Table 3. Financing Implementation

Country / Items	China	India	Pakistan	Bhutan	Nepal
Central Govt.	USD 1.5 billion, USD. 25 billion	Partial investment	Not clear	Only on irrigation and partly on drinking water	Small amount on WH in FINNIDA Project
State/ Provincial Govt.	Research support	Himachal, UP hills, Tamil Nadu	Not clear	This level does not exist	This level does not exist
Local/ Village Council	Support by village council	Not clear	Not clear	Not clear	Contribution by VDC in project area
Household (HH) Contribution	2/3 of the cost	HH contribution	Not clear	HH contribution for channel const.	Rs 300/hh for rainwater harvesting

Agency staff need to be able to carry out better planning, monitoring, and evaluation and to work effectively with user-participatory management. Organization and management costs for irrigation and drinking water have to be borne by the users.

There is a substantial subsidy to facilitate the use of surface water for irrigation in Bhutan. Domestic water supplies were managed through private efforts. It is believed that, as only small quantities of water are required, group efforts are not warranted.

In China, the funds for water harvesting come not only from the government outlay on poverty assistance programmes and allocation of funds for irrigation work, but also large amounts of aid and resources are allocated for water harvesting by the central government.

Since China's open door policy was introduced, the total amount of international loans directly used for the poor in underdeveloped areas is estimated to be US$ 1.5 billion. Most of this loan was spent on water harvesting. The World Bank provided a loan of US$ 0.25 billion for the poor of the southwestern mountain regions of China.

Local government and water users join hands to draw plans for water harvesting. The users themselves provide funds for local construction.

When the project is to address the poverty issue, the local government provides a substantial amount of the funding and local people provide labour to build the structure. Water harvesting can improve the local economy and quality of life, many water-harvesting structures are built by the users themselves.

Both the provincial as well as local governments in mountain regions have encouraged households to build water-harvesting structures for drinking water purposes as well as for farming.

In Quinghai province, the government provides cement and 1,000 *yuan* (8.28 *yuan* is one US dollar) per household as a subsidy; this also includes transport costs. The county provides technical manpower to guide construction work. The users collect local materials, such as sand and stone, and build the cellars by themselves.

In India, the government provides grants to build rainwater tanks. The maintenance is the responsibility of individual households.

A minimum of 10 per cent of the costs is to be contributed by the users in cash/kind/labour. After completion, full responsibility for organization and management is to be taken by the users.

In Nepal, programmes by the Institute for Sustainable Agriculture (INSAN) and Support Activities for the Poor Producers of Nepal (SAPPROS) for small ponds of 25-30 cubic metres in capacity in Gorkha, Lamjung, Chitwan, and Dailekh have been established through strong community user participation and cost-sharing for small-scale irrigation schemes. Plastic lining and tanks and use of sprinklers for high-value vegetable farming by marginal farmers are activities undertaken by these NGOs in Nepal.

The Rural Water Supply and Sanitation Programme funded by FINNIDA has an incentive mechanism. The cost-sharing mechanism of this programme is outlined below.

- Contribution of Rs 300 (68.65 rupees = one US dollar) from each household plus collection and transportation of local materials, provision of unskilled labour, and transportation of construction materials
- Participation of local people in training to demonstrate methods of construction ferro-cement jars
- Provision of plastic sheets, high density polyethene (HDPE) pipes, gate valves, and a sprinkler for each household in small Rural Water for Household Use (RWHU) ponds-

built by NGOs for high-value vegetable farming (unskilled labour is provided by the users)
- Provision of RWHU by the Department of Water Supply and Sanitation at no cost to users apart from organization and management
- Contributions of from 7-15 per cent of costs by users for small-scale irrigation schemes in accordance with the National Irrigation Policy

In Pakistan, there is a substantial subsidy on groundwater mining. No other specific programme for cost sharing is prominent. Further examination of cost-sharing arrangements between the users and the government needs to be undertaken.

IMPLEMENTATION OF WATER HARVESTING SCHEMES

Water-harvesting policies relate to methods of implementation and actors involved in the process (Table 4). It is also important to look into the changing role of the government. What has been the role of the state in relation to the people and people's involvement in such activities? It is also important to understand the implications and importance of legal provisions for water harvesting. It is important to understand the institutional mechanisms necessary to promote water harvesting at different levels. Such mechanisms are in place at users' level, village level, district level, provincial level, and central government level. However, one should not undermine the important role played by communities and households in managing their own affairs. Policy instruments have to create an environment in which households and communities are encouraged to undertake responsibilities to manage their own affairs. People's adoption of water harvesting on a large scale has also proved effective. There are different modes of implementation across the HKH.

Table 4: Methods of Implementation and Responsibilities of Different Actors

Country / Insts.	China	India	Pakistan	Bhutan	Nepal
Central Govt.	Research/ Policy	CAPART ART	PARC AZRI (Res.)	Department	Department
Provincial/ State	Responsible for implementation	Regulations as in Himachal Pradesh	Support to GW extraction, subsidy	This level does not exist.	This level does not exist.
Local Village	Technical support to HH	Not clear	Not clear	Labour contribution	Local resource contribution
NGO	Not clear	Active	Active in Gilgit Chitral area	Not existing	Active
INGOs	Not clear	Active	In Thar Desert	Not existing	Active
Donor Agency	WB	Active	Not clear	SNV	Active
HH Level	Construction and use	Construction Meghalaya, Mizoram, Tamil Nadu	Yes, in some schemes	HH level for water harvesting	Active

In China, by focussing on water harvesting it is hoped to address the problem of poverty in mountain regions. In order to realise this objective, agencies are actively involved in promoting water-harvesting technologies among the households of mountain regions.

Policy direction for water harvesting is given by the central government as a strategy for addressing poverty by means of making water available for domestic use and for farming.

Research to identify appropriate technologies for water harvesting was carried out in collaboration between the central government and provincial-level government agencies. Once a technology is identified, it is tested at the village level. If a technology is successful, large-scale promotion takes place under the supervision of the local village councils. The users undertake the construction. The users receive partial subsidies and have to contribute to the construction. The structures then belong to the users. Operation and Maintenance of the harvesting structures are also the responsibility of the users.

In India, a high-level committee has been set up in Himachal Pradesh and Uttar Pradesh in the Indian Himalàyas to implement and review policy issues related to Participatory Irrigation Management (PIM). These community-based initiatives are likely to be given legal status under the Irrigation Acts of the States.

Water harvesting has assumed importance in India in recent years. With the growing recognition of the increasing scarcity of water and emergence of many community-level efforts, the viability of water harvesting is being recognised.

The Council for Advancement of People's Action and Rural Technology (CAPART) has been supporting individuals and NGOs in rainwater harvesting under the Advancement of Rural Technologies (ARTs). It supports Himalayan villages by supplying them with rainwater tanks.

Under the Accelerated Rural Water Supply Programme (ARWSP), 5,993 rainwater tanks have been installed in individual houses in 198 villages.

Apart from the Central Government effort, the State has about 10,000 rainwater tanks built by different communities at their own expense. In recent years, government agencies and NGOs have become involved in a massive programme to implement community-based water harvesting. At the people's level, a movement for water conservation and harvesting is taking place with positive results.

In Nepal, water-harvesting schemes are being implemented through the Department of Drinking Water and Sanitation of the Government. NGOs and donor agencies have participated in rainwater harvesting schemes also. Implementation is based on a participatory approach. At the people's level, many water-harvesting systems have been constructed. Some of them have proved difficult to maintain .An institutional mechanism for implementation and preservation is very important.

In Pakistan, the *Rod Kohi* system is governed by rules and regulations called *'Kulyat and Riwajat- i-Abpashi* (Rules and Regulations for Irrigation) which were established more than a century ago by the local people. These rules and regulations provide detailed information on distribution of water to different groups of beneficiaries.The Government provides supervision.

Dam construction is supposed to be carried out each year. However, quality of maintenance has deteriorated as a result of negligence and indiscipline on the part of beneficiaries.

Pakistan Agricultural Research Council (PARC) introduced a research programme on water harvesting in collaboration with the International Centre for Agricultural Research in Dry Areas (ICARDA) to generate viable technologies for water harvesting in rainfed areas. The Arid Zone Research Institute (AZRI), Quetta, developed an on-farm water-harvesting technology to increase water storage in cropped areas. Government departments, such as the Pakistan Council of Research in Water Resources (PCRWR) in Cholistan, have invented many techniques to increase runoff and store it in tanks

Terraces with bunds across the slope of the land on a contour in order to cut a long slope into small ones are used for water conservation. Each contour bund acts as a barrier to the flow of water.

IMPACTS AND IMPLICATIONS

Certain implications need to be considered within the framework of a water-harvesting policy. These implications are as follow.

- Inequitable distribution of project benefits among different sections of society within a given geographical area is to be discouraged.
- The weaker the social groups in collective action, more centralized control is required.The stronger the collective action in the community, the greater the power that devolves to the local community for resource management.
- An appropriate institutional mechanism is necessary to implement water-harvesting schemes and their operation and maintenance.
- It is equally important, along with the revival of traditional technology for water harvesting, to re-energize the institutions responsible for conservation and maintenance of the system.
- It is important to make a thorough evaluation of institutional strengths and weaknesses.

Except in China, the monetary benefits of water harvesting have not been highlighted in the review papers.

It is important that the Central Government supports research to identify appropriate water harvesting technologies.

Infrastructural development and urbanisation are complementary activities that have a direct bearing on water supplies. Competition for water between agriculture and other uses has led to shortage supplies. Roads open up access into watersheds, and this, more often than not, is followed by human settlement. Eventually then comes a rise in demand for social services, increasing the pressure on resources. Should there be regulations to maintain the population at a certain figure in mountain areas?

Mechanisms for strengthening local and community-based institutions are important. While infrastructure is essential, it has to be complemented with adequate support mechanisms in the form of functional institutional arrangements.

Shortage of funds and lack of appropriate technologies are serious constraints to water harvesting. Scattered settlements are constraints to drinking water supply programmes, so it is important to identify appropriate water harvesting technologies.

CONCLUSIONS

A definite policy on rainwater harvesting for household and agricultural use can bring about positive changes in the life of poverty-stricken people in mountain regions. Testing appropriate technologies and materials is to be carried out by the central agency. The implementation of these proven technologies should be carried out with the participation of the beneficiaries and local institutions. Local resource mobilisation through users' contributions should be encouraged, so that the users will have a sense of ownership of the infrastructure. The users will then take the responsibility for operation and maintenance.

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