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Water for mountain households in the Hindu Kush–Himalayas

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Abstract

The Hindu Kush-Himalayas (HKH) are home to nearly 150 million people and the largest storehouse of fresh water in the lower latitudes. These tallest mountains are the sources of the six of the major rivers of the World, which provide sustenance to nearly 500 million people inhabiting these river basins. However water is found generally either at the extreme top (in the form of snow and glaciers) or in deep valley bottoms, while most settlements are in between without regular water supply systems for drinking, food production and other uses. They are totally dependent on meager and scarce local water resources. Water is a fundamental need for human survival and it has already become scarce for the people in these mountains as women and children are spending most of their time in fetching water for household uses. The problem of water availability is more acute in the low rainfall/rain shadow areas. The danger of desertification due to depletion of ground water has also been indicated in some parts of the HKH such as Balochistan, Pakistan. Recent studies have shown that pollution of local water is also increasing. With the population doubling almost every 35 years the problem of water for mountain households in the HKH will be more acute in the coming years. Furthermore, people in these mountains do not have the means to cope with this crisis particularly due to their poverty.

Harvesting of local water, including rainwater, offers the best hope to meet the challenges of the growing water crisis for the mountain households in the HKH as has been seen in China. For this, appropriate policy incentives and support and the use of indigenous knowledge and traditional management systems on water will be essential.

This paper deals with the analysis of the above issues based on studies undertaken in the mountainous areas of Bhutan, China, India, Nepal and Pakistan.

INTRODUCTION

As the largest storehouse of freshwater outside of the polar regions, the snowy mountains of the Hindu Kush-Himalayan region, extending about 3500km and consisting partly or wholly of Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan covering an area of about 4.3 million km2, are the sources of such mighty rivers of South and South East Asia as the Indus, the Ganges, the Yarlung-Tsangpo-Brahmaputra, the Mekong, the Yangtze and the Yellow river. The mean discharge and the drainage basin of these rivers are given in Table 1.

The water resources of the HKH region sustain the lives of nearly 500 million people, of which nearly 150 million are those living in the mountains. However, availability of water is strongly characterised by seasonality and people have to cope with the scenario of

`too much' or `too less' regularly. With the rapidly growing population and their growing demands for water for domestic, agricultural and industrial consumption water stress is now growingly felt by the people in the region. Institutional failure to respond to such rapidly growing demands of water and acute poverty of the masses have further exacerbated the problem in the region.

Table 1. Mean Discharges and Drainage Area of the Major Rivers of the HKH.

River	Mean Discharge (m^3/sec)	Drainage Area (km^2)
Indus	3,850	1,263,000
Ganges	15,000	1,075,000
Brahmaputra	20,000	940,000
Mekong	15,900	795,000
Huang He (Yellow river)	1,365	445,000
Yangtze	35,000	1,970,000

Source: Institute of Geography, University of Berne (1998). Mountains of the World, Water Towers of 21st Century.

THE WATER CRISIS IN THE HKH

A crisis is growing rapidly, albeit quietly, in the HKH mountains due to fastly growing population and decreasing availability of fresh water to the people for their domestic, agricultural and industrial uses. This crisis of decreasing water availability is not only going to hamper seriously the economic development of the region but is also likely to threaten the very survival of the already marginalised rural mountain people facing acute and mass poverty, who have hardly any capacity to cope with such crisis.

The root causes of this crisis can be attributed essentially to the following factors:

> The Human Factor, which is largely known and although quite complex could probably be remedied with necessary commitments and efforts; and
>
> The Natural Factor, which is mainly associated with the impacts of climate change that have been observed in the regions. These are largely uncertain and would be difficult to cope or deal with.

Human Factors Contributing to Water Crisis in the HKH

Recent studies have shown that the following issues are critical with regard to the water crisis and the human factor. These are briefly discussed below:

Population Growth and Demands for Water: The present population of about 150 million people is expected to be doubled by the year 2035 in the HKH. This means that the demand for water for domestic use will also double, in addition to its need for irrigation for doubling the food production. There will also be additional demands due to changes towards greater water-consuming life-style of modern life. Again the impera-

tives of economic development will make further demand on water for power generation, and other economic activities such as livestock and dairy farming. Water for domestic consumption and bare survival has already become a major problem as population has grown rapidly. Assuming 1700 cubic metres/person per annum as the threshold value for water stress for a country, the per capita availability of water in India for a population of 1.8 billion in 2050 will be only 1403 cubic metre. This means that the whole of India will be under water stress by 2050 (Hindustan Times, October 4, 1999). However, in terms of the country availability of water, the situation might not be so grim for countries like, Bangladesh, Bhutan and Nepal.

External Interventions and the Collapse of Local Institutions for Water Management : Till the second half of this century, it could be said that the population was low in the HKH mountains and local water needs of the people were managed by people themselves through their traditional knowledge systems and institutions. Since the early 50's, however, development interventions by the government have continuously marginalised the role of local knowledge, traditions, and institutions of water management except in the very remote areas and the rainshadow areas in the north, as is seen in Ladakh in India (Dawa et al, 1999) and Mustang in Nepal (Parajuli and Sharma, 1999).

The important role of local Institutions in the rainshadow areas and the collapse of the traditional systems in the region are illustrated by the examples from Mustang, Nepal and Bhutan in boxes 1 and 2 respectively.

Box 1. Traditional village organisations in rain shadow areas.

Mustang lies in the rainshadow area of Nepal Himalaya. Each village in Upper Mustang has a single-tiered village level organisation, which perhaps is unique in the country. These village organisations have their own written rules, which may differ from village to village. Each of these organisations is headed by a group of a few people (on basis of joint leadership) designated as gempa. The senior most members of each household in the village are general members of this organisation. These members have strong internal cohesion against other villagers or outsiders, which is often enforced by the local legal system. Of the several gempa in a village, usually the oldest one acts as the chief and others act as deputy. The gempa provide overall leadership for all social, agricultural and development activities in the village. Though gempa have the decisive power, they do not have the right to change those social norms that are being practiced for centuries. The main responsibilities of the gempa are to enforce social rules and regulations, protect public property and resources, manage public funds, summon village meetings and impose fines (usually in kind) on those who do not follow social norms. Water is also managed to this day by such local institutions according to the traditional rules and customs (Parajuli and Sharma, 1999).

During these five decades the population of the HKH region has increased by nearly 2.5 times and the traditional systems with their eroded authority and importance do not have the means and capacity to cope with the present day demands of water in these mountains. During the same period local knowledge on local water resources, which is largely not well documented, has been lost or seriously undermined (Agarwal and Narain 1997). Unfortunately, scientific understanding of local hydrology has also not grown to fill the vacuum left by the neglect of local people's knowledge on local hydrology and water resources.

Need for Participatory Planning Processes : One aspect of the last five decades of development intervention in water resources is the complete dissociation of local people in the planning, execution and operational aspects of local water resources. Most of the government managed irrigation or drinking water systems have therefore failed to meet the desired objectives, and more often than not, have also became non-operational due to the lack of local peoples' support in the repair and maintenance of such projects. Since the early 90's the governments in most of the HKH countries, are trying to reverse the process by handing over the local natural resources such as forests and water to the local community for their management and encouraging local peoples participation in the planning and development of such resources. Peoples reaction to such programmes have been somewhat mixed and real benefits are yet to flow to the people through such programmes.

Box 2. Collapse of traditional institutions due to government interventions.

With the onset of planned development programmes, the Government of Bhutan took up new construction as well as rehabilitation of farmer-built irrigation channels. As the number of such schemes climbed steadily, the farmers began to see it as any easy way out of a demanding task. Routine operation and maintenance was neglected till the channel finally collapsed. Then they turned to the government for assistance, which was readily available. In this manner, many farmer-managed irrigation channels fell into despair and the government had to provide assistance for their repair. Thus, it was no surprise that some channels began to appear regularly on the list of rehabilitation programmes, indicating a collapse of the traditional institutions responsible for their upkeep (Tshering, 1999).

Need for Policy Incentives and Programme for Water Harvesting : With regard to water for the mountain people, comprehensive policy and programmes are still lacking in most of the countries of the HKH, excepting China (Sainju and Malla, 1999; Liu and Cheng, 1999; Saravanan, 1999; Tshering, 1999; Zia and Hasnain, 1999) where water harvesting and management at local level has received high priority and is linked to poverty reduction. In China, government promotes water harvesting in mountains, and gives priority to invest in water harvesting projects for the mountain people. Provincial governments as well as many local governments of mountainous regions are also increasingly encouraging more households to construct their own water harvesting systems for supplying drinking water and developing yard economies. In order to solve the water deficit problems in drinking and irrigation, people are usually organised villagewise to build ponds and to store harvested water, including rainwater, in various ways.

Pollution of Local Waters : The people in the rural mountain areas of the HKH are totally dependent on local springs, wells, lakes and streams for their supply of drinking waters. While such waters were quite safe till a few decades back problem of pollution of local water sources due to uncontrolled disposal of human and animal waste as well as the indiscriminate and growing use of chemical fertilisers and pesticides has been quite serious. Pollution has also affected the net availability of fresh water in terms of quantity, but people are forced to consume such waters as they have no other options.

Furthermore, people are generally unaware about these problems, which makes it even more serious. A recent study in the Garhkot watersheds of Garhwal in the U.P. hills

showed that 60% of the spring water in the watershed was not suitable for human consumption as their nitrate content was more than 30ppm whereas the upper limit of nitrate for safe drinking water laid down by WHO is 10ppm. (Rambabu et al. 1999). Local people were, however, unaware of the problem. Similar situation prevails in most of the rural areas of the HKH. Pollution of groundwater is also a serious problem such as arsenic contamination in Bangladesh (UNEP, 1999: p84) and contamination of iron, ammonia and nitrates in Kathmandu, which are also widely used by local people.

Water and Women's Drudgery : Women and children have the sole responsibility of providing water for household consumption for which they spend long hours every day. A recent study in the Tehri Garhwal in the U.P. Hills in India illustrates this point (Box-3).

Box 3. Women drudgery in water scarce areas.

Considering a minimum consumption of 15 litres only per capita per day in view of the scarcity of water in the area, a family woman was utilising her 115 mandays to meet the domestic water requirement by carrying water from springs located at about one km distance. The travel distance varied from 0.5km to 3.5km and waiting time ranged from 0.3 to 4 hours. Tap water supply was available once a week during winter season with waiting time of 4-8 hours depending upon the location and was mostly non-available during summer. Animals have to travel 4 to 8 km for water particularly from high and mid altitude. Some villagers have to travel 4 to 6 km far away for domestic washing at ponds (Rambabu et al., 1999).

The situation is not dissimilar in other countries too. Despite such burden on women, they are normally not included in the decision making process with regard to the management of local waters.

Overexploitation of Groundwater : Depletion of groundwater due to over exploitation poses the biggest threat to irrigated agriculture. In the HKH countries China, India, Pakistan and Nepal are facing the problem of steady drop in water tables. Postel (1999) has reported water tables drops of 0.6-0.7 meters per year in India and 1-1.5 meters per year in China. In a recent study in Balochistan, a decline of water table from 3-6 meters annually has been reported (Ahmad, 1999). This poses a grave threat which can result in drying up of ground water and consequent desertification and abandonment of farms

Natural Factors Contributing to Water Crisis in the HKH

As regards the natural factors, change in climatic patterns are discernible in recent years. The major impact of such changes are most evident in the retreating of glaciers, decrease in snow cover areas at lower elevations (about 3500-5000m), increased temporal and spatial variability in precipitation with increased frequency of high rainfall/extreme weather events. Although most of these events are in agreement with the possible impacts of global warming and climate change in the region (Chalise, 1994), it is however, difficult to be definite as to whether such changes are within the normal variability of climatic cycles or are due to the impacts of global warming in the absence of sufficient data and studies.

Glacier Retreat and Deglaciation : Glacier retreats, reduction in snowfall and increasing deglaciation of snowy areas have been reported from various parts of the HKH. The

retreating of glaciers and deglaciation will have tremendous impacts on water availability in the HKH at both the local and regional level. It will greatly add to water stress to the people of the region, particularly during the dry period. For people living in the high elevation zones and particularly for those in the cold and arid rainshadow areas, the problem will be more acute as they are totally dependent on snowmelt for all their needs of water. This will also have serious implications for the development of water resources in the region. A drastic reduction in the low flow of the rivers due to deglaciation in the HKH mountains could also lead to serious conflicts among the riparian countries. Glacier retreats have also led to the creation of glacial lakes which are extremely hazardous in some of the HKH countries. Glacial lake outburst floods have caused major disasters in Nepal and Bhutan in recent years. Presently major engineering work is underway and a warning system has been established in order to avoid the potential risk to human life and major infrastructure due to the bursting of the Tso Rolpo glacial lake in the Rolwaling Himal of Nepal (Chalise and Khanal, 2000).

Climate Change Impacts and Lack of relevant Data : In terms of management of water in the HKH, whether to meet the needs of the mountain people, or for economic development, or for the management and mitigation of water induced disasters (e.g. floods and landslides), the uncertainty about possible impacts of climate change on HKH waters further complicates the matter. Again the hydrology of the HKH, particularly of the headwater regions, is not well understood. Presently there are several gaps in knowledge due to the problems of measurement of hydrometeorological parameters, such as precipitation at high elevations and sediment and bedloads in mountain rivers. Similarly, the contribution of snowmelt to runoff is not easy to estimate as reliable models and methods are still to be developed for the region.

Lack of long term and reliable hydrometeorological data and difficulties in accessing available data in the region are major constraints in the development of knowledge on the hydrology of the region. Reliable hydrometeorological data are essential to study the impacts of climate change on the hydrology and water resources of the HKH in order to plan for future needs of water for food and economic development of the people living in these mountains. The people in these mountains are not only most vulnerable but are also likely to suffer most from the unknown and uncertain consequences of the possible impacts of climate change, of which they are neither aware nor for which they are responsible.

WATER FOR MOUNTAIN HOUSEHOLDS: CHALLENGES AND OPPORTUNITIES IN LOCAL WATER HARVESTING

A large part of the cultivated areas in the HKH countries are rainfed as irrigation is available only to a tiny fraction of the cultivated lands. A recent study has shown that food production has remained either stagnant or actually gone down in most of the HKH countries (Banskota et al, 1999). Harvesting of rainwater and local water sources and their utilisation to meet the irrigation needs of the rainfed areas during the critical dry periods could make a big difference in food production. It will also help in the production of high value crops to raise the income of the local people as has already been seen in China

As water is available only during the few months of the rainy season, probably the most important step towards developing such local capacity to cope with the impending and uncertain crisis of water will be to enable people to harvest locally available water, including rainwater to meet their present and future needs. This could be done by enabling them to plan, construct and manage water collection and storage systems, as well as for its efficient use for drinking or irrigation, in accordance with their immediate and future needs. Small and simple systems for the collection and storage of rainwater and other waters from local sources for use during the dry period, if developed at a mass scale, will have tremendous impact on the life and economy of the mountain people.

Raising awareness of the mountain people on the pollution of local water sources due to indiscriminate disposal of human and animal waste as well as that due to indiscriminate use of chemical fertilisers and pesticides will also help in increasing the net availability of fresh and safe water for local consumption.

Year-round availability of water through water harvesting programmes for domestic use will also greatly reduce the drudgery of women and children who, otherwise, have to walk long distances up and down the mountain tracks to provide water.

Experience from China has shown that with appropriate programmes and policy incentives for harvesting of rainwater and local water sources at the household and small community levels can not only boost food production, it can also help local people to increase their income within a very short time (Chalise et al 1999).

The demand for water is determined by the needs of the people which will depend largely upon their culture and cultivation, both in the areal extent and type of crops. The supply of water in terms of its availability in any locality is essentially determined by the climate. Climate, culture and cultivation are therefore critical determinants in terms of meeting the needs of water for the people. As all of these vary widely from place to place and country to country in the HKH, it is difficult to prescribe a general solution to deal with the impending water crisis in the HKH. However, harvesting of rainwater and local waters at the household level will certainly help in mitigating water crisis in these mountains.

CONCLUSIONS

The following two issues emerge as priorities for future action with regard to the impending water crisis which the mountain households will be facing in the HKH.

(i) Enabling local people to harvest and manage their local water resources, including rainwater. This will be necessary to meet their water requirements for domestic use and critical irrigation needs for the dry period at the household and small community level through the promotion of sustainable water harvesting technologies and policy advocacy.

(ii) Improved understanding of the hydrology of the HKH to develop practical methods and models This is necessary to provide benefit to the local people and help in poverty reduction, as well as to develop scientific capacity within the region to deal with uncer-

tain impacts of changing climates on the hydrology and water resources of the region. This will also contribute to the optimum utilisation of the rich water resources of the region for improving the quality of life of the mountain people in the HKH.

The International Centre for Integrated Mountain Development (ICIMOD) has recently launched a regional project on water harvesting with support from the Ford Foundation. A regional hydrological research network viz Hindu Kush-Himalayan Flow Regimes From International Experimental and Network Data (HKH-FRIEND) has also been initiated through the joint effort of the HKH countries, ICIMOD and UNESCO. These regional initiatives will surely contribute to some extent with regard to the two priorities mentioned above. The challenge lies in reviving the traditional wisdom of the local people and their water management systems and using them as a basis to develop efficient local water (including rainwater) harvesting and management systems. However, much will depend on national commitments and initiatives for action and research on water harvesting and improved understanding of climate change impacts on the water resources of the region to face the challenge of the looming water crisis in the HKH mountains.

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