The mountains and uplands as water-towers for humanity: Need for a new perspective in the context of the 21st century compulsions. A short introduction

Jayanta Bandyopadhyay

International Academy of the Environment, Geneva, Switzerland

1995

bandyopa@hotmail.com

Keywords: mountains, water resources, freshwater, precipitation, hydrology, conservation.

Future Challenges in the Global Supply of Freshwater

The planet Earth is able to sustain life because of the existence of water in liquid form on its surface. More precisely, the lifeforms on Earth have flourished because of the simultaneous availability of air, water and soil over large parts of the surface of this planet, which made the-production of biomass possible. Among these three planetary resources, the availability of water, in particular freshwater, is susceptible to extreme variations over both space and time. To a large extent, the history of human civilization can be interpreted as a history of struggle to even out this variation. There can hardly be a comparable need that has led to such heroic expression of human innovative capacity over millenia. Yet, as the present century draws to a close, adequate supply of freshwater has emerged as a major problem over large parts of the world. This, in turn, has prompted the need for a more informed and wise approach to the conservation and use of this resource (Kindler 1992; Falkenmark, da Cunha and David 1987)

Though, water is present in ample quantity on the Earth's surface, the supply of freshwater in the globe is limited and governed by the renewal processes associated with the global hydrological cycle. The mountains and the uplands of the world play an extremely important and distinctive role in the hydrological processes of the planet and in the regional hydrology of all continents' (Roots and Glen 1982). By their interaction with the global atmospheric circulation, the mountains can extract substantial water in the form of snow and rain. In turn this precipitated water flows out as rivers, both seasonal and perennial, forming the most accessible freshwater supply to large areas in the plains below. This supply has been traditionally used by human societies in sustaining themselves as well as to irrigate the farms to ensure food security. With the expansion of human settlements and the growth of industrial

activities, water proved to be the most convenient medium for the assimilation and discharge of wastes. This resource had been taken for granted and only in the past few decades increasing scarcity of this vital resource and drastic decline in the quality of water from pollution has drawn attention of environmental groups as well as policy makers. This led to concerns about where the water will be available from to meet the requirements of the next century.

According to estimates made by Shiklomanov (1991), the annual water demand of the world would increase from 4130 cu.km in 1990 to 5190 cu.km in 2000. This is estimated to be accompanied by sharp decline hi the availability of water on a per human individual basis. This problem is expected to be most acute in large parts of Asia and Africa. While the amount of 5,000- l0, 000 cu.km of water per year is adopted as an adequate amount for healthy living, the projections of annual water availability by the year 2000 for North Africa is 210 cu.m., for Central Asia and Kazakhstan is 700 cu.m. and for South Asia is 1,100 cu.m. The trend is declining for all parts of the world. The pressure for increased food production will put severe demand on the water resources in the South countries whereas industrial demand will use-up almost 80 p.c. of the water resources in the North countries.

Global Water Resources and the Mountains

The planet Earth, on the contrary, is not in short supply of water. The total amount of freshwater on the planet is estimated to be about 36 million cu.km, which is enough to maintain supply for 7000 years at the level of-demand projected for the year 2000. The paradox is that, the most important water resource for human activities is freshwater available in the rivers and the lakes, which form only about 0.01 p.c. of [he total-global water storage. This is where the mountains play a vital role in water supply for the satisfaction of human needs. While, in terms of water reserves in the form of ice, Antarctica, Greenland and the Polar Islands account for about 99 p.c. of the global total, in terms of annual stream flow, they contribute less than 10 p.c. of the global total (UNESCO 1978). The problems of water scarcity in regions like North Africa or South Asia have to be solved on the basis of water availability in the rivers and precipitation in the respective continents. It is here that the role of the mountains and uplands as water towers for humanity needs to be seen with a new perspective in the next century.

Though in terms of the total amount of water resource generated, the mountains may not be significant al a global level, the mountains are effective instruments for the extraction of water from the atmospheric circulations and conserving them for feeding the streams and rivers over long periods. When we consider the availability of water at and spatial closeness to the points of need, in terms of both space and time, the hydrological role of the mountains gain their real significance. Practically all major human requirements of freshwater

are satisfied either directly by precipitation or indirectly by the rivers carrying the water from the mountains and uplands. This human dependence on the mountains is bound to grow in the coming century .in which many parts of the Earth are expected to cope with growing water demands.

In extending the understanding about and interpreting the importance of the mountains and uplands in the regeneration and continued supply of freshwater, the following would be taken as important focal points. In order to define clear action agenda in both scientific research and actual strengthening of water resource bases, these points will be elaborated below:

a) Precipitation, natural storage and conservation of water
b) Possibilities of artificial storage of water in reservoirs
c) Water supply and irrigation within the mountain areas

Precipitation, Natural Storage and Conservation of Water

The process of interaction of the vertical formation of the mountains with the global atmospheric circulations is a complex one and its scientific aspects are also not so well documented. The primary mountain characteristic of vertical formation (Bandyopadhyay 1992) keeps playing a key role not only in the creation of the precipitation but also its conservation. The most important aspect of it is the conservation of part of the total precipitation as snow and ice in the higher altitudes for delayed run-off in the streams and rivers in periods of great water scarcity downstream. Though insignificant in terms of the total water reserve in surface ice at the global level, it is this ice stored in the top of the mountains in the major continents that become vital in maintaining the river flows. This important role of the mountains in providing life-giving waters in periods of stress may be the dominant reason that throughout the world, snow-capped peaks of the mountains have been traditionally seen with divine respect by human societies living downstream.

Possibilities of Artificial Storage: Irrigation, Hydropower and Flood-control

In addition to the natural storage through aquifers and ice covers, the geomorphology of the mountains presents an option for constructing artificial storages to enhance the capacity of the mountain areas to store water during high flow periods and discharge during the lean flow periods. This is directly beneficial to the foot hills and the plains, first from flood-control effects, and second, from the enhancement of irrigation. In recent years, as the urbanization process grows, storage dams in the mountains are going to play increasingly larger roles in providing domestic water supplies, as in the case of Three Gorges dam in China or Tehri High dam in the Indian Himalaya. Furthermore, the growing demand of CO_2 free energy sources is sure to push policies towards larger hydropower installations in the mountains. In this way, the possibilities of artificial storage of water is of great significance for

sustainable development in the lower parts of river basins, and brings the mountains much closer to the regional and national economic processes.

Water Supply and Irrigation within tile Mountain Areas

This increasing significance of mountain water resources should not, however, become a reason for underestimating the urgency of focusing attention to water supply and irrigation within the mountain areas. The question of transforming mountain economies and fight against poverty in most mountain communities, can be best addressed through micro-level water management. The mountains have, for a long time, been seen as an exclusive water tower for the plains. New initiatives at conservation and distribution of water within the mountains so that mountain people, specially women, can avoid the drudgery of spending a large part of their working lives merely carrying drinking water for their families.

Important Elements of NGO Action Agenda on Mountain Waters

Water resources of the world's mountains are key inputs to future economic and social development in both the mountains as well as the plains The history of resource utilization in the mountains is that of processes dictated by the needs of the plains, like large storage dams. Mountain people have more often than otherwise fallen victim to such process like submersion of land and habitat, poor resettlement and finally destitution. As far as mountain waters and their downstream utilization are concerned, the NGO community needs to ask for policy and legislative changes to protect the mountain people from being helpless refugees resulted by other people's development. The new legislation should make it mandatory to make the families and communities threatened by submersion as stake holders in the water project.

The other important element for an NGO action plan is the demand that mountain communities and entrepreneurs should have full control over local water resources at the micro-level and over the generation of hydropower from them. These micro-level avenues for water management are vital for socio-economic development in the mountains but are not important for the economies in the plains. In a global agenda for sustainable mountain development, such a step will be essential.

Scientific Agenda

NGOs need to mobilize governments, United Nations agencies, scientific institutions, etc., to undertake more widespread and rigorous information gathering on water resources and water management projects. Hydrological and hydra-geological information on the mountains are very much inadequate. Similarly, approach to environmental and social audit of large dams need to be

systematized to bring maximum economic and social gains to the mountains from water resources.

Notes to readers

The author may be reached at:

International Academy of the Environment
1231 Conches
Geneva
Switzerland.