Water: A Vital Resource

Introduction

Water is one of the most important natural resources in Central Asia and critical to the development of virtually every sector of the economy. Its availability is a *sine qua non* for the life of humans, animals, and plants. In spite of its being the most fundamental input, its value has historically been taken for granted, resulting in production practices that were both wasteful and polluting.

In Central Asia there is a unique role for the mountains, as they are the source of all water in the region. However, as a result of intensive deforestation in most Central Asian areas, and ill-conceived hydropower schemes, water resources were seriously damaged and limited.

The remaining water in the basins was also used carelessly. At least in the Amu-Darya and Syr-Darya river basins, the water is mostly (about 85%) used for irrigation and only a small amount is used for consumption by humans and animals. The use of water for irrigation has not been very efficient and a lot of water has been wasted through evaporation into the air, or seepage into the soil beyond the reach of crop roots.

As rivers are natural drainage systems, part of the groundwater returned to rivers, reservoirs, and depressions. This water, however, was badly contaminated by various types of agro-chemicals, because the main crop, cotton, required numerous applications of pesticide. This was one of the main reasons for the deteriorating hydro-ecological conditions in the region and occurred to such an extent that it had a negative impact on human health. This has led to the well-known Aral Sea crisis.

If proper water treatment plants are available, industrial waste water and sewage can be re-used to irrigate crops and recharge ground- and surface water. Unfortunately, in Central Asia the funds are

generally lacking for building such expensive plants.

That people are sometimes careless about pollution is illustrated by a report in Central Asian newspapers on 3 June, 1998, that one woman died and a hundred people were hospitalised after drinking water from the Issyk-Kul Lake in Kyrghyzstan. The water contained cyanide; the result of an accident on the borders of the lake involving a truck transporting 20 tonnes of this poison.

The discharge from the main river, the Amu-Darya, varies considerably. First of all the discharge has fluctuated greatly over the years. In an average year, such as 1987, the discharge varied between almost zero in winter to almost 1,500m^3/sec. during the flooding season in July and August. In a wet year this discharge may be as much as 2,000m^3/sec., but in a dry year no water reaches the basin of the Aral Sea at all.

Moreover, the discharge from the Amu-Darya has constantly decreased since 1960, perhaps due to the above-mentioned deforestation. This aspect, together with the inefficient water use in the extensive developments in irrigation following that year, caused the water level of the Aral Sea to fall about 17m. Thus the Sea was reduced to about half of its original size, while the shore line retracted by tens of kilometres.

It is clear that the reduction of the water level and pollution of the water, have had a negative impact on the aquatic life in the sea. The total average annual catches of fish dropped from 7,500 MT in 1970 to 3,200 MT in 1980, while more recently they have varied between less than 1,500 to 4,500 tonnes annually.

Water is also the source of a clean and rather cheap source of energy. In those locations where there is sufficient discharge from the river and a considerable drop in water level, hydropower stations can be built to generate electricity.

The southern part of the Issyk-Kul area in Kyrghyzstan, for instance, is rich in small rivers that are suitable for this purpose. Since these rivers originate from glaciers, their discharges are spread over the year.

In the basin of the Aral Sea, use of water for irrigation is gradually becoming more efficient, because of diversification of crop cultivation away from cotton and also because alternative irrigation methods have been introduced. Of necessity, since pesticides are too expensive (if available al all) and because of environmental awareness, the use of agrochemicals has decreased considerably.

One of the projects implemented in the basin of the Aral Sea is the Aral Sea Wetland Restoration Project (ASWRP), funded by the Dutch government through a trust fund administered by the World Bank, as part of the Aral Sea Programme (ASP) managed by the Interstate Council on the Aral Sea (ICAS). If the recommendations of the study are implemented, they will help to stabilise the eco-hydrological situation, control the desertification process, and restore the functions of the Aral Sea and associated wetlands. Now the UNDP is in the process of reviving the Sustainable Development Commission for the Aral Sea.

In India, a biological process has been developed for the treatment of waste water and sewage. This process is based on the use of lemna, duckweed, and other aquatic plants. The system is very economical, since the energy requirements are only a fraction of those needed for aeration in mechanised systems.

The treatment of highly polluted industrial waste water is increasingly carried out by filtration or osmosis through membranes in combination with disinfection.

Critical Areas

Basin Planning

As water is really a scarce resource in this area, all infrastructural plans have to be aimed at optimal use of available water through improved water management. Development which leads to exhaustion of resources cannot be sustainable in the long term.

In order to guarantee the sustainable use of water resources, development plans should be founded on generally accepted water basin planning. It is most likely that the basic inventory and scientific background information for water basin planning is already available in many scientific institutes in Central Asia.

Salinity Control

Salinity and salinisation caused by overuse of irrigation water and lack of adequate drainage need to be emphasised. This subject, which is one of the threats to the environment and which has been studied in many Central Asian countries, requires attention.

Water Conservation

Water conservation measures should be promoted.

It would be worthwhile to explore the application of new water-saving irrigation techniques (drip irrigation, etc) based upon the experiences in Israel and California. However, special local conditions, such as the hazards of salinisation, should be taken into account. The capital investment required for these systems may turn out to be very high.

Reallocation of Water

In those areas where water is not used effectively, a mechanism could be developed for reallocation of water to more lucrative applications. This brings up the issue of the value of water and the introduction of pricing on the basis of either cubic metres or irrigated surface. Thus a 'water market' can be created and 'water banking' practices can be developed.

Major Issues and Experiences

The Desert Oasis Ecological Agricultural Pattern of Xinjiang

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This paper is not about a system driven by water. It focusses on the principles of ecological agriculture on arid lands in North-West China, especially with regard to the water problems in agriculture in the area. The principles for ecological agriculture in North-West China include water balance, biodiversity for agricultural ecosystems, the landscape pattern, and conservation and sustainable development. In the water balance principle, the moisture index formula is the soundest one used. This index is also used by the UNDP for its desertification projects and is internationally renowned.

The arid areas in China can be divided into four zones: extreme arid, arid, semi-arid, and dry sub-humid. Arid areas will be between 0.05 and 0.65 - that is the moisture index range within the area. I would like to focus on two aspects of biodiversity in eco-agriculture. The first emphasis is on greater diversity of production, especially for oasis agriculture on arid land, especially in Xinjiang. The integration of different kinds of crops, grain, cash crops, forests, orchids, animal husbandry, different lands, fish farms, and processing industries is good for oasis agriculture. The second emphasis is on greater diversity of crops, and this is essential for the sustainable development of agriculture. This means we need different kinds of interplanting between crops, trees, and grasses and al-

ternative planting, crop rotation, and also so-called functional planting such as cover crops and soil-building crops (mostly legumes).

The third principle is the landscape pattern - to distribute and arrange different products as agricultural, forestry, and animal husbandry products. This is done basically according to the topography or the geomorphology of the soil substrata, for example, piedmont, alluvial plains, sand dunes, depressions, terraces, etc.

The last principle — that of conservation and sustainability — is perhaps the most important. Before any land-use activity is carried out, an ecological impact assessment should be done. Ecological considerations should always be the first priority and one should never sacrifice ecological and long-term benefits for short-term results. This is the basic principal of sustainable development.

The desert oasis agricultural pattern for Xinjiang basically consists of three components. First, the agricultural oasis as the core of the system. Second, the zone between the oasis and the desert as a buffer and a base for animal husbandry in agricultural areas. Third, the desert is protected for nature conservation and as such is the 'kingdom of wild animals'.

Need for Rational Use of Water Resources

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This paper deals with some of the socioeconomic concerns of Central Asia focussing on current developments dealing with the problems of water resources and their usage in the Central Asian Republics. The deserts and steppes of Central Asia are in a unique geographical position. Remoteness from the sea, indeed their landlockedness, contribute to their aridity and unique climatic conditions.

Rainfall is scarce and water is a precious resource in Central Asia. Surface water comes mainly from the runoff and melt water produced by high mountain ranges feeding the region's two largest rivers, the Amudarya and Syrdarya, which flow through Uzbekistan, Southern Kazakhstan, and towards the Aral Sea. These two rivers are the main water resources for the entire Aral Sea basin, covering more than a million square kilometres of Central Asian territory and encompassing Uzbekistan, Kyrghyzstan, Tadzhikstan, and southern Kazakhstan where there are more than 30 million inhabitants. These rivers also provide water resources to sustain traditonal irrigation systems. In fact the Kharizm, Khargana, and Tarim basins have remained the most flourishing settlements along the Silk Road owing to their irrigation and settled agricultural systems. The distribution of water throughout these three deserts was previously regulated by local village committees which administered the usage of water. These traditional small-scale, sustainable irrigation systems later gave way to large-scale irrigation networks to bring large tracts of arid land under cultivation. Whereas the Soviet policy of cotton monoculture, extension of arable land, construction of large hydro and thermal power projects, industries, and transportation networks brought certain economic benefits to the region, they also caused damage to the local environment to some extent.

Although increasing population and consumption and management of limited water resources are universal problems, they assume critical importance in the huge landmass of Central Asia. Growing desertification, sinking of the Aral Sea, salinisation, and scarcity of water directly affect the ecological balance in

Central Asia. The Aral Sea has shrunk to about half its size and nearly more than 30,000sq.km. of the dry belts are desertified and thousands of tonnes of salt, along with the residues from pesticides, chemicals, and fertilizers, are blown by the wind across hundreds of kilometres. This has resulted in land degradation, desertification, and a decline in agricultural productivity. It has also affected the regional climate, leading to hotter summers and cooler winters; and as a result the growing season is decreasing. The Aral Sea has become a major international, ecological, and socioeconomic concern and has been receiving attention from international agencies. The UNDP, European Union, World Bank, and other international agencies are actively associated with projects to save the Aral Sea. Another problem is the evaporation of irrigation water from the Syrdaria and Amudaria and their tributaries and canals. Only half of the irrigation water is available for crops, while the rest evaporates or soaks into the ground during transit.

Coordination amongst the five Central Asian Republics of the Aral Sea basin to regulate the allocation, consumption, and exchange of water is a step in the right direction. However, given the limited water resources and increasing demands for both irrigation and energy purposes, the conflicting water demands of various republics need to be evaluated, keeping in mind the ecological requirements of the Aral Sea basin.

Given the specific problems confronting Central Asia, there is an urgent need to promote efficient and rational usage and to organize the distribution of water to sustain and develop the community. There are several measures that can be considered in this respect.

- Traditional farming based on crop rotation and judicious use of water, instead of mass production of cotton which consumes a lot of water, should be practised.
- All those who are engaged in traditional farming (agriculture, horticulture, apiculture, mushroom farming, and sericulture) should receive adequate supplies of water in order to carry out their work. Disruption could force the people to migrate to overcrowded cities without adequate infrastructure, housing, or employment.
- The new Central Asian emphasis on diversification of agricultural practices is shifting the focus from cotton to grain, vegetables, and fruit. These activities need to be supported, both technically and financially. A multipronged approach, differentiating between use of water for drinking, irrigation, and toilets, needs to be adopted. Various steps to ensure optimum use of water resources while at the same time maintaining the ecological balance are necessary to prevent conflict and promote social development as well as economic productivity.

Development of Environmentally Sustainable Agricultural Systems in Uzbekistan

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This paper has been prepared as an introduction to the environmental situation and development of different sustainable agricultural systems (technology and machinery) in the plains of Uzbekistan.

Irrigated land comprises about 10 per cent of the territory and produces more than 95 per cent of the total agricultural output. The main crops are cotton and winter wheat. Subsidiary crops are alfalfa, *dzhugara* (sorghum), Indian corn, *bakhch,* vegetables, melon rice, and so on.

As part of the former Soviet Union, the Republic of Uzbekistan was subjected to

a centralized approach to social and economic development activities. Little attention was given to the impact on the environment. As a result, the Republic is faced with severe ecological deterioration.

About 80 to 90 per cent of the water resources available are used for agriculture. Furrow irrigation (flood irrigation in paddy fields) is the current practice. More efficient water use could be facilitated through improved land levelling, introduction of surge irrigation, and other innovations — including on-field drainage. Subsurface irrigation is less expensive, but it is suitable only for perennial cropping systems.

Cotton is one of the main consumers of water, and this has resulted in significant environmental damage in the area. One way to decrease the use of water and of chemicals is to find alternatives to cotton by introducing other crops that consume less water and crop rotations to reduce the use of chemical inputs. By the mid-1980s, the government adopted new programmes to change the cotton monocrop production system and make more efficient use of water.

Intensive irrigation and ongoing farming practices have damaged the shallow groundwater environment in the river basin. The greater proportion of chemicals applied pass through the soil and drainage systems and are then discharged into the surface water, resulting in contaminated rivers.

Irrigated land is mainly located on light soils (poor in humus) that have a more or less marked tendency to salinisation. The loss of water through surface evaporation could be reduced through groundwater development, adding both to irrigation supplies and contributing to increased yields.

Water quality has deteriorated dramatically because of direct drainage into the river. The main pollutants are the mineral fertilizers and chemicals applied to irrigated land. The amount and type of chemicals present in the drainage water depend largely on the agricultural production systems in the region.

A research and demonstration project was initiated at the research farm of the Tashkent Institute of Irrigation and Agricultural Mechanisation Engineers (TIEIAM) near Tashkent, Uzbekistan, in cooperation with researchers from Iowa State University, with the goals of developing best agricultural practices to control pollutants and conserve soil and water quality in the irrigated areas of Uzbekistan.

The data on chemical concentration in soil samples from the TIEIAM demonstration plot indicate that residual salinisation in the upper reaches consists of insignificant quantities of water soluble salts (from 0.1 to 0.4%). Salinisation is measured according to the amount of chloride ions. Hence, the soil under investigation, which has 0.01 per cent of chloride, is regarded as a poorly salinised soil. Sulphate salinisation is measured according to the amount of natrium (from 0.04 to 0.202). Analyses of groundwater samples show that it is fresh water.

The chemical analyses show that humus and nitrogen contents are within the range for typical serozem soil. A limited number of earthworms is present in this soil. The data on TDS shows that the water is not salty. The balance between anions and cations shows that the groundwater contains chloride, sulphate, magnesium, and calcium. The NO_3-N concentrations in the groundwater, measured in March (before planting), exceeded the Maximum Contamination Level (MCL) three to five fold. During the vegetation period and after several rounds of irrigation, the NO_3-N contents in drainage water decreased sharply. This type of research focussing on sys-

tematic documentation and analysis of findings will help to provide a better basis for decisions about the sustainable use of available natural resources in the region.

Use and Development of Eastern Himalayan Water Resources: Problems and Prospects

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The Eastern Himalayan Water Resources constitute one of the world's greatest natural resources. The Eastern Himalayan region stretches across territories in Bangladesh, Bhutan, India, Nepal, and China (Tibet). The region forms the watershed of the Ganga, Brahamaputra, and Meghana (GBM) river systems. The population density is the highest in the plains where the fertile alluvial soil, warm climate, rainfall, numerous streams and rivers, as well as agricultural production have attracted people over the centuries. One consequence of this has been ecological imbalance and deforestation, leading to soil erosion, siltation, and flash floods. The population of the region has doubled during the last 30 years and, if the population of the region continues to increase at the present rate, it may double again in another 30-35 years.

Due to extreme population pressure, the land-person ratio is decreasing with corresponding increase in rural landlessness. The factors leading to poverty in the region are low productivity, underemployment and unemployment, low wages, and low literacy compounded by limited access to education and income-generating opportunities. The critically vulnerable groups affected by poverty are the landless and marginal farmers (owning up to 0.2 hectares of land), disabled persons, the destitute with no access to economic activities, rural non-farm workers, urban slum dwellers, and the rapidly increasing female-headed households.

The water resources of the GBM region consist of three closely related components, viz., precipitation, stream flow, and groundwater and other water bodies, with stream flow being the largest component. Although availability of water in the GBM basin is sufficient for the diverse needs of the people in the region, the hydrological regime is characterised by extremes of seasonal water surpluses and deficiency. This necessitates the storage and regulation of water behind dams in order to harness it for power, irrigation, inland navigation, management of floods and drought, and promotion of water-based recreation — including fish farming and tourism development.

The potential for hydropower development in Nepal alone is enormous – about 83,000 MW. Out of this, 42,133 MW are estimated to be technically and economically viable. The installed capacity of hydropower stations at present is less than one per cent.

As all the demands for water have to be satisfied in the context of the rising population in the region (expected to reach a billion within the next 30 to 40 years), serious efforts must begin at both national and regional levels. The first phase study, which started in 1990, ended in 1993 with publication of three separate national reports and an integrated regional report. The second phase of the study began in 1995 and is currently underway. The first phase study concludes by saying that, given a cooperative framework and a variety of valuable trade-offs, water sharing in the region can be a very positive action to take.

As in other areas, there is ample scope and need for regional cooperation in the broad area of environmental concerns. Protecting water quality and curbing pollution, treating catchment areas and

controlling sedimentation, protecting wetlands and the eco-system, preserving biodiversity, undertaking reforestation, and controlling salinity are only some among many areas where concerted action from research projects to implement programmes agreed upon is possible.

In conclusion, the study argues that, if there is one outstanding fact that emerges, it is that regional cooperation in the harnessing of the eastern Himalayan rivers, home to the biggest concentration of the world's poorest, offers gains to all the countries far beyond anything that can be achieved by isolated national efforts.

The Eastern Himalayan region is too poor to afford further loss of time. The waters of the Ganga, Brahmaputra, and Meghana constitute an abundance of wealth and energy that must be creatively and cooperatively used.

Sustainable Development of the Main stream of the Tarim River

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Tarim River, the longest inland river in China, is 1,321km long. It is located in the northern part of the Taklimekan Desert. Although this region is rich in water, land, light, heat, and biological resources, its ecosystem is fragile. In past decades, increasing human activities, especially over-irrigation, have led to a degraded environment, thus hampering regional economic development severely. The main environmental problems are discussed below.

Decrease in the Volume of Runoff in the Main Stream of the Tarim River

The river watershed provides the main base for agriculture in Xinjiang. Since 1949, industry and agriculture have made significant progress. With growth in population, extension of cropping areas, and augmentation of economic activities, water consumption has increased significantly, resulting in a decrease in volume of runoff in the main stream of the Tarim River. The river has dried up completely in the lower reaches. The groundwater level of the lower reaches was three to five metres in the 1950s and had gone down to eight to 13 metres by the mid-1990s.

Salinisation of Water

Over-irrigation results in a rise in groundwater and salinisation of land. To relieve this, farmers drained off more water into the River Tarim and hence the degree of mineralisation in the river waters rose. The periods of mineralisation also increased from five g/L lasting only one month, in the mid-1970s, to two months in the mid-1980s and three months in the mid-1990s.

When water use and cropland increased, it gradually brought down the levels of mineralisation because it is the main region for cotton production. It is difficult to reduce water consumption in Xinjiang. The management option is to decrease the volume of runoff from the source flows and ensure adequate water supplies to the main stream.

Engineering Control and Canalisation in the Main Stream of the Tarim River

Another source of concern was waste water. There are 137 openings along the main stream. Most of them were non-engineered and it was difficult to control water discharge. One hundred and twenty-two of these were for animal husbandry and these added to the waste water. To lower water consumption, bank protection was undertaken, permanent inlet controls constructed, and the temporary irrigation openings along the entire river were blocked.

Water-saving Irrigation

Tremendous potential exists to save water. The objective is to increase efficiency of usage. Anti-seepage channels, which now cover only 20 per cent of the irrigation channels, can be improved. In Qara-Tikanlik irrigation district, irrigation channels have been extended by 35 per cent, thus saving water.

Integration of Farming with Animal Husbandry in the Middle Reaches

Nomadic herdsmen rely on traditional production, which is low in productivity, forcing people to live in poverty. There is a need to change living standards and the way of life. This has led to the settlement of nomadic herdsmen with better integration of farming with animal husbandry.

Increase in Desertification

From aerial maps of Aragan, taken at different times, it is clear that desertification is on the rise (from 1,371.22sq.km. in 1959 to 1,494.32 sq.km. in 1996). The annual growth rate is 0.24 per cent. Vegetation losses are accelerating and the most recent decrease has been seen in the Euphrates' Poplar (*Populus euphratica)*. Efforts are needed to restore the balance.

Principles of Sustainable Development

The Tarim River flows through a relatively backward area that is also ecologically fragile. Development efforts have focussed on improving the economy without harming the environment, balancing present and long-term interests, increase in quantity, and maintaining a better integration of ecology, economy, and society. Coordination is critical for a more dynamic equilibrium between population, resources, environment, and economy and the distribution of resources, based on social equity in time and space and thereby preventing unreasonable use of water and other resources.

Measures for Sustainable Development in the Mainstream of the Tarim River

- Controlling water use in source flows and ensuring water supplies to the mainstream of the Tarim River
- Efficient agriculture with people diversifying from cotton to fruit (korla pear) and deer breeding. All these have proved profitable and reduce the pressure on water. Similar approaches should be promoted.

Water Problems in Semi-Arid and Arid Regions of Northwest China

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In China, there is conflict in water management because the land and water distribution is not balanced. There is more cultivated land but less water. Uneven distribution of water is a result of the uneven precipitation which is concentrated more in the south. Half of the northwest area is threatened by desertification. The concentration of population coincides with water distribution, and the agricultural sector consumes most of the water. Environmental degradation on land as well as in water bodies is on the increase. The main water-related problems in the oases are desertification and salinisation. Water pollution and management and distribution of water also pose major problems.

Sustainable development should be the ultimatele goal of each country and development of water resources and human activities should focus on the following.

- Sustainable socioeconomic development

- Better understanding of the volume of water available
- Monitoring of the environment and the ecology
- Water saving
- Optimal allocation and reallocation of water supplies
- Unified water management based on assessment of demand

The main conclusions that emerge are the following.

- In arid and semi-arid regions, water and the environment are mutually dependent.
- The supply of water must meet development needs. Development should be adaptive.
- Harmonious development planning is needed for sustainability.
- International cooperation is helping in the Central Asian countries.

The Problem of Water Distribution in Central Asia

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The essence of the problem is that the geographical distribution of water is very unequal in the region. The main water resources are found in the mountainous countries, e.g., Kyrghyzstan and Tadzhikstan, and the water is mainly used by other countries in the region This was never a problem in the time of the former Soviet Union, but after independent states were established, the costs for the countries in which water resources originate became quite high. With the current economic crisis in all the CIS countries, this is an additional burden. As it is becoming an urgent problem, Kyrghyzstan has introduced a common approach to the problem.Its two main tasks are: first a regional agreement on core financing of hydro-technical facilities and a second regional agreement on the sale of water or sale of services to distribute water. Bilateral and multilateral negotiations are very important in this context.

The President of Kyrghyzstan has issued a decree regarding external policies for sharing the rivers originating in Kyrghyzstan and going to neighbouring countries. Until recently these negotiations have not been successful, but now we can be optimistic. After independence, the countries tried to be self-reliant in energy. Recently, representatives of the Central Economic Committee have made more efforts to negotiate inter-governmental agreements, as well as the norms for water distribution and supplies of gas and coal. In addition, during the meeting of the Presidents of Central Asian states, a decision was taken to establish an international water-energy consortium to discuss inter-state water strategies. I hope this consortium will take into consideration opinions and experiences shared at international conferences such as this one.

Summary and Conclusions

A sustainable ecosystem can be developed and, in oases, marginal zones can be made more productive as grazing land if proper water management is adopted.

With regard to the problems and potentials facing water management in Central Asia the following can be said:

- diversification of crops is needed;
- water management practices should take traditional water management practices into account - practices that were often very useful;
- reallocation of water to different users should be considered;
- re-use of waste water is essential; and
- regional cooperation in management of shared water resources is essential.

The environment and the water resources of Uzbekistan have deteriorated owing to the forced increase in irrigated areas and cotton monocropping. A demonstration farm tried to introduce more sustainable agricultural and water use practises but faced problems of acceptability from farmers, and co-operatives lack knowledge and understanding and are economically in a difficult position. Environmental awareness should be promoted and research should provide and demonstrate alternative techniques in which farmers are to be trained.

There has been a dramatic reduction in river flow. There has also been an increase in salinity in the Tarim River during the last 20 years, and excessive land reclamation without proper drainage systems. The solution is to control water extraction at the source, use water saving techniques, control water use and seepage, and use an efficient irrigation system, proper drainage, and canalisation of canals (lining). Crop diversification and increase in area covered by pastures would also help to solve the problem.

To improve the water situation in China, among other things, water pricing and better regulation of water extraction are of paramount importance.

To improve the water resources overall in Central Asia, the following steps are suggested.

- Environmental impact assessments are a must before undertaking any action.
- Diversification and rotation of crops are required.
- The use of agro-chemicals should be reduced.
- Efforts should be made to increase efficient irrigation.
- Campaigns to enhance general awareness about water scarcity are recommended as well as training and education for farmers in more efficient use of water.
- Water allocation and water pricing should be introduced.
- Interstate communications about water use is essential (the World Water Council is perhaps a useful vehicle).

The technical, environmental, and social conditions in the Eastern Himalayas are tragic. The water resources available are not well used and not well distributed. The hydropower potential is tapped to the extent of about one per cent. River and water management should be instituted in an environmentally-acceptable way and for this intergovernmental agreements are required. NGOs play a part and are recognised as useful vehicles to bring about necessary changes.