Preliminary Proposal
for
Establishing Regional Water Management Research Center for Arid and Semi-Arid Zones in Pakistan under the Auspices of UNESCO

1. Background

Water is an essential component of all ecosystems and a basic element for life and health. Although it is the most widely occurring substance on earth, but only about 2.5 percent is fresh while the remainder is saline. About two thirds of this freshwater is locked in glaciers and permanent snow cover which is inaccessible for human uses. The other 0.8% is accessible in aquifers, rivers, lakes, and 8,000 cubic kilometers of man made storage reservoirs. The available world water resources have come under increasing stress due to population increase, increased urbanization and industrialization, expansion of agricultural activities, water quality deterioration and global climate changes.

During the last century, pressure on freshwater resources increased dramatically. The world's population has grown to about 5.5 billion, and will probably exceed 8 billion within the next twenty years. By the end of the last century, one third of the world's population was estimated to live under water stressed conditions, and it is expected that two thirds of the population will experience the same by 2025. Demand for water can only increase, but growing pollution is likely to reduce the available quantity of useable water. Irrigated agriculture and hydroelectric power generation compete with other users for limited water within national boundaries. At the same time, maintaining the health of ecosystems is increasingly accepted as an essential concern. There are about 300 river basins and numerous aquifers which are shared among two or more nations; competition for water among nations could become a potential source of conflicts. Since less than 1% of the water presents on our planet is accessible and fresh, we cannot afford pollution of this essential and scarce resource.

Globally, the per capita annual water availability falls from an average of 7800 cubic meter (m^3) in 1990 to 4800 m^3 in 2025 (Table 1). The Asia is the most vulnerable continent in the world from water availability stand point. Moreover, the water withdrawals also show increasing trend as a result of economic, population and irrigation expansion (Table 2).

Table 1: Continental Renewable Water Resources Position

Continent	Available Water Resources (Cubic Kilometers/Year)	Per Capita Water Availability (Cubic meters)	
		1990	2025
Europe	2900	3990	3920
North America	7770	17800	12500
Africa	4047	6180	2460
Asia	13508	3840	2350
South America	12030	40600	24100
Australia and Oceania	2400	85800	61400
Total	42655	7800	4800

Source: Shiklomanov, 1997[1]

Table 2: Continental Water Withdrawal

Continent	Water Withdrawals (cubic kilometers/year)		
	1950	1990	2025
Europe	94	491	619
North America	286	642	836
Africa	56	199	331
Asia	859	2067	3104
South America	60	152	257
Australia and Oceania	10	29	40
Total	1365	3580	5187

Source: Shiklomanov, 1997

The South Asian region (Pakistan, India, Nepal, Bhutan, Bangladesh, Sri Lanka and Maldives), Central Asian States (Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyzstan, and Tajikistan), Afghanistan, Iran, Western China and Middle East countries (Oman, Yemen, and Saudi Arabia) fall in arid and semi-arid regions (Figure 1). Out of 403 million hectares of geographical area in South Asia, agriculture is being practiced on about 50 percent of the area (Table 3). While agricultural expansion has almost reached its potential maximum limits, the population of the region has already exceeded 1.30 billion, an increase of 140% during the last 4 decades. Population is further expected to become doubled in the next 20 years. The magnitude of population size, limits on agricultural expansion, and ever increasing gap between demand and supply of water could very well pose serious threat to the availability of food, fiber and shelter, besides endangering the environment.

[1] Shiklomanov, I.A., ed. 1997. Assessment of Water Resources and Water Availability in the World. Comprehensive Assessment of the Freshwater Resources of the World. Stockholm Environment Institute, Stockholm.

Figure - 1: Map of South Asia

Table 3: Profile of South Asian Countries

Country	Population (million)	Land Area (Mha)	Cultivated Area (Mha)	Average annual rainfall (mm)
Bangladesh	126.90	13. 017	8.774	2320
Bhutan	2.10	4.700	0.160	N.A.
India	998.10	297.319	169.500	1170
Maldives	0.30	0.030	0.003	1883
Nepal	23.40	14.300	2.968	1500
Pakistan	140	79.610	22.050	125-750
Sri Lanka	18.60	6.463	1.888	2000
Total	1309.4	402.422	205.343	-

2. Justification of Establishing Water Management Research Center

South Asian region is often portrayed as a water surplus region due to presence of many large rivers of the world. However, in reality the hydrology of South Asia has distinct characteristics of violent variation in water availability both in space and time. The region mostly depends for its water resources upon monsoon rains, which prevail for a limited period of the year. Due to shortage of water, many times, countries of the region have plunged into bilateral water sharing disputes. In the last 53 years since the partition of India, a very little progress was made with regard to water sharing and development in an equitable fashion in South Asia. During this time, political agenda often received priority over the human and environmental needs. Due to population, economic, agricultural, urban and industrial growths, water demand is projected to be increased by many folds in the coming decades. On the other hand, too little water available in the dry season may lead to further inter- and intra-country water disputes unless a regional holistic water development approach is pursued. Integrated water resources management, therefore, plays vital role in meeting requirements of all demand factors such as water for human, water for food, water for energy, water for industries, water for environment and sanitation.

Pakistan, the second largest nation on the South Asian peninsula has arid and semi-arid area of 70 Mha, including 11 Mha of deserts. The areas are characterized by low and erratic precipitation, extreme temperatures and low humidity. These conditions are very difficult for plant life. There are frequent droughts, occurring in virtually all the climatic regions; but with higher frequency and probability in the arid and semi-arid regions.

Though, once a water surplus country due to the huge water resources of the Indus River System, Pakistan is now a water deficit country. Population growth has reduced per capita water availability in this country from 5600 m^3 to 1200 m^3 during the last 50 years. About 131 Bm^3 is being supplied to the agriculture sector for irrigation through a huge network of irrigation and link canals, distributaries, and watercourses. Intensive field measurements and surveys have shown that about 50% of the water diverted from the rivers is lost before reaching farmers' fields. The field application losses are also high due to dominant use of traditional basin

irrigation and undulations in the fields. These losses not only deprive the farmers of much of this scarce resource but are also major contributors to the problems of waterlogging and salinity.

Improved methods of water management at every level, from the reservoirs to the farm, coupled with appropriate institutional and regulatory reforms provide the keys essential to improved utilization and conservation of this vital resource.

Field research designed to minimize wastage of water has been initiated in the irrigated area of the country. Focusing on the factors and areas contributing to huge water wastage, many water management technologies and procedures have been developed and demonstrated to increase water conservation on the fields. They include low cost channel linings, compacted cores in earthen channel banks, bed and furrow irrigation systems for cotton and wheat to reduce water use and increase yields, reducing water requirement of rice with bed and furrow and sprinkler irrigation, low head jet pumps to eliminate the submergence of canal outlets, interconnected shallow, low capacity wells to more effectively "skim" freshwater from underlying saline water, irrigation application strategies for different crops under various depths of watertable, drainage layouts for smaller farms (5-10 hectare), quantification of individual and combined effect of waterlogging and salinity on crop yields and determination of suitable water tables depths for various crops. In addition to this research and development, more than 21,000 watercourses have been lined and improved in the country. Precision land leveling, high efficient irrigation technologies like trickle, sprinkler, bed and furrow irrigation systems are being propagated among farmers. Above all, Pakistan has a huge data base on water management which can be shared with regional and international agencies concerned with improving the quality of water and the efficiency with which it is used.

There is a need to establish a water management research center in South Asia. Being an arid country and having extensive experience in water management and research, we propose that a center be established in Pakistan to focus on the problems of water management of arid and semi-arid areas.

3. Objectives and Functions of the Center

3.1 Objectives

The objectives of the center are:

i. To generate and provide scientific and technical information on water resources management issues in arid and semi arid zones of the world for formulation of sound policies leading to sustainable and integrated water resources management at the local, national, regional and global level;

ii. To promote research on various aspects of water management involving international institutions and networks, in particular those under UNESCO/International Hydrological Programme (IHP) auspices;

iii. To undertake effective capacity-building activities at institutional and professional levels, and awareness-raising activities targeted at various audiences, including the general public; and

iv. To enhance cooperation with regional and international institutions in order to advance knowledge in the field of water resources management in arid and semi arid zones.

3.2 Functions

The functions of the center will be:

i. To promote scientific research and capacity building on the issues and problems related to water resources management in arid and semi arid zones;

ii. To create and reinforce networks for the exchange of scientific, technical and policy information on water resources management issues among institutions and individuals;

iii. To develop and coordinate cooperative research activities on water resources management issues, taking advantage particularly of the installed scientific and professional capacity of the relevant IHP networks, and nongovernmental organizations;

iv. To conduct international training courses on the subject especially for the practitioners and researchers of arid and semi arid parts of the world;

v. To organize knowledge and information transfer activities on the subject, including international symposia, workshops, and to engage in appropriate awareness-raising activities;

vi. To develop a strong programme of information and communication technology to further the Centre’s objectives;

vii. To provide technical consulting and advisory services; and

viii. To produce technical publications and other media items related to the activities of the Centre.

4. Collaboration with UNESCO's Center

The proposed center will establish close collaboration with the following UNESCO's regional centers and network located in arid and semi-arid zones to achieve its objectives and perform functions efficiently:

i. Regional Centre on Arid Zone Hydrology, Cairo, Egypt
ii. Water and Development Information for Arid Lands (G-WADI)
iii. Regional Centre for Water Centre for Arid and Semi-Arid Regions of Latin America and the Caribbean – Cazalac, La Serena, Chile
iv. Regional Center on Urban Water Management, Tehran, Iran
v. International Centre on Qanats and Historic Hydraulic Structures, Yazd, Iran

5. Pakistan's Contribution

The Government of Pakistan will contribute through providing research facilities established by Pakistan Council of Research in Water Resources (PCRWR) in arid and semi arid areas of the country to facilitate UNESCO for establishing the proposed center in Pakistan. The PCRWR has been engaged in conducting, organizing and promoting research and development activities in water sector to cope with emerging water related issues under the administrative control of Ministry of Science and Technology. This Council is also acting as a secretariat of Pakistan National Committee on International Hydrological Programme (PNC-IHP). The PCRWR with its headquarters at Islamabad has 6 Water Resources Research Centres located Peshawar, Islamabad, Lahore, Bahawalpur, Tandojam and Quetta. All the Centers have well equipped water and soil testing laboratories as well as other research infrastructure. Meanwhile, this Council has established linkages with international, regional and national research organizations. In this way, this Council can play an important role as an effective and facilitating gateway for better linkage to the regional and international levels.