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Water Resources Management Issues in Turkey and Recommendations

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Abstract: The prevailing trends towards rising population, increasing urbanization, spread of more water intensive life styles as well as widespread use of water intensive agriculture sweeping around the world are going to make water resources even scarcer especially in countries like Turkey with scarce water resources and high development and population growth rate, economic and social aspects of water resources become even more important. Turkey, like many countries today, faces challenges in efficiently developing and managing its limited water resources while maintaining water quality and protecting the environment. To add to the challenge, Turkey will need to continue to develop its water resources in order for its economic and social development to keep pace with its rapidly growing and urbanizing population. This article deals with water resources management problems in Turkey and provides recommendations on water resources management issues at the country level. Its objectives are to summarize key water resources management issues to review institutional and legal framework and to provide suggestions for effective water resources management in Turkey.

Key words: Water resources, water resources management, watershed, watershed management, Turkey

INTRODUCTION

Water is the basis of the life and is the driving force for economic and social development and for poverty eradication. Yet, it is generally agreed that rapid population growth and urbanization, spread of more water intensive life style and agriculture is leading to over utilization of limited an in some cases diminishing fresh water supplies which will lead to growing water shortage especially in certain parts of the world where water resources are already are scarce. This will have very series repercussions in modern life style and agricultural productivity and will lead to catastrophic water crises in many parts of the world in the decades to come especially in areas where water supplies are already scarce and conflicts of sharing the international water supplies already exist (e.g., The Jordan Valley- the Nile, the Tigris and the Euphrates-there is also a danger of conflict over water which may lead to future wars to control the water in the region) (Global Water Partnership, 2000; Giordano and Wolf, 2003; Clausen, 2004; Cai *et al*., 2006). The first 80 years of the 20th century saw a 200 percent increase in the world's average per capita water use, which accounted for a remarkable 566% increase in withdrawals from the world's freshwater resources. This massive increase in water extraction coincides with another debt on the water-ledger: a significant portion of these resources have now become unusable due to industrial and agricultural pollution. Since all life depends on water, present trends of water waste and pollution threaten the earth's basic life support systems (Pottinger and Horta, 1999; Jackson *et al*., 2001). Already, 1.1 billion people do not have access to safe drinking water and almost 2.5 billion do not have access to adequate sanitation. According to the World Water Council (2003) by 2025 almost a third of the world's population will face water shortages and will have to divert water from irrigation and food production to household consumption, implying further underdevelopment.

Water management is akin to conflict management among human beings and between human beings and their environment. Water and river basin management systems are created to avoid prevent or resolve such conflicts. Since the relative scarcity of water will become ever more pressing as time goes on, as a result of economic growth, social demands and climate change (Dourojeanni, 2001; Rao, 2005; Johnson *et al*., 2001; Sakthivadivel *et al*., 2004; California Water Plan Update, 2005; Bruneau, 2005), humankind needs to learn to live with these conflicts and deal with them adequately. Effective management of water resources is essential for sustainable growth and poverty reduction. Poor river basin management increases economic damage and loss of life from floods, droughts, landslides and erosion. Low-quality water carries health risks, damages fisheries, tourism and recreation industries and leads to loss of

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ecosystems and biodiversity. Poor drinking water delivery service affects the well-being of local communities, while unreliable irrigation water leads to loss of livelihoods. Weak inter-sectoral allocation of water can result in insufficient supplies for irrigation, hydropower, municipal water supply and ecosystem maintenance. Inadequate water policies, institutions and pricing regimes drain central and local government budgets and lead to poor water resources management and service delivery (The World Bank Group, 2004).

Turkey has a total land area of 779,452 km^2, of which 14,300 km^2 is water surface. The actual surface area of the Turkey inclusive of its lakes is 814, 578 km^2. Turkey has influential geo-political status because its location serves as a natural bridge between Europe and Asia. It is surrounded by the Black see in the north, the Mediterranean Sea in the south and the Aegean Sea in the west.

Turkey possesses 177,714 km of river, 203,599 ha of natural of lakes and 179,920 ha of lakes created by dams and artificial lakes, an area which is increasing continuously. To review matters related to water resources, Turkey has been divided into 26 water collection regions. The rivers often have irregular regimes and natural flows cannot generally be considered as usable resources. The country's great geographical and climatic diversity means that its water supplies are often not to be found in the right place and at the right time to meet demand. While the world average precipitation is 1000 mm, the annual precipitation in Turkey is only 642.6 mm, but this figure conceals wide variation from region to region (FAO, 2001). Rainfall accounts for an average of 501 billion m^3 of water annually. It is estimated that 274 billion m^3 of this returns to the atmosphere through evaporation and transpiration from soil, water surfaces and plants; 41 billion m^3 feeds underground reservoirs through leakage and deep percolation and 186 billion m^3 runs off into seas or lakes. Around 6.9 billion m^3 of water is added to the country's water potential through rivers of neighboring countries (World Water Council, 2003).

Thus the renewable fresh (surface) water potential of Turkey is about 234 billion m^3, depending on climatic fluctuations. The total safe yield of ground water resources is estimated at 12 billion m^3. It is estimated that the total (technically and economically) usable surface and ground water potential of Turkey is 110 billion m^3, with 95 billion m^3 of this coming from internal rivers. 3 billion m^3 from external rivers and 12 billion m^3 from ground water resources.

Between 1990 and 2006, the Turkey's population grew by almost 17.9 million: from 56.1 million to 74 million (expected). About 67% of the population was classified as urban in 2006. The population is expected to grow to 84.3 million by 2020, of which three-quarters will live in urban areas (Wikipedia, 2007; Turkish Statistical Institute, 2007). Water resources play a key role in the economy of Turkey: between 30-40% of the total electricity production of the country is based on hydropower and between 15-18% of the crop land is irrigated contributing to 34% of agricultural GDP (FAO, 2001).

WATER RESOURCES MANAGEMENT IN TURKEY

Studies for the development of water resources in Turkey began in the 1930s. They were initiated especially for the development of small-scale irrigation projects, the size and scope of these studies expanding in a relatively short period of time. But, it was not until the late 1940s that basin wide hydrologic assessment and master plan studies were started. Activities in this respect gained a momentum and accelerated with the establishment of a number of institutions. These studies served as a blueprint and constituted a solid foundation at each stage of the basin-wide development efforts throughout Turkey. Master plan and individual studies were followed by intensive design and construction work which has so far contributed to the realization of many large and small dams.

In Turkey, the responsibility for the development, management, protection and conservation of water resources is shouldered by numerous ministries and agencies.

INSTITUTIONAL FRAMEWORK

Large number of organizations, governmental and non-governmental, has direct and indirect interest in the aspects of water resources management in Turkey (Alpan and Openshaw, 2003). Information about the main organizations related with the water management issue and their responsibilities are summarized below.

The ministry of environment and forestry: The Ministry of Environment is the main responsible body for environmental management and is charged with coordinating all national and international activities concerning water resources.

Ministry of Forestry protects mountainous and upper basins as the origin of streams and undertakes the development of projects to protect such areas (i.e., utilization and protection of in-forest streams, rehabilitation lakes and creation of reservoirs; afforestation; rangeland rehabilitation; erosion control,

etc.). The Ministry conducts studies and surveys on problematic basins and areas as identified by The General Directorate of State Hydraulic Works and other organizations and identifies relevant measures to control erosion.

The general directorate of State Hydraulic Works (SHW): It is affiliated to the Ministry of Energy and Natural Resources. It is a leading body carrying out most of sub sector activities at all stages of water resources development. SHW ensures the long term supply of drinking and industrial water and also plans, executes and in most cases operates works for flood protection, irrigation, drainage and hydropower generation. The responsibilities of SHW also include performing basic investigations such as, flow gauging, soil classification, water quality monitoring, preparation of river basin development plans and formulation of proposals for constructions financing and subsequent operation of these works.

The general directorate of bank of provinces: It is affiliated to the Ministry of Public Works and Settlement. The responsibilities of Iller Bank are to provide infrastructure projects on a turn-key basis for municipalities, to provide credit for financing these projects, to prepare urban development plans, to provide technical assistance for construction, mapping, selling or renting materials and equipment, to insure property and to train the staff of the municipalities.

The general directorate of electrical power resources survey: It is affiliated to the Ministry of Energy and Natural Resources and has the responsibility of carrying out hydrological studies, geotechnical investigations and mapping activities to evaluate the national hydroelectric potential and subsequently preparing reconnaissance, prefeasibility, feasibility and final design studies of identified projects. The projects are set out in protocols made with SHW.

The under secretariat of State Planning Organization (SPO): Its principal function is to prepare annual investment programs and five years development plans for various sectors of the economy. In line with the policies and principles set out in the development plans, SPO adjusts the national fund for the allocation of the projects and the programs which are under the responsibility of various ministries.

The ministry of agriculture and rural affairs: It is responsible for the development of villages, the development of agriculture, assistance in the development of water and soil resources, carrying out investigations and research, planning programs and projects to meet the needs for protection and development of water and soil.

The ministry of health: It monitors the water quality, performs physical, chemical and micro-biological analyses of water; assesses the use of chlorine; issues licenses and permits for water use.

Local governments: Water and Sewage Administrations connected to the Metropolitan Municipalities (15 out of 80 provincial capital municipalities) have taken part in the implementation of pollution control policies, including water supply and construction and operation of wastewater treatment facilities.

Non Governmental Organizations (NGOs): Environmental protection activities and public consciousness about the scarcity of water resources, mostly seen in the last decade, have led to the development of many NGOs operating at the national and regional level in the field of the environment in Turkey. The main national NGOs are actively involved in many water and environmental problems in order to create public awareness and to encourage public participation. They propose efficient solutions and act as pressure groups in the decision-making process.

LEGAL FRAMEWORK

There are almost 50 laws related to the water resources and management, including the laws identifying the responsibilities of related organizations. In general terms, Turkish law in water resources and environmental protection areas has been developed in four key areas:

- Constitutional mandates.
- Regulatory law.
- Natural resource utilization regulations.
- Public health law.

The major systematic aspect of water related activities in Turkey is central planning. At the national level, Five Year Development Plans (FYDP) is aimed at ensuring the optimum distribution of all kinds of resources among various sectors of the economy. Every five years, DPT (State Planning Institute), with experts from all sectors prepares the Development Plan. In the seventh FYDP (1996-2000), the main principles, policies and objectives with regard to proper management of water resources were as follows (World Water Council, 2003):

- Institution of a new structure for the management of water resources with an emphasis on harmony in the construction of municipal water, sewerage and treatment facilities,
- Ensuring the participation of the users in the planning, implementation and management of infrastructure investments which are placed within the context of land and water resource development.
- Drawing up of a special law which includes institutional reorganization concerning planning, management and conservation of groundwater and surface water resources for the purpose of rational utilization in different sectors and elimination of disorganization in the existing legislation,
- Drawing up necessary legislation for the planning and implementation of the required environmental impact assessment Studies and resettlement projects.

Although legislation in this area has been a matter of Parliamentary interest since the formation of the Grand National Assembly in the 1920's, some of the most important and far-reaching reform in water resources and environmental protection has taken place within the past twenty years.

The Turkish Constitution of 1982 states that water resources are natural wealth of the country and under the authority of the State, to be used for benefit of public. As defined by the Constitution, control over all ground and common surface waters, with the exception of some privately owned springs and small waters is vested in the Government.

The 1983 Environmental Law was the first piece of legislation that addresses the qualitative assessment of water resources. This law introduces the polluter pays principle for controlling pollution into the environment and water bodies. A subsequent piece of legislation was the Water Pollution Control Regulation, which became effective in 1988. This regulation classifies all inland waters in line with water quality standards and identifies industrial effluent discharge criteria. The main priorities of the regulation are the prevention of pollution in surface waters, protection of groundwater, prevention of coastal and sea pollution and restoration of polluted aquatic ecosystems. It refers to the establishment of an action plan for water quality improvement and long-term water basin quality management plans (Kuleli, 1996).

The legal framework about water rights and ownership is complex. For example, so far there is no special law for surface water rights. The use of surface water for hydropower production and thermal waters is subject to prior authorization. Other uses of surface water are not subject to any prior authorization.

MAIN PROBLEMS OF WATER RESOURCE MANAGEMENT IN TURKEY

Unplanned urbanization, uncontrolled industrialization, unconscious agricultural activities in Turkey put various pressures on water resources. Surface water resources are threatened by point sources of pollution (municipal and industrial waste) and diffuse pollution from agriculture activities. With rapid industrialization and urbanization, domestic and industrial wastewater has become a major threat to water resources. Large volume of untreated wastewater is dumped into water bodies. Surface water resources are also threatened by point sources of pollution and diffuse pollution from agriculture activities. Deterioration of the quality of surface water is observed in areas of intensive agriculture (The World Bank Group, 2004). The main problems related to water resource management of Turkey are summarized below.

- Large number of organizations, governmental and non-governmental, has direct and indirect interest in the aspects of water resources management in Turkey. The responsibility for the development, management, protection and conservation of water resources is shared by numerous entities. While existing institutions are technically strong, they are managerially weak. There are problems with lack of coordination and overlapping duties in the same area by several organizations, resulting in waste of precious time and money.
- There are almost 50 laws related to the water resources and management. The effectiveness of the laws and relations, which depend on the monitoring and enforcement abilities of the government, is yet to be seen. Legislation needs to be updated in order to take full account of good international practices and principles in water resources management and to specify responsibilities more precisely of various institutions and the different water users. The legal framework about water rights and ownership is complex. For example, so far there is no special law for surface water rights. The uses of surface water for hydropower production and thermal waters are subject to prior authorization. Other uses of surface water are not subject to any prior authorization.
- Strategies do not address water management broadly, although water resources management has been identified as a priority area in the National Environmental Action Plans (NEAPs) of Turkey. The policies related to water resource management are directed towards mainly economic aspects instead of

sustainable protection and management principles (Uzun, 2003). Lack of financial and technical resources to implement policies and enforce regulations is an issue in Turkey.

- The environmental problems related to water resources have reached quite dangerous levels in recent years in Turkey. With rapid industrialization and urbanization, domestic and industrial wastewater has become a major threat to water resources. A large share of the wastewater is dumped untreated in rivers, streams, lakes and the sea. Cities are the major culprits of water pollution. Sewer system is insufficient in many urban areas and does not exist in most of the rural areas. According to available statistics, only 67% of the population has access to sewage systems; in many urban areas, the system is insufficient and in most rural areas the system does not exist at all (FAO, 2001). Since the late 1980s, Turkey has embarked on investments in wastewater treatments in its major cities, but completion of this work has been delayed due to financial problems and difficulties with raising household tariffs sufficiently to recover costs.
- Current monitoring programs of water quantity and quality are inadequate and reliable data is lacking for the past. This prevents monitoring of flood or drought situations and constrains taking preventive measures to reduce damages (The World Bank Group, 2004).
- The number of conflicts about the use of water is growing and is especially evident during drought periods. No statutory priority on the use of the resource exists in the legal framework. Priorities are established on a case-by-case basis in light of public interest, beneficial use criteria and national interest and planning. The default priority list is as follows: drinking water supply, industrial water supply, irrigation, power generation, flood control and navigation.
- Quality of both surface water and groundwater is a serious concern. The deterioration of the quality of water resources due to the use of pesticides is largely observed in the areas of intensive agriculture. Runoff, drainage and deep percolated water from irrigated lands contain high levels of agricultural chemicals, as a result of excessive fertilizer and chemical usage. Rapid irrigation development and poor water management have put pressure on natural resources. In some irrigation schemes, the drainage water is reused or flow to marches threatening endangered wild life. Some drainage discharges and city sewages seriously threaten some lakes, estuaries and marine life as well.
- Water is conductive medium for the spread of diseases carrying bacterial and viral pathogens. The risk that one or more of those diseases are introduced or have impact is significant in irrigation schemes where land drainage is poor or badly maintained and where there are new settlements of immigrants at the suburbs of big cities.
- Sediment accumulation in dead storage of dams and reduction of available water for irrigation and domestic use is threatening irrigated agriculture in many locations because of severe soil erosion from upper watersheds.
- In Turkey, not being counted among the countries that have scarce water, the annual renewable freshwater amount per capita is rapidly decreasing. The amount was 8509 m^3 in 1955, it has fallen to 3623 m^3 in 1990 and it is expected to decline to 2186 m^3 in 2025 (Kuleli, 1996). The prevailing trends towards rising population, increasing urbanization, spread of more water intensive life styles as well as agricultural technology are going to make water resource even scarcer unless timely action is taken. All these factors necessitate the integrated management of water resources.

RECOMMENDATIONS

Watershed management is a mechanism for safeguarding natural resources (water, soil and forests) while at the same time improving incomes for generally poor farmers. Sustainable management of water resources with due respect to ecological, economic and ethical sustainability requires a holistic and integrated approach involving engineering socio-economic and environmental aspects (Bandaragoda, 2000; Maguire, 2003; Ogura, 2003). All the problems should be looked at in their totality. Development of hydropower, lowering of ground water table and devastations faced by people due to floods have to be examined in an integrated manner.

Turkey, like many countries today, faces challenges in efficiently developing and managing its water resources while working to maintain water quality and protect the environment. To add to the challenge, Turkey will need to continue to develop its water resources in order for its economic and social development to keep pace with its rapidly growing and modernizing population. Towards this goal, new management approaches and organizational arrangements needs to be designed to address the critical issue of water resources management. The following measures should be considered as guidelines to provide for effective management of water resources.

Appropriate institutional arrangements: Multiple groups manage and use water resources. Left to themselves, each group tends to give priority to its own needs as coordinating mechanisms do not often exist in a sectoral treatment of water. Consideration of all users and uses

within a river basin facilitates the introduction of such inter-sectoral coordination. Additionally, the stakeholders may collectively derive some synergic benefit from being able to integrate their administrative efforts. To derive some significant benefits from an integrated administrative effort, acceptable forms of institutional arrangements (rules and roles) should be in place. The expected behavior by the various stakeholders should be reflected in well-defined rights and responsibilities, as well as in policies, laws and administrative structures and procedures. The stakeholders should be structured through effective organizational and procedural arrangements so that each stakeholder group is aware of its own (and others') rights and responsibilities. The main objective should be to coordinate effective planning and implementation of equitable, efficient and sustainable use of natural resources in the basin with a view to improving the sustainability of its agricultural development.

Water resources should be managed within river basin boundaries. The European Union Water Framework Directive calls for the establishment of appropriate institutional arrangements, in particular, the identification and setting of competent authorities within river basin districts, adoption of cross-sectoral and cross-border cooperation and active participation of all stakeholders, including Non-government Organizations (NGOs) and local communities in water management activities. This will require additional staff as well as considerable efforts to improve the capacity and technical competence of water resources management authorities at the national and basin levels.

Key institutional reform challenges for Turkey are:

- Update/amend water legal framework and pass needed regulations.
- Improve coordination among water-related institutions.
- Improve the badly deteriorated water quantity and quality monitoring systems.
- Set up an integrated river basin planning process in a few pilot basins.
- Formulate coordinated and comprehensive policies and strategies for water resources management, development and pollution control.
- Increase participation from users (urban, irrigation, hydropower and environment) in the formulation of policies and strategies for optimal use of water resources.

Water resources planning: Comprehensive strategies for managing lakes and reservoirs need to be designed for the unique physical and biological characteristics of the watershed, including the type of ecosystem, climate and topography and the socioeconomic conditions, such as the population density and pressure on the resources, the economic and environmental objectives and the legal policy and institutional setting in which the water body is a part. The basic idea is (within those natural geographic boundaries of the river basin):

- To put forward an integrated water resources policy in order to prevent natural hazards.
- To rationally satisfy the various uses.
- To meet the requirements of sustainable development
- To protect the aquatic environment.

Integrated view of water resources would require multidisciplinary policy making, planning and executing teams in place of largely undisciplined civil engineering-oriented teams which exist at the moment. It is particularly necessary that there is effective interface between hydrological and socio-economic planning units. Academic and scientific communities, environmental groups, representatives of project affected people should also be involved in management of water resources (Teodosiu *et al*., 2003).

Effective management: Managing lakes and reservoirs so that they can provide their varied benefits for the future requires a comprehensive approach, involving all stakeholders and covering all activities affecting the water resources throughout the watershed. To work effectively, management plans must be developed at the community level, involve the participation of all the groups who benefit directly and indirectly from the water bodies and have clear and transparent rules for resolving conflicts.

Cooperative partnership and strong community participation: To even consider the management of a complex ecosystem like a watershed or lake it is necessary to foster a cooperative partnership approach. This is one of the lessons coming out of decades of failures of centrally-planned watershed development projects through which local people have been either coerced or paid to undertake terracing, bunding, destocking and other technical measures that external experts believed would cure watershed degradation. Thus, participation is expected to achieve what coercion and subsidies could not, namely to make watershed development more successful and sustainable (Johnson *et al*., 2001; Das, 2005).

Effective partnerships are based on good information and educational efforts. Cooperation requires that the parties have a knowledge of why, how, when and where to cooperate, which can only be gained from shared information and communication. Mutual trust is necessary to make partnerships work and trust can only be earned (HLWTF, 2005).

Participation of all stakeholders to developmental activities both in the planning and operation stages, especially to those of water resources, is of high importance. Environmental Impact Assessment (EIA) studies are an effective way of encouraging public participation in projects at the planning stage. According to EIA regulation enacted in 1993, for every new activity an EIA report has to be prepared and approved by the Ministry of Environment and Forestry. During the investigation-evaluation stage of EIA reports, a public participation meeting is organized. All the local people are invited to this meeting to state their opinions on the project and their opinions affect the final decision about the project. If most of the local people are against the project, it may be rejected and revised to reflect the public opinion. This could also happen for the water resources development projects. But, up to now, all the EIA reports of water resources development projects have been approved by the Ministry of Environment and Forestry. (Turkey Water Report Chapter 4: Water and Sustainable Development).

Pollution prevention and abatement: Reducing pollution effectively requires controlling both point and non-point source pollution. Many countries have successfully reduced point and non-point source pollution using policies combining regulations, economic instruments, public education and enforcement measures. Choosing the right combination of regulations and market-based instruments for controlling pollution to lakes and reservoirs will require careful assessments of the nature and sources of pollution and the practical issues of implementation.

Action needs to be taken to increase the share of the population connected to sewage treatment. Further, the price structure of water should be revised to better reflect the investment and maintenance costs and to ensure its rational use. At present, financing for construction of urban water, sewage and treatment plants is provided largely by the central government through the Municipalities Fund of the Bank of the Provinces. These funds typically fall short of the infrastructural requirement, particularly for the growing urban areas. However, seeking external funds shifts the burden to foreign debt, a matter of current concern in Turkey's efforts to restructure its financial framework through its engagement with the IMF. Therefore, finance for investments in water supply, sanitation, sewage treatment and solid waste disposal is still a burden for the central government and Turkish municipalities.

Monitoring: In order to define environmental and social guard rails for water quality, it is necessary to carry out monitoring operations as comprehensively as possible (Murakuni, 2006). Efforts to build a database on freshwater ecosystems are need of support. Geographical and ecological parameters should be included, as should adverse anthropogenic impacts. The database should also provide the results of a coordinated water body monitoring program, support the production of specialized maps and be available via the Internet to a wide range of users. Special research needs exist with respect to:

- Determining the status of aquatic habitats by expanding water body monitoring in regions and categories (e.g., wetlands, groundwater and lakes) on which little data has been collected hitherto, in order to provide a foundation for the national database.
- Collection of reference data from relatively unpolluted water bodies and investigation of the natural variability of factors relevant to quality (e.g., lacustrine sediments) in order to assess national and regional changes.

The monitoring of environmental parameters must be rigorously undertaken. NGOs and the affected public should be associated with this process. Monitoring can be strengthened by fixing realistic norms and standards, providing training and allocating sufficient funds. According to Hayworth and Hoenicke (2005), development and implementation of a monitoring program follow a logical progression and contain ten essential elements:

- Clear management goals and monitoring objectives.
- Assessment questions formulated directly from goals.
- Monitoring program design.
- Indicator selection.
- Quality assurance.
- Data management.
- Data analysis and assessment.
- Program reporting.
- Programmatic evaluation.
- General support and infrastructure planning.

Flood control: Floods are the third major threat to human life and health, after disease transmission and droughts. Research is needed on:

- Integrated analysis and modeling of the entire causal chain, from precipitation, formation and concentration of runoff, the course of flood events (also in flooded areas), to damage assessment.
- Earlier and more precise forecasts of precipitation with the help of mathematical models. Greater use of remote sensing techniques to predict flood events and refinement of techniques for direct conversion of remote sensing data into stream flow figures.
- Derivation of scenarios for extreme weather situations, both on a regional and local scale.
- Research into the social processes of perception, communication and response in connection with the handling of flood risks as compared to other risks to which individuals and societies are exposed. Investigation of the role of limit values in the acceptance of risks.
- Research to develop simple flood control Technologies for decentralized use.
- Implementation of preventive measures, such as afforestation, rehabilitation of streams and flood plains, restoration of natural flood plains and marshlands and prevention of urbanization in river basins and flood plains.

CONCLUSIONS

Effective management of water resources is essential for sustainable growth and poverty reduction. Poor river basin management increases economic damage and loss of life from floods, droughts, landslides and erosion. Low-quality water carries health risks, damages fisheries, tourism and recreation industries and leads to loss of ecosystems and biodiversity. Poor drinking water delivery service affects the well-being of local communities, while unreliable irrigation water leads to loss of livelihoods. Weak inter-sectoral allocation of water can result in insufficient supplies for irrigation, hydropower, municipal water supply and ecosystem maintenance. Inadequate water policies, institutions and pricing regimes drain central and local government budgets and lead to poor water resources management and service delivery.

Turkey, like many countries today, faces challenges in efficiently developing and managing its water resources while working to maintain water quality and protect the environment. To add to the challenge, Turkey will need to continue to develop its water resources in to keep pace with its rapidly growing and urbanizing population. For several years now Turkey has already been implementing the principles of sustainable development based on water resources through activities.

However, existence of various organizations which have responsibility in different parts of water resources management could cause duplications in implementation. On the other hand, the allocation of surface water resources issue has been still waiting for legal arrangements. In this context, solving of all problems related with water issues requires development of effective coordination and cooperation among the relevant organizations carrying out programs and projects and strengthening the capacity in administrative system including qualified staff and equipment besides legal framework.

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