ADB

WATER for ALL SERIES 12

Past Experience and Future Challenges

Cooperation in Shared Water Resources in Central Asia

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Papers Presented at an Asian Development Bank Workshop in Almaty, Kazakhstan, 26—28 September 2002

Compiled and edited by T. Bayarsaihan and D. McKinney

Abbreviations

ADB	Asian Development Bank
BVO	river basin organization
CAR	Central Asian republic
CEMAGREF	Institut de Recherche pour L'ingénierie de L'agriculture et de L'environnement (Public Agricultural and Environmental Research Institute)
CH	Center of Hydro Research
CIDA	Canadian International Development Agency
ECAFE	Economic Commission for Asia and Far East
EC IFAS	Executive Committee of IFAS
EU	European Union
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GWP	Global Water Partnership
HEPS	hydroelectric power station
ICAS	Interstate Council on the Aral Sea
ICARDA	International Center for Agricultural Research in the Dry Areas
ICID	International Commission of Irrigation and Drainage
ICWC	Interstate Coordinating Water Commission
IFAS	International Fund for Saving the Aral Sea
INBO	International Net of Basin Organizations
IWMI	International Water Management Institute
IWRA	International Water Resources Association
IWRM	integrated water resources management
MASHAV	Israel Center for International Cooperation
MRC	Mekong River Commission
NATO	North Atlantic Treaty Organization
NBI	Nile Basin Initiative
NMC	National Mekong Committee
SANIGMI	Central Asian Regional Science-Research Hydrometeorological Institute
SDC	Swiss Agency for Development and Cooperation
SIC ICWC	Scientific Information Center ICWC
SVP-ECP	Shared Vision Program-Execution and Coordination Project
TACIS	Technical Assistance for the Commonwealth of Independent States
UN	United Nations
UNDP	United Nations Development Programme
UN ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development
WARMAP	Water Resources Management and Agricultural Production
WARMIS	Water Resources Management Information System
WMO	World Meteorological Organization
WUA	water users association
WUFMAS	Water Use and Farm Management Survey
WWC	World Water Council
WWF	World Water Forum

Contents

Foreword

As the republics of Central Asia celebrate a decade of independence from the Soviet Union, they continue to confront a range of difficulties that can only be met effectively through regional cooperation. Of these challenges, none is more important than the wise management of the two great rivers that bind together these states: the Amu Darya and the Syr Darya. While coping with the transition to market-based economies and social reforms, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan have struggled to establish new governance systems to support poverty reduction and sustain economic growth.

Water and environmental management problems in Central Asia first gained international notice as a result of the ecological crisis brought on by the shrinking of the Aral Sea. The catchments of the Amu Darya and Syr Darya rivers, which both exit to the sea, together form the Aral Sea basin. From 1960 to 1990, the Aral Sea's area was halved when inflows were diverted to support cotton and rice production in downstream deserts. An ecological disaster resulted as a vibrant fishery was destroyed, surrounding ecosystems devastated, and the health and livelihood of a million people irrevocably damaged.

The challenge of regional water management for these semi-arid lands is no less acute today. Attention has now turned primarily to the need for balance between upstream hydropower and downstream irrigation interests—even as steps continue to address economic and social hardships facing those still living around the Aral Sea.

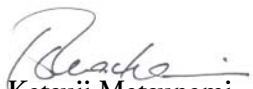
The overarching goal of the Asian Development Bank (ADB) in Central Asia, as elsewhere, is to promote the reduction of poverty. Starting in 1994, as the five Central Asian countries became ADB members, ADB has expanded its operations through grant-financed technical assistance, as well as project and program loans in the region. ADB recognizes that cooperation among the Central Asian republics is a key response to the region's landlocked and remote geographical location, small domestic markets, and the persisting conflicts in the use of resources, all of which combine to suggest a high degree of interdependence and the need for joint efforts. Accordingly ADB initiated its Central Asia Regional Economic Cooperation Program in early 1997, with an aim to promote economic growth and raise living standards.

In recognition of the crucial importance of balanced and sustainable management of water in the regional cooperation, ADB supported the Regional Consultation Workshop on Cooperation in Shared Water Resources in Central Asia: Past Experience and Future Challenges, which was held in Almaty, Kazakhstan from 26 to 28 September 2002. The workshop was attended by senior officials from national

governments and regional organizations as well as by nongovernment organizations and donor agency representatives. It is particularly notable that there was high-level participation from all five countries at the meeting representing the water and energy sectors as well as national hydrometeorological services. The papers compiled in these proceedings provide supporting materials to presentations made at the meeting by Central Asian participants and invited resource persons. It is expected that the proceedings will provide an important background material for debate and discussion during the special session on Regional Cooperation for Shared Resources Management in Central Asia and the 3rd World Water Forum in Kyoto, Japan in March 2003.

These proceedings are individually authored but compiled under the supervision of Agriculture, Environment, and Natural Resources Division, East and Central Asia Department of ADB and the Scientific Information Center of Interstate Committee for Water Coordination for Central Asia.

We would like to express our sincere appreciation to the local organizers of the meeting, in particular to Professor Victor Dukhovny and Dr. Pultakhon Umarov of the Scientific Information Center of the Interstate Coordinating Water Commission for their valuable contribution toward making the workshop a success. Finally, we are grateful to the participants who contributed to the Almaty consultation meeting—for their time and effort in preparing the papers presented herein, and for their continuing efforts to improve living standards in Central Asia through enhanced regional cooperation in managing vital shared water resources.



Katsuji Matsunami
Director
Agriculture, Environment, and Natural Resources Division
East and Central Asia Department

Keynote Address Shared Water Resources Management in the Aral Sea Basin: Issues and Opportunities

G. Le Moigne

Background

Irrigation development by the former Soviet Union (FSU) in the Aral Sea Basin has caused serious environmental problems. These problems, particularly the desiccation of the Aral Sea as well as waterlogging and salinity issues, are well known to the distinguished participants in this Regional ConsultationWorkshop on Cooperation in Shared Water Resource. There has been a tendency in the academe and media circles of the Western world to blame the engineers of the FSU. As a civil engineer, I would like, however, to mention that in spite of the seriousness of these problems at the time of independence, the engineers and scientists of the FSU had achieved remarkable technical achievements both in irrigation and energy development. The regional power distribution network served as a model to present energy distribution systems in the world and the establishment of river basin organizations for the Amu Darya and the Syr Darya (BVOs) created a mechanism of interstate management of water resources of the Aral Sea basin. At the same time, these engineers were fully aware that the projects they were asked to develop would cause the desiccation of the Aral Sea. They had therefore studied several proposals to save the Sea such as diverting Artic rivers (I understand that consideration is again being given to this option), pumping water from the Caspian Sea, and reducing irrigated rice and cotton fields. They were equally conscious of the drainage and salinity issues in the lower portions of the rivers and they had started building major drains (particularly in the left bank of the Amu Darya). When the FSU broke up, hydropower dams were also under construction in the upstream of the Kyrgyz Republic and Tajikistan to improve both the power production and the regulation of water.

When the basin states became independent from the FSU in December 1991, they were well aware of the water issues and therefore of the need to cooperate to address them. The heads of states of the Central Asian republics (CARs) met several times (Almaty, 1992; Kzylorda,1993; Nukus, 1994, etc.) to discuss cooperation in the joint management of interstate water resources. International agencies and the aid community also became concerned with the seriousness of the water management problems. They have tried—with variable success—to support water development projects that require regional cooperation to stabilize the Aral Sea so that it can be sustained by future river and drainage inflows and to rehabilitate the disaster zone close to the sea.

In September 1995, the heads of states hosted a United Nations conference on sustainable development of the Aral Sea basin and signed the Nukus Declaration of Central Asian States and International Organizations. In this declaration, they confirmed that they recognized earlier signed and acting agreements and other regulating interrelations between them on water resources of the Aral Sea Basin. They also appealed to the international community to help in joint efforts of the CAS to solve the problem of sustainable development and enhancement of ecological situation in the region (Interstate Commission for Water Coordination and its Scientific Information Center, 2002). The political will, mutual understanding, and foresight of the heads of states helped the countries resolve water- and energy-related issues by entering into new framework agreements. For example,with the help of the United States Agency for International Development (USAID), a framework agreement on the use of water and energy resources was signed in March 1998 by the Syr Darya riparian states (Tajikistan became a party to this agreement in May 1999). This form of cooperation and agreement between Aral Sea basin states to achieve mutually beneficial and rational use and protection of the water resources has been called the "multilateral factor" by Haskoning (2002).

The various levels of social and economic development of the CARs, however, are making it difficult to implement in full their various water-sharing agreements. For example, the Kyrgyz Republic has enacted in July 2001 a water law stating that all the waters in the territory of the country belong to the State and demanding that downstream countries pay for water coming out of their country. Kazakhstan and Uzbekistan, on the other hand, require that the Kyrgyz Republic provide water that used to be available before regulation and ensure in-stream needs. A recent report of the Scientific Information Center of the Interstate Coordinating Water Commission (SIC-ICWC) in 2002 gives another recent example of this difficulty on the allocation of Amu Darya's water during the dry year of 2001. Upstream areas of Uzbekistan and Turkmenistan received 85–100% of their shares while downstream ones (Karalpakstan in Uzbekistan and Tashauz in Turkmenistan) received less than 50%. The new developments in Afghanistan (which has a significant portion of the flow of the Amu Darya) will eventually cause additional demands on the flow of the river and this will require new negotiations of water sharing agreements among the riparian states. There is therefore a need to discuss, as proposed in this Workshop, issues and opportunities to develop a new vision of cooperation in shared water resources management between the Aral Sea basin states and their development partners. The purpose of this paper is to propose a framework for this discussion and to analyze the issues and opportunities for cooperation.

I propose that, for our discussions on improving cooperation between Aral Sea Basin states and their development partners, we follow an approach recommended by Claudia Sadoff and David Grey (2002) of the World Bank. This approach, briefly summarized below, analyzes four types of beneficial cooperation on international rivers: (i) benefits to the river; (ii) from the river; (iii) because of the river; and (iv) beyond the river. The approach recognizes, however, that these types of benefits "feed into each other inextricably and that they are integrated elements of a much broader, even more complex system that cannot be unbundled."

Proposed Framework for Increasing the Benefits of Cooperation

Benefits to the Rivers and their Deltas

Cooperation across borders in the sustainable management of a river ecosystem, according benefits to the river, can bring benefits to all river uses and users. While there is a growing debate over the preferred ecological state of a river, modern river basin management incorporates a conscious design process to ensure a healthy river system that accounts in some way for the inevitable tradeoffs of river development. A healthy river is typically one with protected watersheds, reduced contaminants and sediment transport, conserved wetlands, and groundwater recharge areas. The objective is to maintain the capacity of these components to buffer river flow and water quality variations and to protect aquatic and riverine terrestrial biodiversity.

The need for cooperation among riparian states to ensure a sustainable management of the ecosystems is clearly established by customary international rules and conventions, particularly

- the 1966 Helsinki Rules on the use of international rivers;
- the 1992 Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes; and
- the 1997 United Nations Convention on the Law of the Non-navigational Uses of International Watercourses.

For example, Article 2 of the 1992 Helsinki Convention mentions that "The Parties shall take appropriate measures to ensure that transboundary waters are used with the aim of ecologically sound and rational water management, conservation of water resources and environmental protection." The UN mentions the need to ensure environmental sustainability as one of its seven Millenium Development Goals. The National Sovereignty and International Watercourses Panel (appointed in 2000 by the World Commission on Water for the 21st Century) points out in its March 2000 Report that the Islamic World has introduced "the notion of offence entailed in wasting water, a God-given resource which must be preserved." In the Aral Sea basin, significant progress has been achieved by some of the CARs in saving water used for irrigation. However, regional experts point out that much remains to be done to improve irrigation and drainage efficiency (the same comments could be said about the wastage of potable water supply in most of the CARs since there is no measurement of water use and hence no incentive to save).

Benefits from the River

Cooperative management of the water flowing in an international river can reap benefits from the river. Managing a river basin from a system-wide perspective can increase the quality, the available quantity, and the economic productivity of river flows. River basin development seeks to promote this integrated, system-wide perspective, where the full range of water-use opportunities and the various interrelationships of individual water uses can be considered. River flows and water uses can be optimized to yield, inter alia, more food, more power, and more navigational opportunities, while sustaining environmental integrity. There will often be difficult tradeoffs to be assessed between environmental conservation and river development, with these assessments best made at the basin scale. This comprehensive and integrated approach to address competition for water is called the "Multi-Sectoral Factor" by Haskoning (2002). Sadoff and Grey (2002) point out, however, that

developing a river basin to promote an integrated, system-wide perspective is always difficult to obtain in international river basins, and this can only be achieved through cooperation.

Issues and Opportunities for Cooperation in the Aral Sea Basin

Regional Cooperation According Benefits to the River

The protection of ecosystems in international rivers has often been complex and costly. There are a few successful examples of major cooperative efforts to restore and protect shared water systems such as those for the Baltic, the Danube, and the Rhine. In less developed countries such as those in the Aral Sea basin, there are fewer incentives for, and therefore little interest in, managing the ecosystems of the rivers and their deltas. We mentioned earlier the case of the allocation of the Amu Darya's water in 2001. A recent paper by SIC-ICWC (2002) refers to the need and difficulty of fostering "hydrosolidarity" between upstream and downstream users of a river. The paper points out that upstream users are not likely to give up their interests for the benefits of "strangers" (the downstream users) "without any moral or material compensation" such as reduced taxes or other benefits such as the financing of investments or the provision of nonrelated goods and services. In this connection, it is interesting to note that international conventions recognize the "principle of compensation" for harm done by a watercourse state to other riparian states. Article 7 of the 1997 UN Convention, for example, requires "states whose use cause harm to discuss the question of compensation."

Another approach to motivating stakeholders in agreeing to hydrosolidarity is through public awareness of the need to protect rivers and their deltas. This is a complex task particularly in the Aral Sea basin because only a few nongovernment stakeholders are active participants in Central Asia. As pointed out by McKinney (2002), "it will take time and patience on the part of both NGOs and the water management officials to develop a complementary, rather than antagonistic, relationship with one another. There are now a few NGOs accepted by the water management officials as participants in some activities. In the future, it will be necessary to determine how to make this a broader and more participatory effort." I am therefore pleased that the role of NGOs and other stakeholders in developing water management strategies has been included in the agenda of this important workshop.

A key element of public awareness is the availability of adequate information. Although Article 9 of the 1997 UN Convention mentions the need for "regular exchange of data and information," experience has shown that providing wide regional information and data exchange is always difficult even within national boundaries. McKinney (2002) indicates that "past experience in Central Asia has made the governments and donor agencies wary of the creation of regional data bases." He proposes a new concept "of a distributed data basin, where the raw data stay in the initiating countries and reports are sent periodically to the other countries." He mentions that the five national hydromet services have been working on the development of regional cooperation and data sharing for the past year or so. In this connection, I look forward to the presentation later this morning by H.E. Minister Chub on the "Exchanges of Hydologic Data and Information among Aral Sea Basin States."

The SIC-ICWC Paper highlights that "hydrosolidarity" should be based on a leading role of institutions in government, religion, and education, and on the development

of basic moral principles. In the Aral Sea basin, the principle of protection of the environment (particularly in the river's deltas) appears to have received less attention from the CARs' institutions (and also from the aid community) than the overall principle of cooperation.

Some government officials have proposed to increase the responsibility of the BVOs to include biological resources in the Aral Sea deltas. Another proposal made in the SIC-ICWC Paper to foster hydrosolidarity is to prepare a vision that includes forecasting complications. The hope here is that concern for descendants, family, and future generations may cause every man to recognize the inalienable human water right. The Paper considers that wide information and simultaneous respect and even religious treatment of water would promote this behavior. The Paper further argues that hydrosolidarity should be promoted also by the UN Security Council that should agree upon a range of fundamental regulations to be followed by countries all over the world, while developed countries would become the pulpit of these ideas to the developing world. The Paper also proposes that the next step should be the development of intolerance against water egoism.

The SIC-ICWC Paper to promote the necessary hydrosolidarity among users of a river provides a basis for discussions on a new vision of cooperation among the Aral Sea basin states and their development partners to ensure the sustainable management of the Amu Darya and Syr Darya ecosystems, particularly of their deltas. I therefore suggest that—during our Workshop—discussions on this topic address measures that could be taken by the Aral Sea basin riparian states and their donors to enable better management of the basin ecosystems by

- developing public awareness and involvement through wide information dissemination and participation of key stakeholders in helping create social acceptability of the need for hydrosolidarity;
- forecasting scenarios that illustrate future complications;
- assisting leading institutional structures in playing a lead role on the development of moral principles and in searching compromises that would protect the rivers; and
- creating a regulatory system with both incentives and strict regulations.

Regional Cooperation Bringing Economic Benefits from the River

As mentioned earlier in this presentation, it is to the credit of the CARs to have established, since their independence 11 years ago, a regular regional and bilateral cooperation that has enabled them so far to avoid major conflicts in the allocation of water resources for their respective developments. Regional coordination for the planning and financing of future development projects such as the Kambarata dam in the Kyrgyz Republic, the Rogun Dam in Tajikistan, or dams in the Fergana Valley in Uzbekistan to attain energy and agricultural objectives is, however, proving difficult to achieve.

To address this issue several donors have highlighted the need for strengthening existing regional institutions such as the International Fund for Saving the Aral Sea (IFAS), the Interstate Commission for Water Coordination and its Scientific Information Center (SIC-ICWC), the river basin water management organizations (BVOs in Syr Darya, Amu Darya, and Zerafshan), the Unified Dispatch Center Energiva, and the recently established Power Council of Central Asia Republics. I

will simply mention here a proposal made to me by senior CAR officials that, as an element of strengthening the regional organizations, particular attention should be paid to satisfy the riparian states that their staff have broad qualifications enabling them to show independence of judgment. Experience has shown that competitive selection of professional staff, with adequate consideration given to nationality mix, contributes significantly to the performance and efficiency of joint agencies. The role of the aid community to support such an approach is, however, a sensitive issue as the decision makers in the CARs often consider that international organizations try to impose their views without having fully understood the economic and political conditions in the riparian states.

Another reason mentioned by some donors for the difficulty of regional coordination for the planning and financing of future development projects is *the absence of institutional mechanisms to coordinate agriculture, energy and environmental policies at both the national and regional levels.* These policies have a large impact on water management in the Aral Sea basin. There *is a need for a multisectoral approach* (called the Multi-Sectoral Factor by Haskoning) that should be decided at the highest levels of government. Daene McKinney (2002) indicates that no new agreements on water or energy have reached the prime ministers or presidents since 1998 and he suggests that donors try to promote consensus on this approach. In particular, McKinney recommends convincing the high-level advisors to the presidents that stronger regional cooperation on a multisectoral approach can lead to increased benefits, stability, and security for the countries and the region.

A complementary approach recommended by some experts to facilitate reaping benefits *from the river*, is to focus on the benefits derived from the use of water in a river system rather than the physical water itself (i.e., not cubic meters but dollars). Broadening the perspective of basin planners to these benefits may provide a greater scope, and hence a greater flexibility, in defining cooperative management arrangements that are acceptable to all parties (Sadoff and Grey, 2002). In general, the optimization of benefits should be more robust and more flexible than the optimization of physical water resources because benefits tend to be more easily monetized and compensated and they have less political and psychological significance. A recent SIC-ICWC Report (2002) on "Interstate Water Allocation in the Aral Sea Basin" supports the analysis of Sadoff and Grey. The SIC-ICWC Report recommends that "each state of the Region should have a clear view of the benefits and losses resulting from the fulfillment of their obligations, both in economic as well as in social aspects." The report considers that having a clear idea on benefits and losses is one of the real possible ways of bringing together positions and establishing collaboration between countries on issues of joint management of water and energy resources of the Aral Sea basin.

The report points out that so far none of the countries of the basin have done such estimates. It recognizes the complexity of carrying out these estimates that should cover not only the water and energy sectors of the economy of the countries but should also be linked with other trends of interstate relations. The suggestions from Sadoff, McKinney, and SIC-ICWC mentioned above could serve as a basis for our discussions on the *benefits from the rivers*. I therefore propose that we address the following questions.

- What measures could be taken to strengthen existing institutions to ensure that they have the responsibility and the capacity to manage the shared water resources to the satisfaction of the riparian states?
- Should a multisectoral approach that would coordinate the agriculture, energy, and environment policies be promoted by the aid community and decided at the highest levels of governments?
- What institutional mechanisms should be established to ensure this coordination both at the national and regional levels?
- Should each state of the Aral Sea basin attempt to have a clear view of the benefits and losses—both in economic and social aspects—resulting from the fulfillment of their obligations in water sharing agreements and should the aid community assist the riparian countries in estimating these benefits?

Regional Cooperation Arising Because of and Beyond the River

Cooperation in managing and developing international rivers may contribute to political processes and institutional capacities that themselves open the door to other collective actions, enabling cross-border cooperation *beyond the river.* Increasing the benefits from the river and decreasing the costs arising *because of the river* enable broader economic growth and regional integration that can generate benefits even in apparently unrelated sectors. Easing tensions among riparian states may also enable cooperative ventures that would not have been feasible under strained relations. Flows other than those of the river—such as improved communications, trade, and tourism—may grow. For example, another potential source of cooperation in the Aral Sea basin is the development of tourism. Uzbekistan and the Kyrgyz Republic have both stated their objective to cash in on their country's rich cultural heritage and beautiful mountain sites (the same argument to promote tourism would also apply to the other CARs). A favorable climate of cooperation brought about by harmonious regional management and development of the rivers of the Aral Sea basin would improve regional tourism and bring significant increase in the gross domestic product (GDP) of the CARs. This would have major implications in employment situation and future rural and urban water use.[1] Much remains to be done however to achieve regional tourism development as infrastructure and bureaucracy would have to be significantly improved to attract private investments that would in turn ensure a steady flow of visitors.

There are a few examples in the world where benefits derived from the river through cooperative management have brought substantial benefits *beyond the river.* I will have the opportunity later on in this Workshop to describe the examples of the Mekong River and the Nile River basins. I will briefly mention here that sharing the Mekong's benefits has proved to be an important stabilizing factor in the region, bringing substantial benefits *beyond the river* both directly from forward linkages and indirectly from diminishing tensions (Sadoff 2002). During the years of conflict between the Lao People's Democractic Republic (Lao PDR) and Thailand, for example, the Lao PDR always provided hydroelectricity to Thailand, and Thailand always paid for that electricity. Similarly, the Government of Thailand has followed an explicit strategy of increasing regional stability by creating mutual dependency

and thus purchases gas from Myanmar and Malaysia and hydropower from the Lao PDR and the People's Republic of China (PRC), in part because these are low-cost supplies and in part because they create ties that bind the countries in a web of mutual dependency.

I would like to propose that during this Workshop our discussions also focus on the benefits that could arise because of and beyond the regional management and development of the Aral Sea basin rivers.

Role of Development Partners

The success of cooperation in shared water resources management among Aral Sea basin states require the development of mutual trust and understanding among the riparian states. This can be achieved by continuing intense discussions among the states and support from their development partners, essentially the aid community. To play an effective role in providing additional incentives for regional and basin-wide cooperation, international and bilateral organizations should improve their own coordination. Experience in the Aral Sea basin has shown that there is a great possibility of duplicating efforts without good aid coordination. McKinney points out (2002) that this lack of coordination in the past has also caused reduced effectiveness of programs, inefficient use of funds, and lack of recognition of achieved results. It must be pointed out that the issue of aid coordination is a worldwide issue as highlighted by James Wolfensohn, the president of the World Bank, in a recent article (FT 2002). While aid coordination cannot be done in the absence of government representatives, some sort of uniform set of principles and objectives of the donors would serve to focus the efforts in more effectively achieving results. The donors should now encourage the governments to propose regional investment projects by utilizing the results of the significant amount of research, pilot projects, and studies that have been carried out already. In this connection, a most interesting proposal has been made by Professor Dukhovny (2002) to establish a donors' coordination board, to be headed on a rotation basis by representatives of major organizations sponsoring the Aral Sea Basin Program. This board would discuss progress activities, coordination of projects, and issues related to projects financing. Planning of donors' interests and meeting the needs of beneficiaries should be subject to consideration by the board while looking for mutually acceptable and agreed decisions. This approach would maintain the spirit of continuous and effective cooperation among participants in the program.

The Aral Sea basin states may be interested in the experience of the Nile River basin, which provides a useful example of recent aid coordination. In spite of serious potential conflicts among the 10 riparian states, they have now decided to rise above national differences and pursue a common social and economic vision by establishing in 1999 the "Nile Basin Initiative." In June 2001, the international aid community pledged $140 million in grants to implement a basin-wide program of research, capacity building, and technical assistance. The grants will also be used to begin detailed planning of investments programs, the first of which is expected to amount to $3 billion. As mentioned earlier, more details on cooperation in the Nile River basin will be presented in another session of this Workshop.

I propose that, during our Workshop, discussions on the role of the Aral Sea basin development partners be focused on how to achieve better coordination among the members of the aid community and what might be the expected results of this improved coordination.

Conclusion

The heads of states of the five CARs have on numerous occasions, since their independence from the former Soviet Union, signed agreements to confirm their cooperation in the management, utilization and protection of water resources in interstate sources. They have also established (or confirmed existing) intergovernmental institutions for reinforcing this cooperation. The political will and foresight of the heads of states helped the countries resolve water and related energy issues by entering into new framework agreements. The various levels of social and economic development of the CARs are, however, now causing difficulties in implementing in full all their water sharing agreements, creating the need for a new vision of cooperation among the states and their development partners. This paper has proposed a framework for discussing how to approach this new vision. The framework is based on a recent article by Sadoff and Grey (2002) that analyzes four types of cooperation and benefits on international rivers: benefits to the river, from the river, because of the river, and beyond the river. The paper also analyzes the need for improved coordination of the aid community, together with an indication of the benefits that could be expected from this improvement. It is hoped that the various types of analyses presented will help guide the discussions during our Workshop on future directions of collaboration among the Aral Sea basin countries and their development partners.

I would like to conclude this presentation by following a recommendation of UN Secretary General Kofi Annan at the World Summit on Sustainable Development in Johannesburg earlier this month. If there is one word that should be on everyone's lips at this Workshop, one idea that should animate the plan of cooperation among Aral Sea basin states and their development partners, one concept that should embody everything we all hope to achieve before it is too late, it is responsibility—responsibility for each other as stakeholders of the ecosystem of the Aral Sea basin and, most of all, responsibility for cooperation of all stakeholders (decision makers and representatives of civil society and of development partners) to contribute to the well-being and security of the people of the Aral Sea basin and of their succeeding generations.

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Country Perspectives on Regional Cooperation in Shared Water Resources

Water Resources of Kazakhstan

A. D. Ryabtsev

Analysis of Status, Issues, and Perspectives of Water Resource Use

The Syr Darya basin is a complex situation, especially in its lower reaches, due to the expansion of irrigated areas in the middle reaches and increases in water diversion for irrigation. Reduced flow and increased pollution have led to the degradation of the environment and the well-being of the population in the basin. The Syr Darya delta has lost its regulation functions for both the Aral Sea and its coastal zone. Desertification now covers an area of 2 million hectares (ha). Collector-drainage and wastewater discharges to the Syr Darya have led to chemical and bacterial pollution and an increase in diseases. The complexity of the region's water problems is a result of the full exhaustion of water resources in the basin. The ensuing deficit cannot be reduced by water saving measures alone, but by principal transformations also in basic economic sectors, especially irrigated agriculture, and strengthened interstate cooperation.

Transboundary Issues in the Large River Basins

Syr Darya Basin

The Syr Darya river crosses the national boundaries of four countries: Kyrgyz Republic, Tajikistan, Uzbekistan, and Kazakhstan. Water availability in the Kazakh territory of the lower Syr Darya basin largely depends on the water policies of the countries located in the upper reaches. Previously, all water facilities in the Syr Darya basin were considered to be part of an interconnected system. Due to its multiyear regulation capacity, the Toktogul reservoir had a sustainable operating regime. Since 1992, the Toktogul reservoir has been under Kyrgyz Republic ownership and it has had a new operation regime oriented toward energy generation that has led to negative impacts on the economic and ecological situation in the Priaralie (Aral Sea costal zone).

The main reasons for the deterioration of water resources management in the Syr Darya basin are as follows:

- aspiration of all states for full food self-sufficiency;
- transfer of reservoir operation to a power regime in winter periods and nonconsumption of hydroelectric energy in summer periods;
- expansion of irrigated lands; and
- collector-drainage and wastewater discharges to the river.

The above-mentioned reasons have led to the following major issues in the region:

- water resources deficit;
- water quality deterioration;
- Aral sea desiccation and loss of fish production; and
- unreliable drinking water supply.

Shu-Talas Basin

More than 75% of the surface water resources available to the Zhambyl oblast of Kazakhstan come from the Kyrgyz Republic. According to the interstate water

allocation in the Shu River basin, Zhambyl oblast receives 2,790 km^3, or 42% of the river flow, and the remaining 58% is used in the Kyrgyz Republic (Moscow, Minvodhoz of USSR, 24.02.1983). Kazakhstan's share on Talas River is 808 million m^3 or 50% of the flow (Moscow, Minvodhoz of USSR, 31.01.1983). Each oblast's water use is limited according to the provisions of these water allocations.

The main reasons for water resources deterioration in the Shu-Talas basin are as follows:

- increased Kyrgyz water diversion and use; and
- collector-drainage and wastewater discharges to the Shu, Talas, and Assa rivers.

This has led to the following major issues in the region:

- water resource deficit;
- water quality deterioration; and
- deterioration of the Ters-Ashibulak and Tasotkel reservoirs resulting in threats to settlements downstream.

To provide water to the irrigated lands of the Kordai and Merken rayons in the Zhambyl oblast, the joint use of the Chumish hydrounit and the Big Shu canal located in Kyrgyz Republic has become necessary. A bilateral agreement on interstate water regulation was signed on 21 January 2000.

Socioeconomic and Political Consequences of Disputes Over Water

The situation with drinking water supply is growing more dangerous. Half of the population drink water that does not meet normal health standards. More than 40% of water intakes have no treatment facilities. The status of the distribution network is unsatisfactory and more than 70% needs rehabilitation. Water losses amount to 20–30%. Existing technologies do not provide water treatment according to accepted standards.

In cities, where the main source of drinking water supply is surface water from the Irtysh, Tobol, Syr Darya, Nura, Ural, and other rivers, water quality is unsatisfactory for all water uses. Many cities have no storm sewer system with treatment facilities, resulting in polluted flows entering water bodies. The rural population suffers from water deficit because water supply for irrigation has been reduced significantly. All expenses for water treatment and supply should be paid by the users, but they cannot afford them. As a result, many water supply stations are out of operation and much of the population does not have safe drinking water.

There are no available funds for rural water supply because existing credit conditions are unacceptable. It is worth noting that previously all of them were subsidized. Irrigated agriculture is in the same situation and this threatens the country's food security. Due to the reduced state role in water management, human and scientific-technical potential is also reduced. The preparation of highly qualified water specialists takes 15–20 years. The water-related complex requires rehabilitation and modernization because it is not only the source of water but also the source of danger as well.

The approach to the country's water supply system does not take into account the complex aspects of interrelations in water resources management. The existing institutional, legal, and financial mechanisms are not effective in maintaining sustainable water supply. The Aral Sea tragedy is one of the consequences of unreasonable policies of water consumption. Intensive sea desiccation and coastal

zone desertification have led to deterioration of the population's health. According to some scientists salt and dust from the Aral reach the Fedchenko glacier, accelerating its melting. Water pollution due to herbicides and pesticides has led to irreversible environmental degradation processes.

The water resources infrastructure is deteriorating, but there are no funds for its rehabilitation, which threatens sustainable water supply. Existing institutions cannot solve many water-related questions at both the national and regional levels.

Analysis of the Legal Basis for Water Management and Conservation

The Water Code of the Republic of Kazakhstan (1993) and other legislative acts comprise the legal basis for water policy in the country. Water use in the country is determined by economic interests without regard for social and ecological consequences. The institutional structure for water resources management does not solve the problems of conservation, rational use, and development of water sources. The Water Codefollows the former Soviet Union rules and needs major revision. Legal norms concerning the competence of various authorities to regulate water use do not meet legislative requirements. The code does not foresee reforms in water relations, does not permit solving problems of transboundary water use, does not encourage the development and conservation of water resources, and does not clearly explain the financial mechanism of water-related activities. The Code should be revised and it should become a base for regulations in the water sector. The revisions should be relevant to Article 61 of the Constitution.

The multitude of existing legislative and normative acts makes regulation in the water sector difficult. That is why it is necessary to establish norms of direct action that will reduce the number of acts and even eliminate some of them, putting water relations on a single legal base. Presently, water use issues are being solved on the basis of different laws and acts. For example, consider the issuing of permits for surface and groundwater use as well as wastewater discharge to water bodies. Surface and groundwaters are artificially separated without taking into account their hydraulic interconnection. As a result, it is difficult to define real responsibility for the status of water bodies. One body is responsible for quality, another body issues permits for use and wastewater discharges to it. The economic mechanism related to water use also contains the same problems and contradictions. The Water Code has been developed with regard for only one type of property (state). The Water Code allows water fund alienation under licensing or permission for specific water use issuing. Surface water is under the administration of water management bodies, groundwater under geological bodies, and wastewater under nature protection bodies.

Water Resources Management

Analysis of Activities of Governmental Bodies in Water Resource Use

The Committee on Water Resources governs water resources based on the basin principle. This principle is realized when water resources are distributed between administrative-territorial units within river basins and is implemented by eight basin organizations (BVOs). The BVOs have reduced staff twice and their current low technical level does not allow them to carry out their tasks.

Administrative-territorial principle is implemented in the oblasts by state enterprises, which provide water regulation and operate water reservoirs, main canals, carriers, hydrounits, pumping stations, embankments, etc. The condition of some of them is very poor and many are destroyed or close to collapse. The Committee on Water Resources undertakes measures to improve water supply and management.

To improve the legal basis for water resources use under changing economic conditions, a new version of Water Code is under preparation. Also, a set of legal documents on water services pricing is under preparation. For this purpose, the structure of state registration of water resources is to be changed along with the development of a water resources cadastre. A draft "Concept of Regulation of Transboundary River Issues" has been developed. The main principles and tasks of rational water resources use and conservation, assessment of current water relations, and the main directions of legal base improvement are included in this concept. Drafts of the "Strategy of Water Sector Economy and Water Policy Development," the "Concept of Regulation of Transboundary River Issues," and the "Program of the Republic of Kazakhstan Water Resources Use and Conservation up to 2005" have been developed. Water relations with the other member countries of the Central Asian Economic Community (CAEC) are based on agreements signed by all the member republics on joint use of water resources from international sources.

For providing irrigation water in the southern regions of Kazakhstan during the growing season of 2002, the Committee on Water Resources prepared an interstate agreement on the water-power resources use of the Naryn-SyDarya cascade. In this connection working meetings of experts from Kazakhstan, Kyrgyz Republic, and Uzbekistan were held on 12 December 2001, 19 February 2002, and 11 March 2002.

Under the Ministry of Natural Resources and Environment initiative, together with the Ministry of Foreign Affairs, work has been carried out on the Central Asian countries joining the "Convention of the Protection and Use of Transboundary Watercourses and International Lakes" (UN-ECE, Helsinki, 1992), which will help solve transboundary issues with regard to international water rights.

In accordance with CAEC Interstate Council decision "About Practical Measures on Further Economic Integration" of 24 July 1997, and the "Concept of Principles of Interaction in Establishing International Consortiums" of 12 December 1997, the establishment of the International Water-Power Consortium (IWPC) has been decided. The IWPC statute was approved by the prime ministers of Kazakhstan, Kyrgyz Republic, and Uzbekistan on 17 March 1998. During expert group meetings on establishing the IWPC (Bishkek, 25 and 26 December 2000), certain contradictions occurred. This project has been initiated and submitted by Kazakhstan. The Kyrgyz Republic did not agree with major objectives of the IWPC, in particular, the mechanism of water-power resources management, limitation, and use. The Kyrgyz Republic claims that provisions of the IWPC contradict the Constitution of the Kyrgyz Republic and the debt of Kazakhstan to the Kyrgyz Republic for past electricity provision must be resolved. Experts from Tajikistan consider new hydropower facilities construction as a main goal of the IWPC. Experts from Uzbekistan noted that the countries are not yet ready to establish such a consortium and all questions of joint Syr Darya water-power resources use are being solved through annual intergovernmental agreements. The parties recognized the necessity to continue consultation on this issue.

Conceptual Approaches to the Rational Use of Water Resources

International Expeience in Solving Water Problems

Kazakhstan joined the "Convention of the Protection and Use of Transboundary Watercourses and International Lakes" (17 March 1992) by the Law dated 23 October 2000. This Convention mostly contains declarations and references to interstate agreements. There is no concrete mechanism interaction among parties in this sphere. That is why the Convention's effectiveness is doubtful.

International experience in water relations shows that regional stability, joint management of water resources, and food security can be achieved by establishing a common legal base and mutual respect of interests. The development of the legal mechanism for joint water resources use, taking into account international experience, is a base for eliminating contradictions both at the regional and national levels. Sustainable economic development of the region depends on effective interstate interaction and collaboration and the improvement of the legal base.

Interstate water use should be based on commonly accepted conventions and framework agreements that have a comprehensive character and fixed obligations but do not restrict the rights of parties to the agreements. Process of interstate water relations regulation should be developed based on such conventions as the "Convention on the Protection and Use of Transboundary Watercourses and International Lakes" (Helsinki, 17 March 1992) and the "Convention on the Law of the Non-navigational Uses of International Watercourses," (New York, 21 May 1997).

These international norms establish common principles in the joint use of transboundary waters and are important to ensure equal rights for all participants. It is necessary to note that Kazakhstan is the only Central Asian country that has joined the 1992 Helsinki Convention and it ratified it on 23 October 2000. Other countries of the region recognizing this convention would be an important step in common water resources regulation. Unfortunately, this process is not yet developed in the framework of regional cooperation.

But the fact that other states did not join the Helsinki Convention should not be reflected in interstate relations and multilateral (bilateral) agreements on joint use of international waters. In the Nukus Declaration of 20 September 1995, the heads of state declared their support for the Helsinki Convention and the necessity to create an international convention for the Aral Sea basin. The positive activities of the International Fund for Saving the Aral Sea (IFAS) and its subdivisions like the International Coordinating Water Commission (ICWC), the BVO Syr Darya, and the BVO Amu Darya, are very important.

Economic reforms in Central Asian countries differ in their rate and principles. For example, in Kazakhstan, agriculture is fully privatized, energy-generating sources are given in lease, the distribution network is being prepared for privatization, and management of water is performed at a lower administrative level compared with other countries of the region. All these factors influence international collaboration and should be taken into consideration when developing strategic directions for water-power relations.

Proposed Ways of Solving Transboundary Water Issues

It is necessary to develop state policy in the sphere of common use and protection of tranboundary rivers based on international water law. The development of interstate relations in this direction using international legal norms, along with political commitment for dispute resolution both in water quantity and quality, is the most important element of a transboundary water resources management and protection strategy.

Joining the Helsinki Convention. Other Central Asian countries joining the Helsinki Convention is a perspective that would be an important step for water relations development.

Strengthening the role of IFAS and its regional organizations. Strengthening the role of the IFAS and its regional organizations is one of the priority directions. For our country, which is located in the zone of the Aral Sea ecological crisis, IFAS activity is very important because it integrates efforts of all states in soling a common problem.

Increasing the status of the ICWC and its executive bodies. It is necessary to increase the status of the ICWC and its executive bodies, BVO Syr Darya and BVO Amu Darya, as the international administration on transboundary rivers in the Aral Sea basin. This can be achieved through agreement between the states on the institutional structure of transboundary water resources development and protection strengthening in the Aral Sea basin. Agreement on information exchange and national, basin, and regional database formation is also necessary.

Establishing the International Water-Power Consortium. The system of transboundary water resources management should be qualitatively improved, e.g., the IWPC should be established, which would provide for the rational and effective use of water resources, and the joint operation of water structures on a mutually beneficial basis. For this, rapprochement of legislation is needed to develop the position that meets the interests of all parties. Establishing the IWPC will avoid the necessity of negotiating annual agreements on the Naryn-Syr Darya cascade operation regime and solve related issues.

Strengthening the Hydromet Service. Activity on joint and rational water resources use with neighboring states is based on Kazgidromet data both in qualitative and quantitative aspects. During the last years, due to budget cuts, the hydrological network has been reduced three times. This has negatively impacted Kazakhstan water resources management. Hydrological observations on transboundary rivers (with PRC, Russia, Kyrgyz Republic, and Uzbekistan) require special attention.

Proposed concrete measures in solving water problems are as follows.

In regional water resource use and supply

- Improve the existing management utilizing the basin principles and new forms of management.
- Continuously assess the impact of social, ecological, economic elements on water resources and ecosystems.
- Determine allowable anthropogenic impacts on the basins.

- Restore and preserve water ecosystems and provide stable ecological situation in major river basins.
- Increase the share of available natural resources and their rational use to provide all economic branches and natural complexes.
- Increase the share of available natural resources through further river flow regulation, inter-basicn interregional groundwater reallocation and use.
- Introduce water saving technologies in water consumption.
- Reduce specific water expenses per production unit in industry and agriculture.
- Reduce operational water losses in water distribution and water use systems.
- Increase the volume of water recycling and rotation in enterprises.
- Use brackishwater in industry.
- Develop a program of rational use and conservation of water resources.
- Improve irrigation technique and technology; replace nonengineered irrigation systems with modern ones and introduce new methods of water use based on automation, computerization, and modeling.
- Develop a special program of water saving.
- Reconstruct and clean existing water reservoirs, and repair large water structures.
- Equip water systems with modern means of water metering, recording, and regulation.
- Create a single information system in water use; provide organizational structures with necessary office equipment.
- Propagandize rational and economic water use.

In environmental protection

- Restore and maintain water ecosystems in major river basins.
- Develop monitoring systems and raise the effectiveness of state control over their use.
- Strengthen the ecological aspect in economic activities.
- Reduce the anthropogenic loads on water basins.
- Form ecological conditions of rational water use.
- Eliminate wastewater discharge into water sources.
- Introduce collector-drainage waters reuse in places of their origin.
- Create water protection zones in all water sources, water reservoirs, and water bodies.
- Treat drainage water on irrigation massifs and eliminate melting and wastewater discharge to water sources.
- Determine the volumes of ecological and complex releases in the river basins.

In drinking water supply

- Implement the "Drinking Water" state program up to 2010.

In water sector management

- Separate management and economic activity functions.
- Complete water sector restructuring and reforming.
- Privatize water structures.
- Revise the central executive body's authority and functions in water resources use and protection by creating independent central executive body.
- Make a new inventory of economic instruments in the water sector.
- Apply the procedure of bankruptcy for unprofitable enterprises in the water sector.

- Turn over funds of bankrupt enterprises to firms, companies, and private entities.
- Introduce main assets turnover to long-term lease or concession.
- Create a network of information services and marketing.
- Create an insurance system for water activity and services.
- Strengthen the authorities and functions of basin organizations as a main link of water management.
- Establish limits and quotas for water use. In sphere of international collaboration in joint transboundary water sources use
- Protect the interests of Kazakhstan while developing agreements and treaties on transboundary watercourses joint use.
- Shift from annual agreements to long-term ones.
- Search for complex solution of transboundary water use with regard for needs of neighboring countries for Kazakh natural resources and transit potential.
- Support the activities of interstate bodies in transboundary water management and regulation.

In relations among Central Asian states

- Initiate activity on the Central Asian states joining the Helsinki Convention.
- Support IFAS activity.
- Raise the status of ICWC and its executive bodies.
- Conclude agreement on information exchange and formation of both basin and regional databases ffortransboundary resources use and protection.

Water Resources Management in the Kyrgyz Republic: Legal Base and Directions of Improvement

B. T. Koshmatov

Introduction

The Kyrgyz Republic area is 20 million hectares (ha) of which 10.8 million ha (54%) are arable lands. Pastures constitute 9.2 million ha (46%) and cultivated lands 1.4 million ha (7%) including 1.066 million ha (5.3%) of irrigated lands. The total population is 4.9 million. The Kyrgyz Republic possesses huge water resources supplies in rivers, glaciers, and snowpacks.

There are 3,500 large and small rivers in seven main basins: Syr Darya, Amu Darya, Chu, Talas, Ili, Tarim, and Issyk-Kul. These rivers cross the territory of the Kyrgyz Republic and go to Kazakhstan, Tajikistan, Uzbekistan, and Turkmenistan as well as to the People's Republic of China. Natural average multiyear flow is 44.5 cubic kilometers (km^3) and together with return waters the total comes to 47.23 km^3. Operational flow from surface sources includes, besides natural flow, return waters from irrigated lands discharged to water sources by surface and underground flow.

Mountains are natural accumulators of water, which in turn, feed rivers. The main source of water in the Kyrgyz Republic is melting snow and glaciers. There are rivers with underground recharge in the pre-mountain zone.

Water Allocation

The limit of water resources allowed by interstate agreement to be consumed is 11.9 km^3. Interstate water allocation was established in the Soviet time and was based on all-Union state interests with priority given to cotton-growing regions. Irrigation was developed according to the system of capital investments and resources planning that existed at the time. Water allocation was based on irrigated lands development, and, because of that, the Kyrgyz Republic received only 24.7% of the water resources formed on its territory. Comparison of actual diversions during the past few years and designed irrigation norm reveals that about 40% of the irrigated lands have low water availability. Due to the poor regulation of small rivers the real situation is even worse. This situation has been reflected very clearly during the last 2 dry years (2000–2001).

The flow coming out of the Kyrgyz Republic is 31.34 km^3 annually with 22.3 km^3 in the Syr Darya basin. The total volume of water transferred to other republics is 17.572 km^3 including Kazakhstan 6.591 km^3, Uzbekistan 9.559 km^3, Tajikistan 1.442 km^3. In turn, the Kyrgyz Republic takes 402 million m^3 from interstate water structures, including from Uzbekistan (7 structures) 325 million m^3, and from Tajikistan (Kairakkum reservoir) 77 million m^3. The greatest tension in water allocation is felt in the Syr Darya basin. This allocation is made according to the

framework agreement on the Naryn-Syr Darya cascade water-power resources use (17 March 1998) and annual agreements.

During recent years there were no serious problems in water allocation between neighboring states. In 1992 an agreement was reached between leaders of Central Asian water agencies to maintain existing quotas of water allocation. This decision was confirmed by the heads of state in Nukus on 20 September 1995 and in Kyzyl-Orda on 19 April 1996.

In recent years the Kyrgyz Republic has taken measures to improve interstate water relations. On 21 January 2000 an agreement between the governments of Kazakhstan and the Kyrgyz Republic on the use of interstate structures on the Chu and Talas rivers was signed. Subsequently, this agreement was ratified by the Kyrgyz Parliament (April 2001) and the Kazakh Parliament (February 2002). In accordance with this agreement, the parties share operation and maintenance (O&M) expenses proportionally to the volume of water received (Article 4). This agreement establishes a permanent commission on the operation and financing of water structures (Article 5).

Thus, a commission is to be established: its status, methodology of calculating expenses and damages—and their distribution between the states, participation share, and mutual payments should be developed. This is pioneer work in the sphere of interstate relations and requires a proper approach and performance. This is the first step in organizing shared participation of states in interstate structures O&M without the Kyrgyz Republic receiving any profit. This work requires certain expenses, and it is desirable to have these funded by donors because of the financial difficulties in the region.

Irrigated Lands

Irrigated lands are mainly supplied with water from small rivers due to peculiarities of relief (806,000 ha or 76% of irrigated area). Of this, only 86,000 ha are fed by regulated flow and 720,000 ha (89%) are irrigated by nonregulated flow. This causes unevenness of water availability during the growing season. Absence of regulating capacity on small rivers makes irrigation system operation more difficult and results in losses of peak flow. The small rivers are characterized by daily, decade, and monthly discharge irregularity, causing irregular water availability. The average water availability coefficient is 0.9 in May, 0.54– 0.58 in July and August, and 0.45 in September.

Large rivers irrigate 262,000 ha (24% of irrigated area), from which 154,000 ha are irrigated from regulated water sources. Thus, in the Kyrgyz Republic out of 1,066,000 ha irrigated lands, only 240,000 ha (22.5%) are fed from water reservoirs; water availability in other lands is not guaranteed.

Under existing conditions, there are 632 irrigation systems (covering 1,066,000 ha), which are served by water structures under Water Department administration. Engineered systems serve 430,000 ha of irrigated land. They have engineered intake structures on the rivers preventing siltation, passing peak water discharges, and guaranteeing water diversion from sources to irrigation systems; engineered canals are lined by monolith and reinforced concrete. Half-engineered systems serve 368,000 ha and they have engineered intake structures, partly lined canals, and are partially equipped by regulating structures. Nonengineered systems serve 222,500 ha. They do not have engineered intake structures, lined canals, or regulating structures. Total

length of main and distributive canals is 6,500 km and in-farm canals—21,500 km. Most of the regulating structures, gauging stations, and protecting structures are on main and distributive canals.

Water Facilities

The Water Department operates 62 pumping stations (irrigated area is 51,700 ha), 34 water reservoirs, and almost 400 basins of daily and decade regulation with total capacity 2 billion m^3.

Large water reservoirs are of IV and III danger categories and they are complicated with regard to their safety and reliability. They require urgent repair-rehabilitation work with replacement of gates, electric-mechanical equipment, control devices, and means of automation. The safety of these dams is an urgent need because of their ageing and location within high seismic zones. For example, Papan Dam, where work is conducted within the project irrigation systems rehabilitation, threatens two oblast centers: Osh in the Kyrgyz Republic and Andijan in Uzbekistan, with a total population of 1 million. Other large water reservoirs are used by two or more countries.

Land Reclamation

Many countries face issues connected with land and water resources that require actions in irrigation and drainage management. For the Kyrgyz Republic, where there are many mountains and a small quantity of arable lands, land resources and their protection are very important. Land reclamation covers a range of measures directed toward improvement of agricultural production and increasing land fertility: irrigation; drainage; clearing lands of bushes, reed, and stones; combating erosion; leaching saline lands; leveling fields; constructing ponds and basins, etc.

Drainage remains an important tool in agricultural development, because it creates conditions and possibilities for the use of fertilizers, new crops, machinery application, etc. In this role drainage is an important condition for competitive and stable agriculture. In most developing countries drainage plays an important role in food production as well as in rural zone development, helping improve health services, and solving other social issues. The total length of the collector-drainage network is 5,473 km (3,130 km open drains and 2,343 km subsurface drains). In the Kyrgyz Republic, 113 towns and settlements are waterlogged. Of all irrigated lands, 37% (398,000 ha) have bad reclamation conditions, of which 13% are subjected to salinization of different degrees, 19% have shallow groundwater; and 8% have crop yield reduced by 80%. The on-farm collector-drainage network, which constitutes 88% of the network, is in critical condition. Previously these systems were part of the collective and state farms, now they are managed by local administrations or private farms and, due to lack of financing, they have not been repaired for the last 10 years.

In the Chu Valley, which is the breadbasket of the country, each sixth hectare has a poor reclamation state. The same situation exists in the Tuyamuyun massif and the Uzgen rayon of the Osh oblast, in the eastern Issyk-Kul rayon, Batkent oblast, in the middle reaches of the Talas River, etc.

Water Systems Financing

Irrigation system financing has been reduced and the state of the systems is worsening: concrete repair work has been reduced three times, digging and transport machinery two times, andpersonnel four times. Irrigated lands with unsuitable groundwater levels have increased from 78,600 to 90,300 ha.

The Kyrgyz Republic invests annually 10 million som for reclamation of irrigated lands, which is not enough to keep up with the needs of O & M. Irrigated agriculture is the main form of agricultural production in the Kyrgyz Republic. Irrigation systems exhibit the following characteristics: zonal differences, small amount of land suitable for irrigation, natural moistening, and irrigation system deterioration. Because of lack of funding, it is necessary to attract private and foreign investments in the water sector for O&M. Territorial and basin bodies will play an important role in such market formation.

Water sector financing is performed now from two sources: the state budget and water delivery fees.

Unfortunately, during the last 10 years, due to lack of financing, the state of the main canals, dams, and other structures has deteriorated and they have lost their operational reliability. The total primary and secondary canals capacity has been reduced by 25%. Large peak flows in 1999 led to an emergency situation for the intake headworks. The safety of high dams is also questionable.

Water Systems Management

Water resources management at the national, oblast, and rayon levels is executed by the Water Department under the Ministry of Agriculture and Water Resources. The previously independent Ministry of Water Resources was combined with the Ministry of Agriculture for budget unification and better coordination of activities. The Water Department regulates water resources use and irrigation infrastructure design, construction, and operation. The Ministry of Emergency, the State Agency for Geology, the Ministry of Health, Kyrgyzzhilkommunsoyuz, and the Rural Water Supply Department are also partially in charge of water management.

Major Directions in Kyrgyz Water Sector Development

Program of Concrete Measures and Actions

By the end of 1999, the Government had considered the state of the irrigation fund and approved the program of concrete measures and actions including

- reforming the water sector;
- improving the tariff policy for water delivery from state irrigation systems;
- realizing measures on establishing sustainable water users associations (WUAs), giving assistance in irrigation systems rehabilitation, and O & M;
- attraction and effective use of foreign investments for constructing small hydropower plants, irrigation systems rehabilitation, flood control, and irrigation perspective development; and
- completion of the national water strategy regulating actions, measures, programs, contracts and agreements both within the republic and in interstate water relations.

Current Projects

Taking into account the importance of the irrigation subsector, since 1996 the Government has undertaken measures to attract International Association of Development (IAD) loans for support of this subsector. Since October 1998, the project "Irrigation Systems Rehabilitation" and since July 1999 the project "Emergency Flood Protection Measures" has been started. At the moment, the project

"On-farm Irrigation" has been launched. The total cost of all these projects is $85 million, of which $65 million comes from loans and $20 million is allocated from the state budget. Successful realization of these projects will provide rehabilitation of significant portions of the irrigation infrastructure and increase irrigated lands water availability and productivity.

Major Future Directions

Major directions in water sector and irrigated agriculture development are restoration and development of the country's water-related base through

- reforming institutional structures and decentralizing management, transferring to rural water consumers and their associations a substantial part of the state irrigation systems, maintaining relevant infrastructure under state administration—large dams, hydrounits, inter-rayon canals and pumping stations;
- developing and introducing economic measures to promote the rational use of water resources, including paid water use on a contractual basis and water delivery services according to tariffs providing normative indicators of operational costs and expenditures;
- rehabilitating on-farm and interfarm irrigation infrastructure, creating necessary normative potential for further operation;
- attracting internal and external investments for further O & M of the Scientific Information Center of the Interstate Coordinating Water Commission irrigation fund and reforming development;
- developing typical, scientifically grounded, and economically accessible irrigation structures of on-farm and on-association water use and consumption;
- fully developing available irrigated lands that provide existing irrigation regimes;
- gradually reducing state subsidies and increasing WUAs' economic independence;
- completing the first stage of rehabilitating the state irrigation network at the expense of investments and internal sources of financing;
- developing and realizing a scheme of industrial base development linked with a program of irrigated farming development;
- raising water consumption up to a desirable level with full satisfaction of all needs;
- designing and constructing regulation facilities on small rivers for winter and peak flow use to guarantee irrigated lands' water availability;
- putting into operation uncompleted water structures to permit full water resources use—South BChK, on Chu tributaries, Kara-Buura reservoir, South Talas canal, Nizhne-Ala-Archa reservoir, second line of Obvodnoi Chu canal, etc., and irrigated lands expansion from existing reclamation fund; and
- improving the legal base in irrigated farming and water sector, including
  - contractual economic interstate relations on the Kyrgyz Republic's water resources use;
  - completion of WUAs and of their rayon and basin associations establishment and transfering to them a substantial part of the irrigation fund;

- transforming all basin water administration into independent self-sufficient bodies; and
- revising tariffs for water delivery in order to cover all O&M costs.

Actions on Increasing the Effectiveness of Water Resources Use

The following actions on increasing the effectiveness of water resources use are foreseen in the "Complex Base of Development up to 2010" accepted by the National Meeting on 29 May 2001.

- Introduce amendments and complements in water legislation with regard to the changed political, economic, and social situation.
- Complete the water cadastre of the Kyrgyz Republic.
- Assess return waters impact on basin water balances.
- Adjust and introduce UN and Swiss Agency for Development and Cooperation (SDC) indicators for assessing sustainable water use.
- Introduce modern systems of water fund management.
- Form a single national database of the water fund in the Kyrgyz Republic.
- Establish WUAs and support their activities on sustainable development.
- Gradually introduce updated technologies in irrigation.
- Introduce economic tools for transition to effective water use, water saving, and water protecting technologies.

Development of the Water Management System in Tajikistan

A. A. Nazirov

Introduction

Since independence, international water relations among the Central Asian republics have been established and the Program of Concrete Actions for Environmental Improvement in the Aral Sea basin has been adopted by the presidents of Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan. In addition, at the initiative of the President of Tajikistan E. Sh. Rakhmonov, the UN General Assembly declared the year 2003 to be the International Year of Freshwater. In this context there is an urgent need in Tajikistan to improve government policy in rational water use and conservation and to attract world attention to this important issue. In December 2001, the Government of Tajikistan approved the "Rational Water Use and Conservation Concepts."

Tajikistan has great water reserves. The total glacial reserves are about 845 cubic kilometers (km^3), more than seven times the annual flow in all the rivers of the Aral Sea basin. The average, long-term river flow originating in Tajikistan is 64 km^3/year or 55.4% of the average, long-term runoff in the Aral Sea basin. Waters in most areas of the republic are of good quality for drinking and have favorable hydrochemical composition for irrigation use. Over 1,300 lakes with a total area of 705 km^2, hold more than 46.3 km^3 of water, of which 20 km^3 are fresh. Difficult access has resulted in mountain lakes being insufficiently studied and they need additional research.

Tajikistan has nine operational reservoirs with capacity ranging from 20 million cubic meters (m^3) to 10.5 billion m^3 and net storage volume of 15.344 km^3. New reservoirs could be constructed in the Amu Darya basin with a total reservoir capacity up to 66.8 km^3 with 35.6 km^3 of net storage volume that is 56.6% and 30.2% of the average annual long-term river flow in the Aral Sea basin.

Having few oil and gas reserves and hardly any developed coal deposits, Tajikistan ranks eighth in the world in hydropower resources (527 billion kWh/year) with a net cost of 0.4 cent per kWh. Tajikistan is at the top regarding hydropower resources per capita and per unit area. Currently at least 40–50% of this hydropower capacity is technically feasible and as new techniques develop this figure will grow. At the present time, 5–6% of hydropower resources have been developed.

Water diversion in Tajikistan is about 20% of the flow formed in the republic and 11% of average long-term flow of the Aral Sea basin. The major water consumers are irrigated agriculture (84%), household-drinking and agricultural water supply (8.5%), industry (4.5%), and fishery (3%). The main and now priority water user in Tajikistan is hydropower engineering. These major players of the water management system influence the national development strategy of Tajikistan.

Land Management

Tajikistan is mainly an agrarian country; therefore agriculture is at the center of the most critical problems. There are two basic elements both forming and restricting agricultural development. Those are minimal land resources and water resources with a high cost of supply to fields. Considerable population growth, despite intensive development of new irrigated lands (and non-development over the last 10 years due to critical events), led to a decrease in available irrigated land per capita; in particular, arable lands decreased to 0.08 ha/capita and it is expected that this figure will become 0.07 ha by 2005. This is the minimum in the Central Asian region. Due to the shortage of arable lands, Tajikistan has had to develop marginal lands, such as sandy-stony, saline, and subsident soils of loess plateaus and mountain areas with slopes critical for surface irrigation. This has resulted in excess soil erosion. At the present time (2002) Tajikistan has 720,000 ha of irrigated lands.

Major factors restricting soil fertility in the republic are as follows: 22% sandy and stony soils; 16% saline soils; 8–10% soils subjected to water and wind erosion; and 10–12% lands irrigated on subsident soils. Thus, 55–60% of the irrigated lands have unfavorable characteristics that limit their fertility and hence agricultural production. Reduced cropped area, particularly irrigated area, demonstrates the effects of those factors. Maintenance of such lands to ensure their effective output requires huge power and material resources both during development and operation. As a result, in the 1980s Tajikistan had the highest output from irrigated lands among Central Asian countries.

Complex, hilly, and flat relief influence the current water management system in Tajikistan. It consists of a complex, unique, and, to a certain degree, a vulnerable system of hydrotechnical structures.

Irrigation Systems

Up to 60–70% of the irrigation systems were once well equipped. The value of the capital reclamation stock was $1.5 billion. By 1990, quite extensive collector-drainage networks had been constructed on 311,200 ha (on average 36.2 meters per ha) with drainage rate of 0.3–0.4 l/s/ha. Vertical drainage wells cover 47,400 ha, of which about 60% is nonoperable due to lack of funds for their rehabilitation and irregular power supply. The interfarm system includes 5,896 km of water supply network, 432 km of drainage network, about 8,000 hydrostructures, 517 pumping stations, 26.6 km of tunnels, 3,272 km of roads, and other stock. Farms manage 26,000 km of irrigation system, 16,100 km of drainage system, and about 15,000 hydrotechnical structures.

Population growth and shortage of lands for gravity irrigation led to increased development of lift irrigation, which was the most vulnerable to market conditions. In Tajikistan up to 40% of irrigated lands (about 300,000 ha) are served by pumping stations, of which 64% are located in Sogd oblast. Almost 30% of the pumping stations are many-stage and pump water through 5–7 stages up to 250–300 m and more. These stations have complex hydromechanical and power equipment, and operation mode and therefore they require highly trained personnel, the level of which drops due to the outflow of professionals from the sector. The socioeconomic consequences of transforming the zones with cascade pumping stations into pastures with cattle breeding, as proposed by a range of international consultants, threaten the population of these zones. This will cause secondary desertification and migration, and solution of this problem will be more costly than maintenance of pumping

stations. Tajikistan is undertaking measures to cultivate more profitable, low water-consuming crops and is applying preferential power supply during the transition period. As a whole, Tajikistan lacks water meters, particularly in private farms, which complicates water service payments.

Maintenance and Rehabilitation of Irrigation and Drainage Systems

Until 1996 all the costs were borne by the Government. Since 1996, with transition to market a economy, payment for water supply services has been introduced. However, during that period, farm consumers could cover only a small portion of operation and maintenance (O&M) costs resulting in more than a 50% deterioration of the irrigation and drainage system, reduced efficiency of water supply, and increased deterioration of lands on more than 100,000 ha. Thus, during 1992–2002, on average 5–6% of the needed O&M investment in irrigation and collector-drainage systems was made and 30% of the systems required major repair.

Due to the critical economic situation since 1992, development of new irrigated lands and reconstruction of irrigation and collector-drainage systems have been almost stopped, and all efforts have been focused on maintenance of existing systems. Upon a certain revival of economy and an increased collection of payments for water supply services (40% in 2000 and 51% in 2001), cleaning of irrigation and collector-drainage systems raised from 25% in 1999 to 43% in 2001 against levels of 1990 when volume of these works was more than 32 million m^3.

Tajikistan faces the complex, capital-intensive, and long-term task of rehabilitation and improvement of the technical state of irrigation and collector-drainage systems since these systems play an important economic, environmental, and ecological role for 75% of the population (4.6 million people). It is necessary to take inventory of capital stock, which has not been done since 1990, to solve this task. Then, based on this inventory, we will develop and implement first priority, medium- and long-term measures on rehabilitation and further development of irrigation and drainage in Tajikistan. It is necessary to note effective cooperation between Tajikistan and international donors toward these directions. Currently we have the Republican Support Center for Farm Privatization, which deals with rehabilitation of inter- and on-farm irrigation and collector-drainage infrastructure in 10 pilot rayons through a World Bank $20 million loan. The Asian Development Bank allocated $4.5 million for rehabilitation of the Yavan water supply system, including reconstruction of 7.5 km of irrigation tunnels and construction of bypass canals. The Islamic Development Bank gave a loan for an irrigation project of 6,000 ha in Dangara Valley (in the south of Tajikistan).

Rational water use, to be reached through improvements to the soil—landscape, reclamation, water allowance zoning, application of sound irrigation scheduling and advanced water saving technologies, and the improvement of the reclamation state of lands—is of economic and environmental importance. Improvement of irrigation system efficiency and irrigation techniques and technologies, as well as major and current land leveling and all-round reconstruction of irrigated lands, will be implemented through long-term programs. This will require investments from effective Tajik legislation sets the following investment sources:

- funds collected from water consumers;
- national budget;
- local budgets;

- land tax;
- foreign investments; and
- other sources not prohibited by law (private sector, funds received from expropriation of lands for nonagricultural needs, tariff and tax regulation for raising effectiveness of irrigated agriculture, etc.)

In general, investments in rehabilitating irrigation infrastructure will depend mainly on standard financing of infrastructure maintenance.

Water Management System

The Tajik water management system is a good basis to achieve food security. To meet demands of both the population and the national economy for grain and cereals, a targeted comprehensive program is being implemented to increase cereals production and reach yields of 1 million tons, including at least 40 centner of rice and wheat per 1 ha of irrigated lands, 50 centner/ha of maize, and 30 centner/ha of soybean. The problem of increasing cotton yields and its production up to 700,000 tons (450,000 tons were gathered in 2001) should be dealt with at the national level and, first of all, by searching for effective investors. In particular, the Government has decided to stop gradually cultivation of cotton on stony and sandy soils, which requires high costs and irrigation water, and on steep slopes causing soil erosion, and to transfer to less power-consuming technologies for sustainable and economically sound yields. Appropriate tasks are established in other directions, such as cattle breeding, viticulture, potato production, etc.

Calculations show that in the next 10–15 years and in the far future, water consumption will depend on sustainable economic development, demographic situation, formation and implementation of living standards system, gradual improvement of livelihoods, and development of all economic sectors. However, the food problem is getting increasingly critical and has to be solved by increasing current land productivity, mainly irrigated lands, and developing all suitable new irrigated areas covering only 880,000 ha. Thus, the total area of irrigated lands will be 1.6 million ha. They will be developed gradually, it will take many years, and downstream states in the Amu Darya and Syr Darya basins will have an opportunity to reconstruct their irrigation systems as well.

Optimization of the water management system in Tajikistan is considered at the institutional, technical, and economical levels. Technical problems of water supply in economic sectors and the environment should be solved by increasing the available share of natural water resources and using them rationally with simultaneous implementation of water conservation measures. Institutional and economical measures should be implemented at the national and international levels. The following actions are planned in Tajikistan:

- gradual transition to system management approach within hydrographic, not administrative, boundaries (basin principle);
- acceleration of extensive WUA establishment;
- application of water demand management in practice;
- provision of differentiating payments for water supply depending on specific conditions; and
- development of various types of private, collective, and stock-holding water use based on market water activities.

Regional Water Resources Management

Taking into account all above-mentioned, as well as development of industry, especially mining, and other economic sectors, future water consumption in Tajikistan will be at least 19–22 km. That corresponds to an equitable water allocation and to the principle of integral sovereignty over natural resources, which is reflected in UN General Assembly's Resolution 1803 (XVII): "People and nations' right to integral sovereignty over their natural wealth and resources must be realized in the interests of their national development and well-being of appropriate states." This will require the establishment of new interstate water allocations. Currently, the water resources of Aral Sea basin are used based on adopted post-Soviet agreements, but on the basis of feasibility studies done by the Soviet period when compensation mechanisms to level out inequitable water allocations was active. In the past, priority in development of new irrigated lands belonged to republics with maximum cotton and rice production. As a result, Tajikistan has less irrigated land and water available per capita as compared to other Central Asian countries. Under conditions of the single state system Tajikistan received fuel, power, financial and technical resources for an inequitable water resources allocation. Under the new political and economic conditions, due to the absence of economical water use mechanisms, former water allocations have become unacceptable. Therefore, the main issue in the Aral Sea basin is interstate water allocation, including guaranteed water supply to the Aral Sea. Other problems, including environmental ones, are derived from the main problem, solution of which will depend on the basin states and their joint efforts.

The foreign policy of Tajikistan in the field of water relations is aimed at integrated water use; consideration of water as an economic welfare; and establishment of an economic water use mechanism; support of regional efforts on joint water management; and establishment and strengthening of conflict resolution mechanisms. Reliable forecasting of water availability from sources and mutually acceptable compromises will help solve emerging water use problems.

In 1994 in Nukus, during approval of the program of concrete actions in the Aral Sea basin, the heads of the Central Asian states agreed to develop a new water allocation strategy for the region. Thus, in this regard, the Global Environment Facility (GEF) Water and Environmental Management Project and the United Nations Special Programme for the Economies of Central Asia (UN SPECA) projects have been implemented.

In view of the water use conditions formed during the long years when the Central Asian peoples jointly lived under a single state system, and now in the context of their new independent states, two scenarios for regional water resources use are being considered.

- Continue the old practice, when downstream countries kept using water resources for irrigation needs, thus causing a sharp power crisis in the upper watershed countries.
- Use water for power needs, thus leading to water scarcity in the lower reaches of the river basins.

Both these options are extreme and cannot be acceptable for all the nations in the region. Therefore, there is an urgent need to optimize operating modes of hydrostructures taking account of both national and regional interests. This can be solved only by establishing a mechanism of mutual services and compensations. Thus, with regard to water use in the Central Asian region the states should build

their relationships based on tolerance for each other. In general, these relationships are being developed in a civilized manner. InFebruary 2002, in Almaty we celebrated the 10th anniversary of the Interstate Commission for Water Coordination in Central Asia, which plays an important role in practical water management at the regional level. Presidents of our states are carrying out leadership of the International Fund for Saving the Aral Sea Saving on a rotational basis.

Since the beginning of 2002, leadership of this Fund has been transferred to the President of Tajikistan, E. Sh. Rakhmonov, for the next 2 years. In December 2001, the Central Asian Economical Community was transformed renamed the Central Asian Cooperation Organization. I would like to wish all of us effective cooperation.

Water Resources of Turkmenistan: Potential, Technology, and Ecology

K. M. Volmuradov

Introduction

The total water resources of Turkmenistan consist of surface runoff of the Amu Darya, Murgab, Tejen, Atrek, and smaller rivers of the northeastern slopes of the Kopetdag mountains and insignificant amounts of ground and collector-drainage waters. Surface water constitutes 87.5–98.2% of the total water resources of the country. All water resources of the country are formed outside the country and are transboundary ones. The total water resources available to the country amount to 25–26 cubic kilometers (km^3).

It can be clearly stated that Turkmenistan, having huge climatic potential and land resources, faces a real problem of water scarcity. The Karakum River (canal) has special importance to the country. Its length is 1,300 km and the area of the lands irrigated from the river is 1,250,000 hectares (ha). The intake is located on the left bank of the Amu Darya in the Mukry gorge. The average annual intake from the Amu Darya is 12–13 km^3.

Additional water resources can be captured by constructing mudflow and flood protecting reservoirs, but taking into account that filling them depends on climate changes, this solution is doubtful. The problem of protection from mudflows and floods remains very acute for the Murgab, Tejen, and Atrek rivers and the Ministry of Water Resources is taking the necessary measures in this area.

The main consumer of water resources in Turkmenistan is the agriculture sector, which uses 96% of all the resources. Other consumers are as follows:

- population - 2.2%;
- industry - 0.9%;
- pastures - 0.25%; and
- other consumers - 0.25%.

In accordance with the "Strategy of Social-economic Transformations in Turkmenistan for the Period up to 2010" irrigated land area is supposed to increase up to 2,240,000 ha in the nearest years with the rehabilitation of 1,335,000 ha of land. With regard to agricultural development, water demands can be satisfied only under certain conditions, of which the most important are

- improving the technical level of irrigation systems through reconstruction;
- reconstructing and reclaiming irrigated lands;
- increasing the regulating capacity of existing water reservoirs and constructing new ones to regulate flood flows; and
- increasing collector-drainage, and industrial and municipal wastewater use.

Management of Future Water Demand

To resolve the latter -- the wastewater problem—President of Turkmenistan Saparmurad Turkmenbashi's Decree 3172 "About Karakum Lake Creation" was issued on 31 August 2000. This decree calls for the building of the collector in the

Karashor depression to dispose of and reuse collector-drainage waters for pasture watering, irrigation, etc. Calculations show that if irrigation system efficiencies are increased up to 0.75%, the need for irrigation water can be covered by existing resources. However, if efficiencies remain at the current level, agriculture water availability will be about 75–77% and this will negatively impact the agriculture sector.

Analysis of water consumption by other branches of the economy and assessment of their likely development indicate that total water resources used by these branches is about 1.7– 1.8 billion m^3 and by 2020 it will be about 4.0 billion m^3.

The main measures for reducing the projected water deficit include

- improvement of irrigated land reclamation and irrigation system technical state;
- improvement of irrigation techniques and technology; and
- increasing water reservoir capacity.

The development of additional water sources is possible: for example, brackish collector-drainage water can be used for leaching slightly and medium saline lands, allowing the use of irrigation water during the growing season more rationally. After treatment this water can be used in industry.

In principle, the projected water deficit can be covered by

- increasing irrigation system efficiency;
- introducing water saving technologies with water reuse; and
- constructing regulating reservoirs for accommodating peak flows.

The realization of these measures requires significant capital investments.

Water Resources Management

Every year the Ministry of Water Resources (MWR) provides water supply to irrigated lands. The program of rehabilitating the reclamation network, hydrostructures, pumping stations, wells, and gauging stations is under way. The Etrap (local administrative level) operation services' interaction with leaseholders has been established. To provide water to all irrigated lands in the future, the irrigation network must be improved. The most important construction projects are

- the main Turkmen Collector and Turkmen Golden Lake;
- the Dostluk dam jointly with Islamic Republic of Iran;
- the barrages on 408 and 326 km of the Karakum River;
- increasing the Karakum River (canal) capacity (850–1,100 km);
- increasing the Serakh machine canal capacity to irrigate 18,000 ha of land;
- increasing the Oguzhan reservoir capacity;
- the Zeid reservoir to regulate Karakum River (canal) flow;
- reconstructing Daryalik and Ozerny collector jointly with Uzbekistan;
- land reclamation measures; and
- reconstructing irrigated lands.

MWR (separated from the Ministry of Agriculture and Water Resources by Presidential dDcree on 15 June 2000) is the main body for water resources management in Turkmenistan. All state planning of water resources management is executed by MWR. Under MWR there are 5 production associations in each Veloyat, the Karakum Canal (Karakumderyasuvhojaligi) association, the Turkmen Design Institute (Turkmensuvdesgataslama or Turkmengiprovodhoz), and the scientific-production center "Ecology." In each Veloyat association there are Etrap water boards

responsible for the irrigation system within each Etrap territory. Water resources management at the on-farm level is executed by the Etrap water boards, which provide water to leaseholders. The Etrap boards collect applications from leaseholders and submit them for fulfillment.

As it is evident from the above structure, water resources management in Turkmenistan is the obligation of the State. In accordance with Presidential Decree 31800 of 5 May 1994, industrial enterprises and other water users not connected with irrigation is paid according to the volume of water used. Water for irrigation is delivered free of charge within the established limits; for water taken over the limit, the fee is three times higher compared to the established tariff.

The operation of large drainage collectors is performed by Veloyat associations "Vodhoz" having operation subdivisions. Some of the main subdivisions are "Karakumderyasuvhojaligi," "Turkmendarya," Shacenem Canal, the Main Murgab Board that excludes+++++ the intervention of administrative-command management in the mentioned river, and canal systems management. Any optimized management structure cannot function successfully without regulations and scientific accompaniment. Because of that, the potential of scientific research and design organizations should be used.

Improvement of economic relations between MWR and water users is very important. Water charges should include the cost of water delivery and operation and maintenance (O&M) cost at the on-farm level. The main problem is financing the functioning of the water sector. At the moment, irrigation water consumers cannot cover water services. That is why various alternatives for financing water organizations have been suggested:

- full cost recovery at the expense of the state budget;
- cost recovery at the expense of other sectors; and
- cost recovery at the expense of leaseholders and land users in amounts of 3% of their production. According to calculations this payment can amount to $16–20 million (1,900,000 tons [t] cotton by 1 million manat/t and 2,200,000 t wheat by 400,000 manat/t). Under this option only 20% of the cost would be covered by leaseholders. The rest of the cost should be covered by the State.

Water resources distribution is done based on preliminary applications from each economic sector using water resources. These are the priorities in water supply:

- drinking water supply and sanitation;
- industrial water supply, power engineering, and others including objects of defense; and
- agriculture producing food and export crops (cotton).

First of all, water supply is provided for the top two priorities and then to agricultural users. The water volume for drinking water supply is determined with regard to population growth and a water consumption norm. Water demand for industry is determined according to a production plan taking into account technological processes. Each ministry or agency determines needed water resources and makes an application for the current year. Plans of water supply for irrigation and other agricultural users are formed as below:

- applications for water are gathered from etraps depending on the plan for crop production, taking into account the cropping pattern and crop water requirements; and
- Etrap applications come to the Veloyat production associations, where plans of water supply to Veloyats are formed; and
- Veloyat applications come to MWR and a common plan is prepared and corrected according to the year's projected humidity.

Transboundary Water Management

Water diversion from the Amu Darya is regulated by the "Agreement between Turkmenistan and the Republic of Uzbekistan about collaboration on water issues (1996)". Water diversion from the transboundary Tejen and Atrek rivers is regulated by agreements between the former USSR (Turkmenistan) and Iran. On the Tejen River the "Agreement between USSR and Iran about mutual use of transboundary rivers and water along the boundaries from Geri-rud River to the Caspian Sea" (20 February 1926) is still in force. Amu Darya, Murgab, and Kushka river water allocation on the frontier sites between Turkmenistan and Afghanistan is not regulated because intergovernmental agreements do not exist.

Three draft interstate agreements were prepared jointly by five Central Asian republics on water resources use and protection:

- Agreement between Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan on the development of collaboration and distribution of functions between interstate organizations in water resources management, and development and protection in the Aral Sea basin;
- Agreement between Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan on water resources use under modern conditions; and
- Agreement between Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan on transboundary water resources joint planning and use.

The state system of water resources planning and use is based on the above-mentioned agreements taking into account the climatic forecast (water availability, precipitation, peak flow, etc.). In-year corrections of the Amu Darya water resources planning, management, and use depends on the water accumulation within the basin and based on Interstate Coordinating Water Commission (ICWC) proposals and decisions.

The volume of water resources and its distribution in the transboundary Atrek and Tejen rivers is regulated by relevant agreements that determine the share of flow for each country. The flow of the Murgab and Kushka rivers and other small rivers depends on natural factors influencing the long-term water formation, as well as on seasonal and temporal precipitation, which can vary widely.

Prediction of water availability in the Atrek, Tajen, Murgab, and Amu Darya rivers is impossible because the necessary information from their watersheds is absent in recent years. A separate question is the transboundary surface water management that is the responsibility of ICWC. For Turkmenistan, which does not have its own surface water resources, this question is of high importance because the Amu Dayra is the single source of water for the country's growing population and economic development. The water agencies of Turkmenistan work in close collaboration with ICWC organs, particularly the BVO Amu Darya.

I would like to express hope for further, close, and fruitful cooperation that will lead to solutions of all issues in the water sector of the Central Asian region and strengthening of relations between our countries.

Water Resources Management in Uzbekistan: Legal Aspects and Directions of Improvement

A. A. Jalalov

Introduction

An old proverb says, "Water is life," reflecting the meaning of water in our region. Because nothing is more valuable than life, water is a priceless gift of nature.

For centuries, water was the mighty incentive for economic and spiritual development. Creation and development of civilizations like Khorezm, Ferghana, Bukhara, Samarkand, and Baktria were connected, first of all, with the necessity to develop an irrigation culture in Mauronnahr (the ancient name of our region).

States and their names have changed; one people disappeared and another appeared; one religion replaced another; peoples assimilated; languages, traditions, and rituals changed; but one thing remained unchangeable—a respectful attitude to water, and an aspiration to save and preserve it. All this was transferred from one generation to another. We have lost much from the ancient traditions of the Khorezm, Ferghana, Bukhara, Samarkand, and Baktria peoples, but we saved the respectful attitude toward water from one generation to another.

Water relations developed with the establishment and development of states. During several millennia these relations between close neighbors grew from primitive to complex interstate relationships. To understand the complexity of these relations and feel the negative consequences of wrong or inexpedient actions, it is necessary to understand that the two great river basins were always one common region, a single state existed on its territory, and the peoples living here are relatives. Through the prism of these facts water relations in the region should be built.

The fact is, that five independent states originated in the region with different initial economic conditions, different directions of economic and political development, leading to changes in interstate water interrelations. Obviously, the previous relations were not interstate ones, because each republic's role in regional water resources management and distribution and experience in "water diplomacy" was minimal. That is why after the collapse of the USSR there have been contradictory and unreasonable actions in water management. Maybe, market conditions forced the republics to undertake these actions, which are in contradiction with international water rights, but they have allowed survival in the transition period.

Because of that, each water specialist and manager should be careful in any water related actions concerning interstate water interrelations.

Peculiarities of Water Resources Management in Uzbekistan

A mighty water system has been created in Uzbekistan during many generations, which provides all the economic branches with water. This system includes

- scientific research block,
- design research institutes,
- customers,
- construction and installation subdivisions,
- industry,
- transport services, and
- operational block.

All these blocks perform certain functions to create a common water-economic complex fulfilling two tasks:

- water supply, and
- irrigated lands reclamation state provision.

Water is supplied to 4,235 water consumers, including 2,739 agricultural and 1,496 non-agricultural enterprises (municipalities, power engineering, industry, etc.). Irrigated lands amount to 4,270,000 ha. From the total water supply, 87% is used by agriculture, 3.8% by power engineering (taking into account return flow), 3% by industry, 4.2% by municipalities, and 2% by other activities.

For water resources management, distribution, and use, there is a state survey headed by MAWR that includes special republican, oblast, and rayon associations, and inter-oblast and inter-rayon canals management boards. These functions are carried out according to administrative-territorial as well as basin and system principles.

Water resources management, distribution, and use are regulated by the following documents:

- Constitution of Uzbekistan, 1992;
- Law of Uzbekistan "About Water and Water Use," 1993;
- "Land Code" of Uzbekistan, 1998;
- Law of Uzbekistan "About shirkat farm," 1998;
- Law of Uzbekistan "About private farm," 1998;
- Law of Uzbekistan "About dehkan farm," 1998;
- Law of Uzbekistan "About nature protection," 1992;
- Cabinet of Ministers decree 385 of 3 August 1993 "About limited water use in the Republic of Uzbekistan";
- Cabinet of Ministers decree 174 of 7 April 1992 "About water protected zones of water reservoirs and other water bodies, rivers, main canals, and collectors as well as sources of potable water, recreation meaning in the Republic of Uzbekistan";
- Provision "On the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan," 2001; and
- other directive documents.

In accordance with Article 55 of "Constitution of the Republic of Uzbekistan":

"Land, depths, fauna, flora and other natural resources are all national property, are subjected to be rationally used under state protection."

In accordance with Article 1 of "Constitution of the Republic of Uzbekistan," the main objectives of water legislation are as follows:

"Water relations regulation, rational water use for population and economy needs, water protection from pollution, salinization, and exhaustion as well as negative water impact; water objects improvement and rights of enterprises, organizations, dehkan farms and citizens in field of water relations."

Article 3 stipulates, that "water is state property—a natural richness of the Republic of Uzbekistan—should be rationally used and protected by the state."

Article 4 establishes a "single state water fund of the Republic of Uzbekistan, which includes rivers, lakes, water reservoirs, other surface water bodies and sources, canals and ponds, groundwater, and glaciers."

At the same time, the law stipulates that the "right for water use from interstate sources— Amu Darya, Syr Darya, Zerafshan, Aral Sea, and others—is determined by interstate agreements." That is, the law "About water and water use" recognizes relevant requirements of "transboundary watercourses," which are called "interstate" ones. This law also determines that the State (through authorized bodies) performs management and control in water use and protection.

Article 30 of the Law introduces limited and fully or partially paid water use. The order and conditions of limited water use are determined by the Cabinet of Ministers decree 385 of 3 August 1993, which approves the "Provisional order of limited water use in the Republic of Uzbekistan."

In accordance with the Law of Uzbekistan "About water and water use", (Article 8) special authorized state bodies on water use regulation are determined: water management bodies (surface water), State Committee of Geology (ground water), and State Supervision Committee (thermal and mineral waters).

All interrelations in water resources inside Uzbekistan are realized based on the abovementioned documents and contracts for water delivery. Water supply on a contractual basis is provided to all water consumers including between water organizations on the oblast and rayon border. As a rule, water passing volume on the border of a neighboring state based on interstate agreements is mentioned.

Interstate Relations of Uzbekistan on Water-Related Issues

The establishment of new independent states in the Aral Sea basin became a world historic fact. Common water resources belong to all nations of the region including Afghanistan and Iran. Limited resources and their value make them possible reasons for future interstate disputes and conflicts. In this basin the useful properties of water should be realized reasonably, because water is the source of drinking; industrial, recreation and irrigation water supply; means of transportation; and, simultaneously, it is the source of cheap energy and an environmental constituent.

Thus, it is necessary to link water resources distribution, limitation, and use with social, power, ecological, and food issues. Besides, and maybe it is one of the most important factors requiring attention, it is the natural habitat where the Central Asian peoples developed their own attitude during the past millennia.

In the time of a single Soviet state, all water resources were distributed among the republics and allocated to specific water consumers within each republic. The average annual basin flow is 119 km^3 from which 78 km^3 are in the Amu Darya basin and 41 km^3 are in the Syr Darya basin. From this flow 66.3 km^3 are in the Amu Darya trunk and 34.0 km^3 are in the Syr Darya trunk.

All interstate water relations are based on the Constitution of Uzbekistan, the Law "About water and water use," and regulated by interstate, and intergovernmental treaties, agreements, and protocols. Uzbekistan confirms all previous documents taking into account the existing situation in the region. Some previous documents may not agree with new legislative acts of certain states, but it is necessary to take into consideration that in the beginning of 1990s, when these documents were signed, all water resources were already distributed among the states and economic branches and all infrastructure was designed and constructed with regard for this distribution. Because of that, even small deviations from previous decisions may lead to misbalance in the whole region.

Two documents are basic, from our point of view: first, the basin schemes of complex water resources use and protection agreed by all states; second, the Agreement between Kazakhstan, Kyrgyz Republic, Uzbekistan, Tajikistan, and Turkmenistan on collaboration in joint water resources for interstate sources use and protection (18 February 1992).

The first document, developed by relevant scientific-research and design institutes, determines the principles and physical volumes of water allocated in the region. These principles and volumes may not meet somebody's aspiration today, but they were carefully grounded and tested. All obstacles and conditions were properly analyzed taking into account possible directions of economic development and the demographic situation in the region.

The second document (Agreement of 18 February 1992) confirms the necessity of following all previously signed documents on water allocation and use. Beside these two documents, there are many bilateral and multilateral treaties, agreements, and protocols: on the Syr Darya basin, on small rivers of the Ferghana Valley, on the Amu Darya basin, etc. All these documents were accepted after long disputes, expert evaluations, and calculations.

It is worth noting the positive role of the framework "Agreement between Kazakhstan, Kyrgyz Republic and Uzbekistan on water and power resources use in the Syr Darya basin" (17 March 1998), which reduced tension caused by the Toktogul reservoir's shift to a power generation regime. Undoubtedly, this document is not ideal from the point of view of international water rights, and, maybe, it contradicts internal legislation of the parties, but under the conditions of the transition period it is the single "working" interstate document. Due to this agreement, equilibrium was achieved in the relations of states and all countries try to follow it, accepting annual "working agreements" with concrete terms, transfers, releases, and deliveries.

One of the initial documents is the "Protocol of the Scientific-Technical Council of the Ministry of Reclamation and Water Resources of the USSR" Decree 556 dated 10 September 1987, where water allocations to the states are determined, based on which bilateral agreements between Uzbekistan and Turkmenistan were concluded.

The establishment of independent states with their own programs of social and economic development created additional difficulties in water resources management due to new priorities of water use in each republic. These difficulties are the most critical in the Syr Darya basin, where power and irrigation needs contradict each other.

As a result of water resources exhaustion from maximum diversion, neglecting water quality issues and ecological requirements, as well as ancient traditions in attitude to water, many problems have emerged in the region requiring urgent solution. These are the following issues according to existing different priorities:

- water deficit, which is felt critically in dry years (1982, 1986, 1997, 2000, 2001);
- worsening of the ecological situation in river lower reaches,
- river water pollution by pesticides, herbicides, other harmful elements, and water salinity increase,
- land waterlogging and destruction of embankments, and
- irrigated lands reclamation state and fertility deterioration.

Perhaps, the command-administrative principle of water resources management and mistakes in design and construction also facilitated the creation of these issues. As was mentioned in the Beijing Declaration (21 March 1996), the "main unit of water resources management is the river basin and management should take into account current and future requirements, providing further water supply to all competing water consumers according to economic, ecological, and social objectives." The UN International Conference on Human Settlements pointed out that "the solution of these issues requires integrated water management, based on knowledge of the interconnections between water, sanitation and health; between economy and environment; between cities and surroundings; combines land use planning and water use; and guarantees a system approach and the introduction of real standards." Strong political support, interbranch and intersector collaboration, and the participation of all water consumers are needed for integrated water resources management.

Governments in collaboration with water consumers should

- conduct water policy with regard for economic, social, and ecological issues;
- promote collaboration between various sectors and bodies at the national and local levels for allocation of investments and improvement of effectiveness in the water sector;
- carry out institutional and legal reforms to arrange functions and competencies of various organizations;
- introduce economic tools and regulations to reduce losses and support water reuse and rotation;
- continue to develop bilateral and multilateral legal mechanisms for fulfilling the Rio Declaration Principle 13 on ecological damage compensation; states should follow Principle 16 supporting the "polluter pays" principle; and
- minimize damage from hydrological regime changes through development of agreed releases from water reservoirs with regard for all sectors' needs.

Stabilization of the ecological situation in the region depends mostly on measures directed at unreasonable water use in the basin by each country and water user, taking into account real water productivity.

Along with these measures, it is proposed to introduce certain amendments in the principle of limited water use, granting rights to downstream water users to divert more water. This will allow regulation of water diversions from rivers, taking into account both irrigated lands and water quality (mainly, its salinity).

Conclusions and Recommendations on Interstate Water Relations Improvement

The Central Asian region, due to its climatic conditions, closed water systems, interdependence of irrigation systems, mentality of people, and ancient traditions in water relations, requires specific and complex approaches to interstate water relations.

Being within a single state, complicated irrigation-reclamation systems were created in each country taking into account economic, climatic, soil, and relief conditions, serving water consumers both within the country and beyond it.

Taking into consideration the above-mentioned factors and conditions, an interstate legal base has been created for water resources management, protection, distribution, and use in the form of mutually agreed documents, which are followed by the states.

With the establishment of five independent states, destruction of economic links, change of state interests, and forms of property under transition to market conditions, fulfillment of obligations in interstate water relations has become more and more difficult.

The 17 March 1998 framework agreement and successive agreements on water and power resources use in the Syr Darya basin constitute a certain mechanism providing fulfillment of previously signed documents during the transition to a market economu. Along with economic situation strengthening, and sociopolitical conditions improvement, existing mechanisms of legal documents in interstate water relations may be changed as well.

Institutional Capacity Building for Regional Water Management in Central Asia

Strengthening the Role of IFAS Bodies and Refining the Priorities of the Aral Sea Basin Program

S. M. Aslov

Introduction

The primary objective of the International Fund for Saving the Aral Sea (IFAS) is to finance joint practical actions and promising programs and projects to save the Aral Sea and improve the environmental health of the Aral region and the entire Aral Sea basin, given the interests of all countries of the region.

In accordance with the regulations of the IFAS approved by the heads of states of Central Asia on 9 April 1999, the IFAS is financed by contributions of the founder states and members. Beginning in 1998, founders and members of the IFAS have been defining current contributions as 0.3% of the income part of the budget of Kazakhstan, Turkmenistan, and Uzbekistan and 0.1% of the income part of the budget the Kyrgyz Republic and Tajikistan.

Contributions are transferred in US dollars in accordance with the exchange rate between the dollar and national currencies. The Fund's activities include not only developing and financing environmental and water management projects and programs, but also solving all other problems of sustainable development for the whole region.

The President administers activities of the IFAS, defines its foreign economic and international activities, puts forward proposals on amendments and addenda to the regulations of the Fund, and considers and approves work plans of the Fund.

The standing executive and administrative working body of the Fund is the Executive Committee of IFAS (EC IFAS). To arrange the work of the EC IFAS, each founder state assigns two authorized representatives. The Chair of the EC is charged with supervising and administering the activity of these representatives. The chair of the EC renders assistance to the work based on decisions of the Council of the Heads of States of Central Asia, and the President and the Board of the Fund. The Chair also coordinates the activities of the International Sustainable Development Commission and the Interstate Coordinating Water Commission on all issues concerning problems of the Aral Sea (Article 5.4, Regulations of the EC IFAS). In accordance with Article 5.2 of the Regulations of the IFAS, the EC Chair is entitled to represent without proxy the Fund in all governmental, international, and other enterprises and organizations, and have disposal of the Fund's property.

For the last 3 years, various circumstances have weakened the leading and coordinating role of the EC IFAS, but despite that, the IFAS has conducted active operations in all the republics. In accordance with the data provided by branch offices of the EC

IFAS in the countries, a series of measures was carried out at the expense of the countries' contributions to the IFAS. In particular, in 2000–2002 the Fund received the following contributions.

Table 1. Contributions to the IFAS

Country	Local Currency	US$ Equivalent
Kazakhstan	221.3 million tenge	1,440,658
Kyrgyz Republic	11.6 million som	253,115
Tajikistan	473,500 somoni	162,158
Turkmenistan	202.5 billion manat	38,571,428
Uzbekistan	11.62 billion sum	13,633,697
Total		**54,061,056**

Using these funds, the republics put into operation dozens of kilometers of main water pipelines; rehabilitated thousands of hectares of irrigated lands; cleaned collector and drainage networks; built several schools, hospitals, and other social institutions; supported the implementation of governmental health care programs; and provided people with drinking water.

At present, leaders of the IFAS and the EC IFAS are taking steps to improve the work of the EC and other IFAS organizations and speed up the implementation of projects and programs in the Aral Sea basin. In this context, the President of the IFAS requested the World Bank, European Union, and other organizations for assistance to EC IFAS to support projects and programs in the Aral Sea basin. Only the World Bank has consented to providing partial support for the EC IFAS activities.

Problems and Priorities of the Aral Sea Basin Program

Problems

Before 1960, the area of the Aral Sea was about 66,000 square kilometers (km^3), and its volume was over 1,000 cubic kilometers (km^3). The average annual flow of the Syr Darya and Amu Darya rivers was about 120 km^3. Precipitation brought about 6 km^2 and the ground flow about 5 km^3 of water to the sea. Evaporation from the sea's surface was approximately 63 km^3. Thus, the sea level varied in the range of 50–53 meters (m) under the Baltic reference system.

From 1960 to the 1990s, the use of water resources, mostly for irrigation, increased and totaled over 110 km^3 per year, and consequently, the flow to the sea decreased to 9–12 km^3. Hence, the sea level lowered by 17 m; at present, it is 36 m. The sea has lost over 50% of its area. Irrigation development and associated water diversion, especially in 1950–1990 when irrigated areas were virtually doubled up to almost 8 million hectares (ha), led to grave environmental problems.

Land salinization and increased salinity of waters of major water sources, lower groundwater levels, and discharge of highly mineralized collector and drainage flows are the main consequences of irrigating salinized lands. At present, about a third of the irrigated lands in the Aral Sea basin are deemed salinized. The yield of major crops on these lands is very low (less than one third of the yield on unsalinized lands). In the lower reaches of the river basins, it is difficult to find a source of drinking water supply that would meet mineralization requirements. Estimated annual losses from increased water mineralization are several billions of dollars. In the river deltas, these problems are most critical. In addition, the former deltas are exposed to desertification with grave consequences for people as well as the environment.

The environmental crisis spreads beyond the Aral Sea basin and draws attention due to the unstable use of water and land resources. The area of flow formation has lost over 50% of its vegetation. Soil erosion and manifestation of other natural disasters have intensified.

Inadequate management of irrigation and drainage systems as well as scant investments in rehabilitation of the irrigation infrastructure had severe consequences, which affect the economic development of the Central Asian countries.

To solve these serious environmental and economic problems of the Aral Sea basin, the heads of states of Central Asia adopted a program of urgent measures to overcome the situation. The heads of states decided on the necessity to agree on principles of water allocation, and, in 1992, the heads of water management agencies in Central Asia signed an Interstate Coordination Water Commission Agreement, making basin water associations subordinate to this commission. In 1993, the Interstate Council on the Aral Sea (ICAS) and the IFAS were established by the heads of state. In 1994, the implementation of the program of urgent measures started. The major goals of the program were

- to stabilize the environment in the Aral Sea basin;
- to rehabilitate the disaster zone around the sea;
- to improve the management of land and water resources in the basin; and
- to create a base of resources to solve the problems and implement the actions agreed.

On 28 February 1997, a single framework for the IFAS was created and the EC IFAS was established based on the ICAS and the IFAS to coordinate activities of the Central Asian countries and donors concerning the implementation of programs on problems of the Aral Sea basin. The main principles in implementing the program were aimed at

- rapid achievement of tangible results that would meet the interests of the countries;
- preparing national and coordinating of regional strategies to manage water resources and the environment; and
- forming public opinion to create conditions necessary for further actions.

The current social and economic situation and the drastic changes in the environment of the region have underlined the need to define new objectives to solve the Aral Sea crisis.

Priorities

Given that the program of urgent measures to overcome the Aral Sea crisis was developed in the early 1990s, the need to refine the previous priorities has come to a head.

Taking into account the countries' successes in developing technical and economic fundamentals of national and regional strategies of managing water resources and the environment in the Aral Sea basin, it is necessary to concentrate efforts of regional specialists on preparing long-term interstate agreements on the rational and stable use of water and energy resources of the Aral Sea basin. Such agreements would allow basin countries to reach a new level of mutually beneficial cooperation and sustainable development of the region.

Implementation of the program of urgent measures and development of a strategy of interstate cooperation in rational use and management of water resources and the environment have shown an urgent need to rehabilitate the irrigation infrastructure and, in particular, water and energy facilities.

Agriculture is the core of the economy of the Central Asian countries. The share of agriculture in the gross national product of the countries amounts to over 30%. However, stable harvests are possible only under sufficient humidification, i.e., irrigation. Availability of and accessibility to water resources, to a considerable degree, determines the stability of agricultural production. In this regard, monitoring and control over water resources play a significant role. Only the availability of timely and reliable information about snow and ice reserves and monitoring of water bodies would allow reliably forecasting available water resources and the water content of the year as well as the composition of agricultural crops and their yield.

Management of water and land resources in the Central Asian countries is complicated by natural hazards such as floods, mudflows and landslides. Therefore, there is a long-felt need to develop and implement a program of actions aimed at minimizing causes and mitigating the consequences of these processes, which inflict irrecoverable damage on the economies of the countries.

Each country in Central Asia pursues its own strategy of sustainable development. The common feature of these strategies is their orientation toward a higher living standard for the population. Along with major environmental and economic problems, new sovereign states of Central Asia also face intricate social problems. To prepare and implement programs of social rehabilitation, health care system improvement and job creation are among the main priorities for all countries in the region. Assistance in implementing these programs is an urgent objective of the IFAS.

An important factor for enhanced cooperation and close collaboration in various fields, including management of water resources and the environment, is the existence of interstate connections and interstate organizations capable of implementing joint projects. Improving the technical capacity of such organizations and raising their legal status require considerable efforts of all countries in the region.

The IFAS leadership proposed the aforementioned priorities for consideration by governments of the Central Asian countries. In addition, at its meeting on 23 August 2002, the IFAS Board rendered a decision to assign the EC IFAS the task of analyzing the implementation of the Aral Sea Basin Program and putting forth proposals on major directions of the program for 2002–2010 taking into account the priorities adopted. Performing this task, the EC IFAS will work jointly with the governments of founder countries.

Kazakhstan has already delivered its proposal to incorporate the following in the priorities.

- Develop regional and national programs on rational use of water by economic sectors of the Central Asian countries.
- Develop an international program of sanitary and environmental invigoration of populated localities and ecosystems of the Aral region.

Table 2. Priority Activities of IFAS until 2010

No.	Priority	Project	Expected Source of Funding	Notes
1	Develop interstate agreements on the management of water and energy resources in the Aral Sea basin	Syr Darya Basin Agreement	World Bank, European Union, United States Agency for International Development (USAID), etc.	Projects implemented in the region have created preconditions to conclude agreements (Program 1 Aral Sea Basin Program, Water Resources Management and Agricultural Production [WARMAP], Environmental Policies and Institutions for Central Asia Program [EPIC], Management of Water Resources and the Environment [MWRE])
		Amu Darya Basin Agreement		
2	Rehabilitate water and energy facilities and improve the use of land resources	Rehabilitate irrigation and drainage systems in the Central Asian countries	World Bank, European Union, USAID, etc.	
		Arrange safety of dams and water reservoirs		
		Improve the use of land resources	European Union .	Within the WARMAP Project, the European Union began implementing specific projects on improved land use. Implementation of these projects needs to be continued.
3	Improve systems of environmental monitoring	Establish a regional hydrology center	Swiss Government, USAID	The Swiss Government initiates the establishment of the Center. USAID expressed its desire to facilitate the implementation of the project.
		Develop a system of transboundary water monitoring in the Aral Sea basin	World Bank, European Union, USAID, Swiss Government, etc.	Equipment was installed on 37 transboundary stations. It is necessary to continue and develop the project.
		Improve the system of monitoring the snow and ice resources of the region	World Bank, European Union, USAID, Swiss Government, etc	USAID and the Swiss Government started creating monitoring system.
4	Program of combating natural disasters	Develop projects on prevention of wind and water erosion	World Bank, Asian Development Bank (ADB), European Union, USAID	
		Carry out measures of riverbank protection	World Bank, ADB, European Union, USAID	
5	Program of assisting the settlement of social problems of the region	Assist in implementing health care programs in the Central Asian countries	World Bank, ADB, European Union, USAID	
		Assist in implementing programs of higher living standards and job creation	World Bank, ADB, European Union, USAID	
		Assist in implementing projects of providing population with drinking water	World Bank, ADB, European Union, USAID, Kuwait Fund, German Fund KfW	
6	Reinforce interstate organizations	Improve the technical capacity and legal foundations of interstate organizations (Central Asian States, BVO Syr Darya, BVO Amu Darya, Executive Committee of IFAS [EC IFAS], Interstate Coordination Water Commission [ICWC], International Sustainable Development Commission [ISDC])		
7	Develop and implement regional and national programs of environmental actions in the area of flow formation			
8	Develop and implement regional and national programs of water saving and reduced water use by economic sectors			
9	Develop and implement an international program of sanitary and environmental invigoration of populated localities and ecosystems of the Aral region and an international program of restoring the environmental stability and bioproductivity of the precious ecosystems of the Aral region, which are included in the List of Internationally Protected Natural Resources			

- Develop an international program of restoring environmental stability and bioproductivity of the precious ecosystems of the Aral region, which are included in the List of Internationally Protected Natural Resources.

After discussing the priorities with representatives of the republics, these priorities need to be approved by the Central Asian heads of states at a meeting on Aral Sea basin problems planned for early October 2002.

After approval by the heads of states, the EC IFAS would hold a meeting of donors regarding these priorities in late November 2002. The task for the EC IFAS is to prepare, in cooperation with Central Asian governments and other IFAS organizations, booklets and technical proposals for the meeting, taking into account the priorities.

Strengthening the Organizational and Technical Potential of Regional Organizations in the Aral Sea Basin: ICWC Scientific Information Center

P. D. Umarov

Organizational Structure

The Interstate Coordinating Water Commission (ICWC) was established by the Agreement among Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan, signed on 18 February 1992 in Almaty to settle issues of the Aral Sea basin water resources regulation, and effective use and protection. The ICWC is a collective body of the Central Asian states that acts on the basis of parity, equity, and consensus. By the decision of heads of states of 23 March 1993 and 9 April 1999, ICWC and its organizations including the Scientific Information Center (SIC ICWC) are subordinated to the International Fund for Saving the Aral Sea (IFAS) and have an international status.

ICWC members are the heads of government agencies in the water sector of the five Central Asian states. This makes the ICWC the only structure in the region capable of organizing real cooperation in water management at both the regional and national levels, including all stages of the water sector management hierarchy bottom-to-top, including interaction with nongovernment organizations (NGOs) within each country. The river basin water organizations (BVOs) Amu Darya and Syr Darya, the SIC ICWC, and the Secretariat are the executive bodies of ICWC.

The BVOs organize planning of water release regimes and water resource allocation, and direct execution of decisions taken at ICWC meetings as to water diversion, schedules of water delivery, and water quality control. SIC ICWC is an analytical and information center elaborating principles and directions of perspective development of the Central Asian water sector, and improvement of the water management and ecological situations in the basin. These organizations, continuously building up their capacity, have proved their sustainability and practical significance in solving daily issues of regional water resources management.

Main Directions of Activity and Capacity Building

SIC ICWC works with the network of scientific research and design institutes in the five Central Asian countries and has national branches in four of the countries, which organize scientific and information exchange at the national level. Information coming to the ICWC from the entire world is processed and disseminated to all the Central Asian countries to provide information support to the water sector. The priority objectives of SIC ICWC are as follows:

- regularly provide ICWC members with information on all changes occurring in water management in the world community;

- coordinate joint activities in the region;
- strengthen the legal framework and improve institutional structures;
- develop cooperation in water resources management and use based on advanced international experience;
- initiate and coordinate the implementation of regional projects; and
- provide advance training for water management specialists.

In accordance with its objectives, SIC ICWC—together with BVOs Amu Darya, Syr Darya, and the Secretariat—carry out the organizational-technical work of preparing for ICWC meetings. Meetings are held quarterly in every state, by turns, chaired by an ICWC member representing the host country. For example, the latest and 34th regularly scheduled meeting was held in the Kyrgyz Republic on 27–28 August and the next one will take place in Turkmenistan in the last quarter of 2002.

ICWC also deals with ecological issues related to the Aral Sea shrinkage and depletion of water resources, sets annual volumes of water supply as well as sanitary releases along rivers and canals. ICWC meetings consider the following:

- drafting of interstate agreements on shared water resources use;
- legal framework of water use;
- creation of a unified information based on water resources use;
- monitoring of irrigated lands and adjacent areas;
- common meteorological support; and
- coordinating joint research on scientific-technical support in tackling water management problems and implementing work.

At the 30th ICWC meeting on 23–25 August 2001, thematic working groups (institutional legal, finance-economic, technical and training) were established for arranging collective consultation work on developing principal documents of mutual interest. Appropriate standing orders and the main directions of their activity were approved.

Within the framework of the European Union Technical Assistance for the Commonwealth of Independent States Water Resources Management and Agricultural Production (EU TACIS WARMAP) Program, SIC has created and continues to develop a regional information system and database for water and land resources management. Information is collected and stored in the following system blocks: economy, surface waters, land, climate, industry, administrative-territorial division, and environment of the Aral Sea and Priaralie (Aral Sea costal and delta zones). All this information is available on the web site: «http//www.icwc-aral.uz». The bibliographic database on the Aral Sea basin management, developed by SIC, is also available on this site.

Alongside scientific-developmental works and in the interest of hydro-energy, irrigation and environment, SIC, jointly with its branches, facilitates interagency cooperation in the region through active participation in interagency commissions, conferences, and meetings dedicated to integrated water resources management in the Amu Darya and Syr Darya basins. Coordination of activities between the water sector and hydro-meteorological services has also been emphasized. This issue was given special consideration at the 28th and 29th ICWC meetings, where an action program was drawn up to resume regular observation at meteorological stations of regional significance to define more accurately the Amu Darya and Syr Darya flows

and augment the reliability of hydro-meteorological forecasts; as well as to restore hydroposts along Aral Sea basin rivers.

SIC ICWC assists the IFAS in promoting regional integration of efforts undertaken by various agencies and organizations to tackle the problems of the Aral Sea basin.

SIC ICWC, jointly with the network of scientific research and design institutes of the ministries of agriculture and water management, coordinates and performs scientific research under the ICWC Interstate Program. This Program is approved every 2 years and financed by the ministries of the countries. It is addressed to substantiating major components of ICWC policy in irrigation development, water saving, conflict-free water resources management, and protection in the Aral Sea basin.

Scientific research projects may be referred to as the most significant ones that SIC has been involved in, among which are the following:

- development of long-term plans and strategies of effective land and water resources use with respect to sustainable development in coordination with the UN International Program "Vision XXI";
- elaboration of recommendations on national planning of long-term water resources use;
- development of the main requirements for a water-energy consortium;
- formulation of provisions on integrated water resources management; and
- creation of a unified set of software for mathematical models of the basin and planning zones and development of a database applied to selecting zones of effective collector drainage use for irrigation in the region.

The results of scientific research works serve as substantiation for improving water management practice; they are presented at international workshops and published in collected articles, which SIC ICWC regularly issues.

Alongside scientific research works, SIC assists in implementing engineering and design works for improving hydrometric device capacity. This work is carried out by personnel of the Coordinating Metrological Center (recently organized as a regional organization) of ICWC, established on the basis of the Kyrgyz design institute "Vodoavtomatica and Metrologiya," which previously had been part of SIC ICWC.

Within the framework of international cooperation SIC actively interacts with the International Commission of Irrigation and Drainage (ICID). All ICWC member countries are ICID members, having established their national committees of ICID. These committees, created under the aegis of ICWC, have been gradually turning into rather appreciable nongovernment water management organizations—consolidating on the one hand highly qualified water management professionals, and on the other hand sectoral agencies with various water institutes. The recent example of such cooperation was the participation (with support from the Canadian International Development Agency [CIDA]) of an ICWC delegation in the XXVII ICID Congress in Canada (June 2002).

In March 2000, an ICWC and IFAS delegation (again with CIDA support) participated in the Second World Water Forum in The Hague, Netherlands. The materials of this forum reflect the long-term outlook for global water problems. The overall objective of the forum was to find consensus between water demands for nature, for producing food, for man and the world. It is possible to achieve this,

under the following conditions:

- implement integrated water resources management;
- equitably manage transboundary water use in the interests of neighboring countries and at the same time the natural environment;
- create and maintain appropriate water management infrastructure;
- create an information system; and
- increase water saving and productivity in every cubic meter of water.

It is expected that an ICWC delegation will participate (with support from the Asian Development Bank [ADB]) in the Third World Water Forum (WWF), to be held in Japan in March 2003. The main task of this Forum is to define ways and possibilities of transition from vision to action to ensure sustainable world development for the next 25–30 years.

A program to strengthen cooperation in integrated water resources use was worked out by SIC and approved at the 31st ICWC meeting on November 2001. In addition, SIC was registered by the organizing committee of the Third WWF in the capacity of a messenger and coordinator of the regional virtual forum, timed to this grandiose event—this being possible due to active participation of SIC in preparing for the forum. Such status of SIC permits us to involve all those willing to cooperate in developing partnership and integration in Central Asia. For this purpose a special program has been developed, and is now being implemented.

SIC ICWC has been cooperating at the level of membership with such international organizations as the Technology for Water Resources (TECHWARE), World Council on Water Supply and Sanitation (WWSCC), World Water Council (WWC), International Net of Basin Organizations (INBO), International Water Resources Association (IWRA), and Global Water Partnership (GWP).

Cooperating with UNESCO in developing and implementing "Global Vision XXI," SIC prepared the regional report "Water and Food," improved the "Globsite" model and is further perfecting it for analysis of the Aral Sea development scenarios.

SIC ICWC continues to cooperate with the World Bank, ADB, EU, United National Development Programme (UNDP), and United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP). A good example of such cooperation is the latest UN ESCAP workshop on strategic planning for Aral Sea basin water resources management, which was held jointly with the 34th ICWC meeting.

Since 1993, SIC ICWC has been a member of the International Program of Technology and Research of Irrigation and Drainage (IPTRID) network organized by the World Bank, ICID, UNDP, and Food and Agriculture Organization (FAO). This network is based on the following vital points of information:

- International Land Reclamation Institute (IRLI), Vageningen, Holland;
- International Water Management Institute (IWMI), Colombo, Sri Lanka;
- Bureau of Melioration, USA;
- Scientific center CEMAGREF, France; and
- Center of Hydro Research (HR), Wallingford, England.

Information obtained from the sources is processed by qualified experts, annotated, and disseminated in Central Asian countries through information and review articles, bibliographies, IFAS and ICWC bulletins (partly translated into English), which

SIC ICWC issues regularly. Circulation of these publications remains limited in number (though they are much in demand) because of insufficient production facilities and lack of funding.

One of the main directions of water sector capacity building is professional development. Taking into consideration the previous (1970–1980) experience of arranging and conducting international UN training courses for developing countries promoted by the former USSR Ministry of Water Management, and consequent experience of work with CIDA, Food and Agriculture Organization (FAO), Israel Center for International Cooperation (MASHAV), International Center for Agricultural Research in the Dry Areas (ICARDA), IWMI, TACIS, United Nations Educational, Scientific, and Cultural Organization (UNESCO), and World Meteorological Organization(WMO) (1997–2000), SIC developed advanced training courses for water management specialists of Central Asian countries.

On the strength of an ICWC decision of 24 October 98 adopted at the 21st ICWC meeting, the SIC Training Center was established in Tashkent for professional development of water specialists of Central Asia, under sponsor support rendered by CIDA, with participation of McGill University (Canada, Montreal) and Mount Royal College (Calgary, Canada). The objective of the courses is to provide high- and middle-level specialists advance training, and technological know-how in water and land resources management, irrigation, drainage, and environmental protection. Alongside professional skills improvement, this is intended for fostering cooperation between the countries of the region in water resources use and management, and development of unified approaches at the level of water specialists and decision makers.

The system of training is designed to help in gaining world experience, outlining ways of transition from vision to action, selecting priorities, and advancing one's work to the level of modern computerization, informatics, and application of the Internet and globalization resources.

Professional development of water specialists in Central Asia is carried out by organizing monthly workshops for training 20–30 people from five countries in 7–10 days depending on the theme, which may be any of the following:

- integrated water resources management;
- cooperation on transboundary rivers;
- water law and policy; and
- improvement of irrigated agriculture

The first two workshops for Central Asian water specialists were for representatives of ministries and agencies responsible for environmental protection and energy, and NGOs; the workshops on water law and policy conducted by specialists from the United Kingdom (Dundee University) and Israel were for ministries of foreign affairs and justice, involved in preparing interstate agreements.

The interactive form of training—based on disseminated lecture materials and handouts, opinion exchanges and discussions between trainees while analyzing problems and objectives of the sector, assisted by experienced moderators—facilitates forming mutual understanding, common grounds, openness, and trust. Every training workshop turns into a roundtable for representatives of various countries and sectors, who—by way of brainstorming and encouraged by moderators and themes of

lectures—promote achieving consensus in the region at intersectoral and interstate levels. At the end of each workshop, the minutes and collective decisions are compiled, which later are distributed to ICWC members for further dissemination aimed at continuously improving the system.

An important consideration in organizing such regional training is promoting camaraderie during joint studies and spare time among specialists from various countries and sectors engaged in tackling problems on water resources management. It acquires more importance if one considers that the present trainees—young specialists—may tomorrow become heads of local and national authorities, enterprises, and even sectors, thus being would-be decision makers.

Considering the advantage for decision makers of an advanced experience for capacity building of water management, SIC Traning Center is contemplating on the feasibility of conducting—within the framework of a training program—study tours for ICWC members and heads of ICWC executive bodies to familiarize them with the experience of operation practices in the Murray-Darling (Australia) and Mekong (Cambodia) river basins.

To maintain regular contacts with its former trainees, the Training Center developed a special database, where current information on each trainee is stored. This database is annually updated to account for all the changes in trainees' careers—some of them are expected to be engaged in the work of the Training Center national branches, which are now being formed. Information on the Training Center is on the web site: «http//tc.aral-sea.net». To date more than 400 specialists have obtained training and though not much time has passed since the inception of the Center, it is still possible to become aware of the outputs confirming the effectiveness of this work.

Let us take, for example, the course on integrated water resources management, where more than 200 specialists of high and medium levels, as well as representatives of grassroots level water users and their associations participated. Making these people aware of the significance and necessity of reforms in the sector—through implementing advanced methods of water resources management based on hydrographic and integrated approaches; equal consideration of all water users' interests; and coordination of all water sector hierarchy levels, consensus, and broad public participation in solving the water crisis in the world—provided favorable conditions for promoting "Integrated water resources management in the Fergana Valley." IWMI and SIC ICWC specialists, with participation of interested ministries, are implementing this project, funded by the Swiss SDC, on test sites located in three irrigation systems on the Kyrgyz, Tajik, and Uzbek parts of the Fergana Valley. Previous attempts to introduce such projects in the Fergana Valley—for example, "Peace Building" of CIDA—failed to get acknowledgment. At present—owing to enhancing the circle of like-minded specialists and disseminating through our trainees conceptions of integrated water resources management as the only way for survival of the planet in future—partnership of the Fergana Valley water specialists is being augmented. Now they are actively uniting around mutual cooperation in tackling water problems. Assessment of the inception phase of the program— conducted by the Training Center with participation of more than 80 specialists, water users, representatives of water management agencies, heads of province and district organizations, deputy governors, and NGOs—revealed astonishing unanimity in supporting broad application of the integrated water resources management (IWRM)

methods, based on the hydrographic (basin) principle and public participation as the only ways of survival in this region with high social tension in conditions of water resources deficit and demographic pressure. Furthermore, possibilities have already been contemplated for implementing the IWRM in the downstream areas of the Aral Sea basin and launching similar works have been agreed upon, with financial support from USAID, in the Uzbek portion of the Zerafshan River basin.

The same improvements can be attributed to the results of workshops devoted to cooperation on transboundary rivers, water law, and policy. Water specialists, representatives of ministries and agencies of energy and environmental protection, foreign affairs, and justice participated in these workshops. All of them are engaged in activities of intersectoral conciliatory commissions, which develop drafts of interstate agreements.

Experience gained from the workshops and their collective decisions indicate that the Aral Sea basin countries can successfully and effectively solve problems of water supply and energy generation only by introducing effective, mutually beneficial collaboration and cooperation based on principles of hydrosolidarity. That is, respect for, and taking into account, the interests of all countries and minimizing damages from both irrigation and energy generation as well as the environment, applying (in present market conditions) the potential that had been created before attaining independence.

Previous separatist tendencies dominated interstate relations and hindering implementation of agreements signed by ICWC members on information exchange and institutional structure of regional organs. At present, due to enhancing the circle of our associates not only in the water sector but in other ministries and agencies too, growth is taking shape in understanding the necessity of consolidation on the basis of cooperation and willingness on the part of each country to resume the work of intersectoral conciliatory commissions.

The same may be said of the workshops on advanced irrigated agriculture, which promoted the idea that in conditions of water resources deficit the only means of alleviating contradictions between water supply and water demand in the region is through water demand management by introducing water saving methods. The growing (but again owing to our associates at the local level) understanding of the possibility to achieve increased levels of water productivity, permitting an almost twofold increase in agricultural production and a decrease in water use of 10%, determined the willingness of the states to allocate certain capital investments to activities with respect to water saving. This allowed the establishment of a network of demonstration plots designed to render consulting and demonstration services to farmers, ater users associations (WUAs), and water management organizations.

Main Tasks of Further Improvement of Work and Capacity Building

Thus, the ICWC Training Center, being the promoter of the most advanced approaches to improving practices of water management and amelioration, is also becoming a political institute facilitating strengthening of regional cooperation among the Central Asian states.

SIC, being an executive organ—implementing missions formulated by ICWC to study all changes continuously occurring in water management in the region and in the world— constantly analyzes results of its own daily activities and has been

searching for new directions of further perfecting and strengthening its organizational and technical potential.

As to organizational improvements, thematic working groups were established in 2001 along the following principal lines of activities:

- institutional-legal,
- finance-economic, and
- technical, including training.

Representatives appointed by ICWC members with appropriate credentials of ministries were included in these groups on a parity basis, which should be considered as informal subunits of ICWC. SIC is responsible for arranging the performance of thematic working groups. The following are actions necessary for developing this activity:

- Organize regular participation of representatives appointed by ICWC members in work conducted by the three thematic groups and ensure control on the part of heads of appropriate national organizations over implementation of mutual accords and obligations.
- Provide conditions to systematically carry out working meetings of these groups for preparing current items to be included in agendas of scheduled ICWC meetings, and elaborating issues of long-term development along all three thematic directions.
- Ensure coordination between work carried out by thematic groups and activities conducted by the ICWC Training Center by submitting recommendations proposed at workshops by trainees, for consideration and further realization in decisions taken by ICWC. This kind of coordination can be a mechanism for continuously perfecting the system. For example, the experience of the US-CANADA United Commission may be of interest—the activities of such similar thematic groups are financed there within a rather large budget, for working out a finalized agreed document on each issue. We need support of donors in implementing similar approaches.

One of the main directions of capacity building is creating a solid cadre reserve by training young specialists in water management, who are skillful in applying sophisticated methods of performance in informatics, management, economics, and law. Therefore, there is a need for further development of the training activities, which have become the basis for building consensus between countries, sectors, governments and NGOs.

To enhance the effectiveness of training by decentralization and involve a larger number of specialists in training, new subregional branches of the Training Center are being established in Dushanbe (for trainees from the southern Tajikistan and the Syrkhandarya and Kashkadarya provinces of the southern Uzbekistan), in Osh (for trainees from the Fergana Valley provinces within the border of Kyrgyz Republic, Tajikistan, and Uzbekistan), in Dashoguz (for trainees from the Amu Darya downstream provinces and districts of Turkmenistan, Karakalpakstan, and Uzbekistan), and Kzyl-Orda (for trainees from the rice growing areas of the southern Kazakhstan and northern Uzbekistan). The issue of establishing the first two branches has been already solved, with support from the World Bank and the Swiss SDC. As to establishing the rest, it is still pending awaiting support.

Interaction between the head office of the Training Center and its branches will be carried out by

- training high- and medium-level specialists in Tashkent; concurrently the head office develops materials (programs, lectures, methodology, and technical handouts) for branches; and
- training specialists from lower levels of water management in the branches using materials prepared by the head office and with participation of moderators who were engaged in developing lectures.

The demonstration plots network of pilot projects will be used in this kind of training, as well as the database and the SIC regional integrated information system.

Training themes also need to be expanded by engaging specialists from related sectors such as energy, environmental protection, water supply, and hydrometeorogical services. A series of pertinent workshops should be carried out to prepare the appropriate basis for promoting broader public participation in water resources management, and establishing NGO networks in every country, interacting with water management agencies. There is a need to organize training on project management in irrigation and environmental protection, economic reforms, and agricultural production, including fishery on the basis of irrigation systems. In addition, the sphere of training activity may be enhanced at the account of arrangements within training programs executed by international financial structures and UN organizations such as UNESCO, FAO, UNDP, and UN ESCAP.

Another direction of capacity building is broad computerization and implementation of information systems and databases, accounting and forecasting systems, and application of modeling in current and long-term water management. The WARMAP project includes the Water Resources Management Information System (WARMIS) database with geographic information system (GIS) and data of remote control over hydraulic structures. However, only a regional level of the information system design has been completed. For further development of this system, it is necessary to supplement it with data collected at national and province levels, then reorganize them into an integrated information system, conduct approbation, and make it ready for further application by ICWC and interested organizations through the Internet. This is significant in assessing socioeconomic and ecological factors, efficiency of water and land resources use, and volumes of the river channel losses.

As to the GIS, it was developed by SIC and "Glavgidromet" (Metereological Service) – but it was not endorsed for broader application to BVOs and national organizations. The main objective at present is to design and develop integrated information dataware intended for the province level, irrigation systems and WUAs based on the principles of construction adopted for a regional information system.

Further improvement and development are required for application of another part of the information system—the knowledge base, developed on the basis of enduring work within the IPTRID program. But in modern conditions, its communicational basis needs to be created, which would unite all water management organizations in a virtual community on the Internet, thus successfully enhancing information flows and ensuring access to the database. Here, major attention should be paid to enhancing network of information exchange down to the province level, irrigation systems, and WUAs. Creating such a database should serve as the intellectual foundation for

developing and implementing future permanent demonstration sites, providing farmers, WUAs and water management organizations consulting assistance on extension service.

One of the priority programs submitted by ICWC at the meeting with donors during the Jubilee session in Almaty was "The system of interrelated models" Program developed by SIC, which includes:

- a river basin model;
- a model of the standard planning zone in the Aral Sea basin; and
- a model of national water policy development, meeting water demands of each state depending on socioeconomic development.

Using such analytical apparatus will allow creating methodology and obtain data necessary for analyzing:

- future development at the regional level as the basis for a regional water strategy;
- future development at the national level as the basis for a national water strategy;
- tasks of long-term flow regulation while conducting forward planning;
- annual planning of water allocation and its updating by BVOs in the interests of regional states; and
- tasks of current water planning and management for each BVO.

Completion of this work would lead to developing an instrument of continuous decision support system in water management in real time operation mode and applying in future a mechanism of prioritizing for national planning of water resources allocation and use.

Experience and Problems of Water Resource Management in the Syr Darya River Basin

M. Kh. Khamidov

Introduction

Water is an important element of the natural system and is vital for life. Rivers—being primary thoroughfares—connect people in this region. The Syr Darya is one of the two largest rivers in Central Asia. The river basin has great reserves of heat resources and lack precipitation. Therefore, water resources management should be sustainable. It should be based on ecosystem requirements and satisfy demands without causing harm to other states or the environment. The river waters benefit about 20 million people in the Syr Darya basin. The uniqueness of the river is in the high degree of its water resources use. Few water bodies in the world have resource use that exceeds the total available supply. This is because more than 40% of the water is made up of return flow in the lower reaches, which is delivered again for consumption.

The Syr Darya basin is part of the Aral Sea basin and occupies 484,500 square kilometers (km^2); the river flow is mainly formed in mountains (upper reaches), while the middle reaches are stretched across the steppe and then turn into the lower reaches in the Kyzylkum desert. Four sovereign nations—Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan— are located in the river basin. The Syr Darya River begins at the junction of the Naryn and Karadarya rivers in the eastern part of the Fergana Valley. The length of the river is 2,337 km. The total surface water resources of the river are 40.84 cubic kilometers (km^3) of which 37.88 km^3 relate to the section up to Chardara reservoir. The major portion (more than 60%) of these resources is formed by runoff from mountains.

Water is distributed by large waterworks, head intake structures, and inter-republican canals. These structures were mainly constructed during several decades of the 20th century and provided major water consumers, primarily irrigated agriculture, with water. Water resources distribution among major water consumers of the basin is as follows:

92%	irrigation needs
3.5–4%	drinking—household and municipal needs
2%	industrial needs
1.5%	agricultural needs

The rest is distributed among other water users, including fishery. Moreover, water resources are used for power generation. The irrigated area within the basin is about 4.0 million hectares (ha), including 1.9 million ha irrigated directly from rivers Naryn and Syr Darya. The River Basin Organization (BVO) Syr Darya was established in 1988 to satisfy demands of the basin's population for water and to provide regular and necessary water supply to lands.

In the past, under the supervision of the Soviet Ministry of Water Resources, commissioners from all over the country supervised water withdrawals by the republics during critical periods. Some of the participants of this workshop acted as these commissioners and were involved in water allocation.

BVO Syr Darya

In the beginning of 1988, the republics agreed to establish BVO Syr Darya and place major waterworks and intake structures under its control. The BVO functions were as follows:

- operate the above-mentioned structures;
- provide state water consumers with water according to approved water withdrawal limits;
- study, develop, and implement operation regimes of the Naryn-Syr Darya cascade of reservoirs; and
- provide water passage to Kazakhstan (inflow to Chardara reservoir).

The first years of BVO Syr Darya operation showed a substantial increase of transboundary water management efficiency. This included improvement of on-line river basin water management and uniform functioning of the Naryn-Syr Darya cascade. State water consumers received water resources regularly, according to set water withdrawal limits. Chardara reservoir received required inflow, and, as a result of measures undertaken by the BVO, water losses were reduced.

BVO Syr Darya arranges water delivery within the Syr Darya basin to sovereign state members of the Interstate Coordinating Water Commission (ICWC), operates water intake structures and waterworks, and undertakes measures on the improvement of the ecological situation and the control over water quality in the basin. The organization controls stream flow conditions in the rivers Naryn, Karadarya, Chirchik, and Syr Darya up to Chardara reservoir. The BVO is financed at the expense of shares of the state-members, allocated proportionally to amounts of river water withdrawn by each state.

The BVO is responsible for head intake structures located on the Syr Darya river and its main tributaries, as well as for interstate canals (mainly the Dustlik and Big Fergana [BFK] canals). There are 203 hydrostructures, including 21 located directly on the main watercourses of Naryn, Syr Darya, Karadarya, and Chirchik. The discharge of these structures ranges from 20–2,500 m^3/s, while discharge of structures located on the Dustlik and BFK canals reaches 400 m^3/s. Measurement of water withdrawals from the rivers and canals is taken at 445 sites, including 21 head intakes, 36 stationary pumping stations, and 172 temporary pumping units, as well as outlets from the main canals. Measurements of surface waters are taken primarily by national hydrometeorological services. BVO Syr Darya and national water management organizations measure surface waters at intake structures.

The BVO Syr Darya has a three-level management structure: the first level—central office in Tashkent; the second level—local office branches; the third level—on-site control and monitoring centers. The central office prepares information on inflows to water structures, estimates water demands, plans water allocation among four states and the Aral Sea (with breakdown by each intake from the Syr Darya and interstate canals), plans the operation of the Naryn-Syr Darya cascade of reservoirs, and collects information on river water quality. The second management level comprises five local offices that repair hydraulic structures and directly control them,

i.e., operate these structures, maintain limits at all water intake sites, and monitor river water quality. The third level is made up of on-site control and monitoring centers composed of head intake structures, dams, pumping stations, and hydroposts. The objective of these centers is to prepare information on the state of the water management system and to maintain the control process.

Transboundary Water Resources

As mentioned above, the activities of the BVO have changed since 1992. Irrigated agriculture was, for a long time, the only consumer of Syr Darya water. The situation changed during the late 20th century—other water consumers and water users arose. This resulted from rapid population growth, urban and rural development, industrial development, and hydroelectric power station (HEPS) construction. The emergence of various water consumers with different interests inevitably leads to complex situations and we must find optimal solutions to resolve them.

With the collapse of the Soviet Union and the establishment of five independent nations in Central Asia, the Syr Darya river has turned—using modern terminology of the international water law—into an "international watercourse." Thus, the issue has arisen on the use of transboundary water resources in the river basin and in the Aral Sea basin as a whole.

Management and use of water resources in the Aral Sea basin is complicated by a range of factors, including

- continuous population growth in the basin (by 2.5–3% per year) indicating a twofold increase by 2020 and a corresponding increase in water demand;
- tough environmental requirements caused by the Aral Sea problem and overall aggravation of the environmental situation in Central Asia, including water quality deterioration that in turn decreases water use efficiency; and
- fragmentation among various sectors and owners of hydrostructures at the interstate and national levels leading to uncoordinated actions and unavoidable water losses.

Operation, maintenance, and protection of water bodies and hydrostructures require cooperation in water management. This can be achieved only through transparency of borders.

The main water use problem lies in a the widespread conflict between downstream and upstream, which recently has become apparent in the Syr Darya basin. The physical nature of such conflict is simple: most of the river runoff is formed upstream, where power generation interests prevail and major water use occurs in the autumn-winter period, while irrigated lands are located downstream and need water in the summer period. Previously, most of the population in Central Asia was employed in agriculture, priority in river water use was given to irrigation, and upstream areas were compensated through heat and energy supplies. The compensation mechanism and supplies were not limited to Central Asia, but they were supported by the whole Soviet Union.

Due to a decline in the economies and breakage of economic ties between the countries, opportunities for riparian countries to supply heat and energy resources to the Kyrgyz Republic have decreased considerably. For example, in 1995, gas supplies reduced twofold; fuel oil (mazut) supplies, 10 times; and coal supplies, twofold, including Kyrgyz coal, 20 times compared with 1990. Therefore, electric energy

generation by thermoelectric power stations dropped in the Kyrgyz Republic, while lack of natural gas and coal led to abrupt increases of electric energy consumption in the domestic sector, thus inducing a marked growth of electric energy consumption in winter. To satisfy new electric energy demands, the operating regime of Toktogul reservoir was charged with generating electric energy in winter. As a result, maximum generation of electric energy by HEPSs now occurs in the nongrowing season. This results in

- acute shortage of water for irrigation;
- increase in irrevocable losses through water discharges into the Arnasay depression since it is impossible to pass to the Aral Sea the increased winter releases due to ice conditions in Syr Darya lower reaches; the releases to Arnasay have flooded areas and damaged all infrastructure there;
- environmental sustainability of Syr Darya water systems has been lost. In winter, the river channel is flooded and incapable of disposing return waters, while reduced summer releases cause both a critical situation in irrigated agriculture in the river basin and create tense environmental and epidemiological situations. The absence of water in the river in summer, with temperatures reaching 75°C, opens the door to infections and epidemics that do not recognize any borders and sovereignties; and
- under conditions of low water years, Toktogul reservoir may be emptied—according to the new operation regime—and would not be able to regulate Syr Darya flow in the long term; at the same time, power generation would drop.

The threefold growth of population in the region (from 7.5 million in 1970 to 20 million in 2002) should also be considered. In this context, objectives of water management should include the following.

- remove intersectoral barriers and create interstate cooperation in water use and development;
- establish efficient regional cooperation;
- achieve coordinated actions of water consumers on rational water use;
- overcome administrative barriers through the involvement in management of regional organizations with their equal representation in management bodies;and
- have a common aspiration of developing economic and legal tools of water conservation.

We should dwell on another problem that has become apparent since supplies of heat and energy resources according to agreements between the Kyrgyz Republic and downstream states enable the needs of irrigated agriculture to be satisfied during growing season; however, these agreements do not refer to operation of Toktogul reservoir during the autumn-winter period. This nonvegetation season operation regime is developed based on electric energy demands of the Kyrgyz Republic. Meanwhile, such development of Toktogul operation, particularly during low water periods, is incorrect. Measures undertaken are light and allow irrigated agriculture to overcome critical situations only in the growing season of a particular water year; but in general this situation leads to a dead end. It is necessary to widen the approach to the problem solution by approving, first of all, the volumes and regime of releases from Toktogul over the whole year. We have suggested the following technical solution: compensate the Kyrgyz Republic for reduced releases from the reservoir during

nongrowing season and release, if necessary, water saved this way during growing season. The difference between the proposed solution and recently implemented options is that until now the Kyrgyz Republic was compensated only for increased releases during growing season, while winter operation of the reservoir was developed only based on the Kyrgyz Republic's energy demands. In our proposal it would be possible to rehabilitate and save the governing role of Toktogul reservoir for the Syr Darya. While exerting control over volumes of winter releases from Toktogul, it would be possible to avoid releases from Chardara reservoir to the territory of Uzbekistan. BVO Syr Darya proposed an interim option for Toktogul operation: maintain releases of up to 6.5 km^3 during growing season and up to 4.9–5 km^3 during nongrowing period, at the same time the water volume in Toktogul reservoir ensures the head necessary for generating 1,200,000 kilowatt-hour (kWh). It is clear that such an operation regime should be accompanied by respective compensatory supplies of heat and energy resources.

Similar problems arose in Kairakkum reservoir operation—the matter concerns an attempt to reduce releases during the growing season and increase releases in winter. However, the latter was not necessary since under current Toktogul operation during the nongrowing season, inflow to Kairakkum reservoir ensures operation of the HEPS units and provides 200–500 m^3/s of free-running releases. These and many other problems made the governments agree on compensation principles to ensure rational use of water and energy resources in the Syr Darya basin. These principles were confirmed in the Agreement of 17 March 1998 and in a Protocol of 17 June 1998 (as applied to Tajikistan, which has joined this agreement). The above documents confirm that volumes of supplies and operation regimes of reservoirs will be determined by annual interstate agreements.

Abovementioned factors may lead to a situation where an amount of available water per capita will be twice less in 20–25 years. It is useless to speak about survival of the Central Asian population without a wise combination of technical and institutional measures, and their interaction and efficiency.

ICWC was established in the beginning of 1992 and it has carried out management of water resources in the Aral Sea basin. In an agreement of 18 February 1992 (Almaty) senior water management officials proclaimed on behalf of five Central Asian governments their faithfulness to the principles of cooperative transboundary water management, strengthening, and development of cooperation in water resources use, as well as particular attention to nature conservation and to the Aral Sea problem and interest in further improvement of cooperative water resources use.

Present Experience in Water Resources Management

Water resources management allows balancing human, industrial, agricultural, and ecological demands for water, which would help overcome sectoral fragmentation; absence of mutual interests of water consumers on the one side and water management organizations on the other side; and lack of interest of all players in the water-related hierarchy in final water productivity.

ICWC approves the limits of water withdrawal for each country-water consumer and amounts of water supply to the Aral Sea and Priaralie. By agreement of all ICWC members, water withdrawal limits are set based on actual water withdrawals, which used to be observed by each Central Asian state during the 5-year period before 1992.

While keeping succession in management, ICWC proclaimed BVO Amu Darya and BVO Syr Darya as its main executive bodies, which put into action the approved water withdrawal limits and releases to the Aral Sea and Priaralie. Water withdrawal limits remain practically unchanged—for an average water availability year—up to now. They are corrected only during low water years. Supply of Syr Darya water to the Aral Sea and Priaralie depends on available water resources and the operation regime of the Naryn-Syr Darya cascade of reservoirs, which is approved also by ICWC.

Since 1992, difficulties have arisen in managing water resources in the basin, and the ICWC-approved operation regime of the Naryn-Syr Darya cascade is carried out with considerable deviations since hydropower departments, which own the reservoirs, redevelop their functioning either due to the absence of agreements on compensatory supplies or due to nonfulfillment of obligations set in agreements. As a result there is serious disorder in operation of the reservoir system and the whole water sector of the region.

All these things lead to the conclusion that the water resources planning and management mechanism depends on an institutional structure—its leaders and interactions within this structure—capable of formulating and clarifying a strategy of measures undertaken. For example, the Kyrgyz Republic passed a law that declares all the water flowing out of its territory to be a good that the republic supposedly "supplies" to downstream states and for which these states must pay. In this context it should be noted that downstream republics also must be paid for winter power releases that cause huge damage. Moreover, for destabilizing the flow in their own interests, hydropower engineers require purchase of their energy at world prices; supply of fuel and energy resources; and sharing costs of regulation. Apparently this is a dictate and pressure exertion on downstream states in Central Asia. Besides, it is illegal that one state assumes the right to control and regulate water resources supply to other states. It is necessary to study and elaborate recommendations on electric energy pricing policy to make it profitable for riparian republics.

Dictating and exerting pressure on neighboring countries do not promote fruitful cooperation among the Central Asian states. All the problems should be solved through negotiations and by adopting mutually beneficial regulations based on international water laws.

Documents of IFAS and the GEF Project Agency on "public opinion raising" support our position that there is a lack of mutual trust among the countries and little recognition of the great joint capacity. Cooperative use of this capacity will prevent countries from exerting excessive pressure and taking (geographical or territorial) unfair advantage.

It is quite another matter when an upstream country undertakes—on its territory—measures that enable additional water withdrawals from the river. Then we can negotiate about shared participation of other states, compensation of costs borne under these measures, and partial reimbursement of expenses.

Managing water resources in such large transboundary rivers as the Syr Darya is not a simple release of water from a reservoir but a complex system of interdependent actions of all players that withdraw water from, regulate water in, and discharge

water into the river. Absence of unity and coordination causes damage or loss of water resources and related consequences.

Taking into account the high level of regulation in the Syr Darya basin (94% of the annual flow), it is feasible to avoid water shortage situations through adequate system operation and rational work planning. In this regard, uncoordinated and wrong decisions of certain persons cause more harm to crop yields rather than water shortage. For example, I can mention the drawdown of the active capacity of Kairakkum reservoir by 600 million m3 during the growing season of 2000, as well as unwarranted saving of excessive volumes by the end of the season, though these volumes of water were compensated. At that time crop water supply amounted to 75–80% of the required volume, thus causing great damage to each state in the region.

In this context, there arises a need to develop a view of how to avoid potential breaches of cooperative management and cooperation on the rivers. To this end it is necessary to accurately follow the international water law regulations, which set everyday stream-flow in the river and respective principles of water resources use as the base points.

The Aral Sea and Priaralie

As to the Aral Sea and Priaralie, here major reserves may be enabled only after the implementation of a water saving program. First of all, we need to change the management structure: the section of the Syr Darya from Chardara reservoir to the Aral Sea is not under BVO Syr Darya control, while repeatedly ICWC decisions contain both water withdrawal limits and water inflows that should be passed from the Syr Darya into the Aral Sea. However, the BVO Syr Dayra cannot fulfill these decisions since the necessary flows into the Aral Sea are provided from the lower reaches, i.e., beyond the BVO command.

Second, it is necessary to return to the case of water supply to the Aral Sea and Priaralie. It seems to be a resolved matter since the Aral Sea was considered as equal water consumer along with the state-water consumers in Central Asia. However, the Aral Sea position was not adequately recognized as was done regarding the Central Asian republics. As a result water withdrawal limits are approved annually and corrected only in case of considerable changes in water availability, while the share of the Aral Sea varies widely. It seems that in such case an approach that determines a share for the Aral Sea based on the remaining water volumes is incorrect. First we must decide who is responsible for the Aral Sea.

To sum up management of water resources in the Syr Darya basin, it should be noted that establishment of ICWC and the whole present management structure allowed us to avoid chaos after the collapse of USSR and to maintain basic principles of water allocation among new independent states of Central Asia. Recent experience indicates the need of reforming the ICWC and BVO Syr Darya structures.

In conclusion I want to note that the management and use of water resources in large international watercourses, such as the rivers Syr Darya and AmuDarya, should be controlled by regional interstate organizations, such as ICWC, which have all the necessary rights and authority delegated by respective countries. There is no alternative since ICWC decides upon implementation of the regional water-related activities and determines a strategy of transboundary water resources management in the Aral Sea basin. Moreover, it has proved its effectiveness and importance.

The following steps are required for improving regional water management structures and increasing irrigated agriculture efficiency.

- Specify and define concretely the interstate legal documents.
- Provide regular financing to ICWC executive bodies.
- Furnish structures with up-to-date equipment and management approaches.

On the other hand, world experience shows that a notion of cost effectiveness of irrigated agriculture is very difficult to substantiate directly: from a half to three fourths of costs in agriculture are subsidized all over the world. In this regard there must be applied another assessment criterion since agricultural production is an important component of the human life-support system. This is exactly the case where we cannot measure everything in economic terms especially since most people in the Syr Darya river basin are occupied with agriculture, and lack of water will reduce their livelihoods. Therefore, it is necessary to ensure rational use of water resources in the river, to arrange compensation supplies effectively, and to stabilize operation of Naryn-Syr Darya tandem reservoir system. This in turn will secure normal living conditions for millions of riverside residents and improve relations between the states in the region. The results achieved will be invaluable.

The BVO Role in the Amu Darya Basin Water Resources Management

Yu. Khudaibergano

Introduction

The Amu Darya basin covers a broad area—about 1,327,000 square kilometers (km^2), of which 1,018,600 km^2 are in the Central Asian nations. The Amu Darya is the largest river in Central Asia in terms of catchment area and flow volume. It is formed at the junction of the Pyandj and Vakhsh rivers. Its total length is 2,574 km in the section from the Pyandj River head to the Aral Sea and 1,415 km from the junction point. The Pyandj River flows along the border between Tajikistan and Afghanistan. Tributary inflow to the Amu Darya river occurs only along the first 180 km; 12 km downstream from the junction point the Kunduz River (Afghanistan) flows in from the south; 38 km downstream, the Kafirnigan River flows in from the north; 137 km downstream, the Surkhandarya River enters; and 180 km downstream, the Sherabad River joins the main river. The Amu Darya is a river dominated by a glacier-snow catchment area. The area of glaciers in the right-bank watershed constitutes 7,300 km^2. The total watershed area is 226,800 km^2.

Based on morphological and geographic characteristics, the Amu Darya basin is divided into three sections: upper reaches (Kelif hydropost upstream to the border between Turkmenistan and Uzbekistan), middle reaches (between Kelif hydropost and Tuyamuyun reservoir), and lower reaches (downstream of Tuyamuyun). A complex irrigation system has been developed in the Amu Darya basin. It is composed of main canals, pumping stations, collectors, and wasteways. There are two large seasonal storage reservoirs in the Amu Darya basin—these are the Nurek reservoir on the Vakhsh River, the Tuyamuyun reservoir located in the lower reaches, and a dozen in-basin and in-system reservoirs. Irrigated area in the basin is, on average, 3.8–4.0 million hectares (ha).

Lands of the Kyrgyz Republic (small irrigated scheme in the south of the republic), Tajikistan, and Uzbekistan (Surkhandarya oblast) are irrigated in the upstream area. The irrigated schemes are located in such tributary valleys as the Pyanj, Vakhsh, Kafirnigan, Surkhandarya, and Sherabad. In the middle reaches, the largest irrigation schemes are concentrated on extended canals such as the Karakumdarya, Karshi main canal with a cascade of 6 pumping stations, and Amu-Bukhara Canal. The system of each canal includes off-stream reservoirs. The irrigation systems located between Kelif and Tuyamuyun receive water transported by a dozen canals with nondam water intakes. Downstream on both banks large systems of canals were constructed: the Left-bank Big Canal, Right-bank Big Canal, Turkmendarya, Klychniyazbay, Daryalyk, Khan-yab, Kyzytken, and Suenli.

The BVO Amu Darya, an executive body of the Interstate Coordinating Water Commission (ICWC) for 10 years, operating in absolutely new political and economic conditions, has implemented its functions of transboundary water management, and maintenance of hydraulic structures and interstate canals rather successfully.

The main functions of the BVO Amu Darya are as follows:

- Development of water withdrawal plans, operational regime of reservoirs, coordination of ICWC-approved seasonal water limits for the states in the basin;
- Implementation of medium-term planning, joint water resources development and conservation, agreed with water and power agencies of the countries, participation in long-term planning;
- Water supply to state-water consumers, the Aral Sea, and Priaralie in accordance with ICWC decisions;
- Daily management and routine control over observance of water withdrawal limits;
- Submission of monthly information on water resources use for consideration by ICWC members;
- Participation in development and implementation of an automated Amu Darya basin water resources management system, water accounting, and measurement at the head intake structures;
- Conducting, jointly with national hydrometeorologic services, control measurements at state border cross-sections of territorial subdivisions for application in river flow balance accounting;
- Monitoring of ecological conditions of water systems and transboundary water resources quality;
- Undertaking environmental measures within water conservation zones of transboundary rivers and reservoirs according to national legislations, in coordination with local authorities;
- Minor repairs, reconstruction, and operation of hydraulic structures, headwater intake structures, interstate canals, and other structures;
- Participation, in the capacity of a customer, in research and design works, construction of new and reconstruction of existing water structures;
- Development and implementation, jointly with national water organizations and other interested parties, of activities on accident-free flood-flow transportation and protection of settlements and agricultural lands from waterlogging, flood, and other water-related emergencies;
- Control over of financial and economic activities of subordinate organizations;
- Development of human resources capacity in coordination with respective ministries; and
- Labor protection and safety measures.

Four territorial branches of the BVO Amu Darya have been established in Kurgan-Tyube (Tajikistan), Turkmenabad (Turkmenistan), Urgench (Uzbekistan), and Takhiatash (Karakalpakstan). On the agreement between basin countries the BVO carries out management of the river channels Pyandj, Vakhsh, Kafirnigan and Amu Darya, as well as the interstate main canals but not of the whole basin. Three states in the basin have mandated the BVO temporal responsibility for operating 88 hydraulic structures (including 36 head intake structures), 169 hydroposts, 386 km of interstate canals, as well as communication infrastructure (roads, communication lines, electricity transmission facilities, etc.). The BVO controls all pumping stations located on the river channels Amu Darya, Pyandj, Vakhsh, and Kafirnigan and on interstate canals, as well as a part of river water intake structures for which the BVO bears no responsibility.

In terms of organizational structure the BVO is divided into three levels of subordination:

- The BVO head office, which is connected through information network with ministries, SIC ICWC, and hydrometeorologic services of Central Asian states;
- Four territorial divisions, which are directly subordinated to BVO head office; and
- Control and management stations (CMS), which operate hydrostructures and hydroposts.

The positive role played by BVO Amu Darya and its significance for the region is obvious for the following reasons.

1. The decision taken by Central Asian states on shifting to the basin approach to water resources management has been absolutely correct. Such a decision has been approved and supported by the states and the world community.

2. Of great importance are the Decisions by the Head of States on approval of the Provisions of the International Fund for Saving the Aral Sea (IFAS) and the Agreement on IFAS and its status (9 April 1999). According to these documents BVO Amu Darya's status was augmented. Since that moment BVO Amu Darya has become an official international organization.

3. BVO Amu Darya has successfully accomplished the following:
   - Creation of an effective organizational structure capable of timely implementation of operational functions;
   - Development of human resources—formation of qualified personnel is completed in all BVO organizations;
   - Extension and retention of the BVO material and technical basis;
   - Major water structures including interstate canals have been sustained in good conditions: there have been no failures for the whole period of BVO operation;
   - There are good roads for control observations along all interstate canals;
   - Control posts operate on all river intake structures and interstate canals;
   - A reliable communication network has been implemented;
   - Practically all structures are equipped with electric supply facilities;
   - Sophisticated office equipment and computer facilities have been introduced;
   - A database has been developed with regard to water intakes, hydrology, collector-drainage discharges, and other parameters; and
   - Three operational divisions conduct water analysis regularly.

At the same time, the BVO clearly has conceived a series of measures that are necessary to eliminate shortcomings in its performance:

- updating material and technical facilities (dredging machinery, transport, cranes, communications, water meters, motorboats);
- resolving the pending problem of reserve power supply to both river head intake structures and interstate canals; and
- providing training and improving professional skills needed in the light of modern requirements.

The interstate water allocation and distribution in the Amu Darya basin is conducted based on the set limits. Since 1992 limits have been set by the ICWC for the growing and nongrowing periods of each hydrologic year. States of the region have established the following water withdrawal limits (total = 59.12 km^3):

Upstream (total = 10.82 km^3)

Kyrgyz Republic	0.45 km^3
Tajikistan	9.17 km^3
Uzbekistan	1.20 km^3

Midstream and downstream (total = 48.3 km^3)

Turkmenistan	22.0 km^3
Uzbekistan	22.0 km^3
In-stream flow	0.8 km^3 (nongrowing period)
Aral Sea	3.5 km^3

The drought of 2000–2002 revealed that a more flexible, agreed in advance, system of available water resources allocation is required. In this context, water allocation between water users should be carried out in proportion to the amount of water left after completion of the irrigation period in the interest of balancing actual water use. The following options of water allocation depend on water situation:

1. In the period of normal water supply and availability of water resources in reservoirs, water distribution should be carried out according to the set water withdrawal limits; and

2. In low water periods, Article 4 of the Almaty Agreement of 18 February 1992 should be applied stipulating the following criteria for interstate use of set water withdrawal limits:
   - At water availability lower than the designed one, according to an ICWC decision, water withdrawals in the whole river basin should be reduced proportionally;
   - Overwithdrawal of water is limited to no more than 10% as applied to separate periods;
   - When a state exceeds the 10% overwithdrawal limit, BVO immediately holds a meeting with all state representatives to discuss the situation; and
   - The substantiation for introducing water shares (in %) is water resources deficit.

The percentage of water resources distribution between the states in the river basin is guided by the following:

- Water withdrawal shares are determined on the basis of approved limits for the whole period for major water users;
- In calculating water withdrawal shares, the approved quota of water for the delta and the Aral Sea is taken into account;
- Water withdrawal shares are set every 10 days with a progressive total by adding remaining part of set limits;
- BVO Amu Darya is permitted to revise the set water limits within the range of 10% only upon agreement with the national ministries.

The states stipulate to provide maximal flow to the Priaralie and the Aral Sea of at least 4.5 km^3 per year comprised of 3.0 km^3 of river flow in a normal hydrological year (including 2.0 km^3 during the growing period and 1.5 km^3 during the nongrowing period) and collector-drainage flow of 1.5 km^3(including 1.0 km^3 for the growing period and 0.5 km^3 for the nongrowing period). To date the states have not developed a common standard for determining volumes of sanitary-ecological releases along the Amu Darya. During the nongrowing period 0.8 km^3 of releases are stipulated for the downstream reaches. For Karakalpakstan 0.5 km^3 is allotted

for the nongrowing season; for Dashoguz and Khorezm oblasts, 0.15 km^3.

The SIC ICWC has been developing, jointly with member-states, an "Agreement on transboundary waters conservation, the regulations on quality monitoring and provision of ecological sustainability in the region".

One of the important principles of the Amu Darya water resources management and regulation at the level of the BVO is mutual settlement of flow passing boundary posts and introduction of in-system and in-stream water balance. The boundary hydroposts are located in Kelif, Darganata, Tuyamuyun, Kipchak, and Samanbay. Currently the BVO carries out regular balance calculations and water analyses for several sections of the river. The analyses revealed that there are periods when solid residues before the Takhiatash waterworks is higher than 2.0 g/l.

Problems have emerged in the last 3 years in conditions of severe water scarcity that require special attention:

1. Water resources use inequity along the river when upstream water users divert more water than approved;
2. Increase of nonproductive losses on all river reaches;
3. Breach of water discipline by water users;
4. Necessity to replace obsolete communication facilities; and
5. Insufficient funding of BVO Amu Darya.

To improve interstate and intersectoral water use the following should be implemented:

1. Ensure observance of water discipline at all water management levels;
2. Establish water withdrawal limits;
3. Observe agreed water withdrawal regimes;
4. Introduce a unified system of sanctions for breach of water discipline;
5. Continuously take measures to improve water accounting; and
6. Develop an automated river basin management system.

To extend the scope of water resources management in the basin and to make it compatible with international requirements and standards the following should be done:

- Delegate to BVO responsibility for all major water intakes exerting an impact on the water situation in the basin;
- To prevent conflict situations in the basin and mitigate potential tension between the states, exclude all forms of distrust, and delegate to BVO responsibility for the main tributary channels and the Amu Darya river proper; and
- Augment the status of ICWC in the capacity of an interstate organ in basin water resources management, and strengthen the legal and financial status of ICWC bodies (BVOs, SIC ICWC, and the Secretariat).

In spite of difficulties in water management carried out by BVO it bodes well that a number of state-donors and international organizations showed interest in rendering effective assistance for BVO to implement automation and telemetry, and to improve accounting.

Recent Experience in Promoting Regional Collaboration in Water Resources Management

Incentives and Benefits of Cooperation Between Riparian States in the Mekong and Nile Basins

G. Le Moigne

Introduction

The Aral Sea basin, like other international river basins of the world, is under growing pressure from increasing water demand and water quality deterioration. While realizing that each river basin has unique characteristics reflecting a wide range of political, geographic, economic and cultural circumstances, it may be useful to understand what lessons could be learned from the benefits of cooperation between riparian states and their development partners in some international river basins.,. The purpose of this paper is to present experiences in cooperation (how cooperation occurred and how it was fostered) between the riparian states of the Mekong and Nile basins and to draw lessons learned from that experience that may be of interest to the decision makers and key stakeholders in the countries of Aral Sea basin.

Cooperation in the Mekong Basin

The Setting

The Mekong is approximately 4,200 km long and carries an average annual flow of 475,000 million m^3, more than four times the combined annual flows of the Amu Darya and Syr Darya. The basin covers 795,000 km^2 and encompasses six countries. As shown in Figure 1, the headwaters of the Mekong River originate in the Tibetan Region of the People's Republic of China (PRC). The river then flows through Yunnan Province in the PRC before forming the boundary between the Lao People's Democratic Republic (Lao PDR) and Myanmar for approximately 200 km and between the Lao PDR and Thailand for another 100 km. The river then courses through the Lao PDR for approximately 500 km before once again becoming the boundary between the Lao PDR and Thailand for another 800 km. The Mekong then flows through the heart of Cambodia, where a unique physical feature exists-the Tonle Sap River and the Tonle Sap Lake (Great Lake). At Phnom Penh, the Tonle Sap River enters the Mekong and, shortly below the city, the Mekong divides into the mainstream Mekong (called the Tien River) and a smaller river (called the Bassac River), both of which flow into Viet Nam and empty out through the delta of Viet Nam into the South China Sea. During the wet season, the flow of Tonle Sap reverses and the Great Lake fills and becomes a natural storage that releases its flow in the dry season, mainly to the benefit of the Mekong delta. In the delta, there is also a unique feature in that the Tien and Bassac divide into the Nine Dragons to deliver essential water and valuable nutrient-laden sediment through the delta (Radosevich and Olson, 2001).

The Mekong basin experiences a tropical monsoon with torrential rains from July to October resulting in high flows (typically in the range of 30,000-40,000 m^3/sec) and regional flooding. The dry season, usually from January to May, is almost without rainfall and flows at the rate of around 2,000 m^3/sec. Although this low flow appears an important amount of water by world standards, most of it must be retained for in-stream uses to protect against salinity intrusion in the delta. The basin supports one of the most productive and diverse ecosystems in the world. The biodiversity is exceptional in the upper reaches, in the wetlands of the Tonle Sap, the Plain of Reeds, and the Mekong estuary. In addition to its inherent ecological value, the basin states rely upon the natural productivity of the basin's fisheries to help meet the subsistence needs of many of the approximately 60 million residents of the basin (the population in the basin is expected to grow to 100 million in 2025). According to the Mekong River Commission (2002), more than 80% of the people live a subsistence life relying on water resources for food and more than 30% of the population live in extreme poverty. This growing pressure will have negative impacts on the natural resources and will be a source of potential conflict among the countries.

Regional Cooperation from 1950 to 1995

Since the early 1950s, the Economic Commission for Asia and Far East (ECAFE) of the United Nations (UN) in Bangkok was fascinated by the great potential of the Mekong and initiated the concepts of using the Mekong's potential for economic development of the basin countries. These countries, with the exception of Thailand, were among the poorest in the world and suffered for decades from the ravages of continuing wars. The first report on the potential for integrated development of the lower Mekong basin was published in 1952 by ECAFE. The idea of using the Mekong's vast resources to bring prosperity and peace to the region greatly appealed to the international community. The United States Bureau of Reclamation also issued a report in 1955 on the development potential of the Lower Mekong basin. These reports helped initiate the establishment in 1957 of the Mekong Committee, comprising ministerial representatives from the four countries. The Committee did not include the PRC, which was not a member of the UN at the time and Burma (now known as Myanmar), which did not express interest in membership due to political reasons. South Vietnam represented Viet Nam (Kirmani and Le Moigne, 1997).

The Mekong Committee was supported by a secretariat headed by an executive agent who was appointed by the UN in consultation with the four riparian countries. An advisory board of international experts was also established to support the executive agent. The Committee's declaration of principles cited "coordinated development of the basin's resources on the basis of reasonable equitable sharing between the riparian states" as its main objective. The main function of the Committee was to "promote, coordinate, supervise and control the planning and investigating of water resources development projects in the lower Mekong Basin."

The United Nations Development Programme (UNDP) financed the administrative cost of the committee and secretariat. Donor countries Australia, Canada, France, Germany, Japan, the Netherlands, New Zealand, United Kingdom, and the US financed the cost of planning, investigations and studies. The Asian Development Bank (ADB) also supported the effort. The strong interest and support of the

international community for the Mekong effort was motivated by many factors. The challenge of developing the vast resources of a great river was irresistible. Extreme poverty and continued suffering of the people by the ravages of wars generated great sympathy. Many donor countries emphasized that the cost of developing the Mekong was a tiny fraction of the huge expenditure on the continuing war that was destroying the region's economy and its people. They shared the belief that the Mekong could bring peace in the region. Moreover, the Mekong provided opportunities to every donor country to support one or more aspects of its development according to the size of its financing. For example, Japan studied the Sambor Dam, the Netherlands examined the drainage problems in the Viet Nam delta, France took up flood control studies, and others investigated the potential of tributaries. The effort on investigations and planning was immense. The Mekong Secretariat coordinated the activities and formulated the overall plan.

After more than a decade of intensive studies, the Mekong Secretariat prepared an Indicative Plan for development of the lower Mekong that was finalized in 1970. The report estimated the hydropower potential of the lower basin at 37,000 megawatts (MW), of which 51% was in the Lao PDR, 33% in Cambodia, and the balance in the other two countries. The Indicative Plan proposed a cascade of seven major dams on the main river with a total storage capacity of 136 billion m^3 and installed power of 23,300 MW. PaMong (4,800 MW), Stung Treng (7,200 MW), and Sambor (3,400 MW) were the largest. In addition many dam sites were identified on the tributary rivers. Of these, Nam Theun 1 and 2 in the Lao PDR were the most attractive for power generation. The Plan also covered other multipurpose aspects such as irrigation, flood control, navigation, and fisheries, but its power aspects were dominant.

At the request of the UN Secretary General U Thant, the World Bank reviewed the Indicative Plan in the light of the economic and political situation of the basin countries and their absorptive capacities. The World Bank concluded that the Plan was inconsistent with the needs and priorities of the countries at the time. The PaMong and Sambor projects, which were studied in greater detail, required more work before they could be considered. Other projects were still at the prefeasibility or reconnaissance stages. The demand for power in the basin countries was too small compared with the potential of the proposed projects. The World Bank also noted that the governments of the basin countries had little involvement in shaping the Plan. Thailand was skeptical; South Vietnam was too deeply involved in war to seriously consider development of the Mekong; and the Lao PDR and Cambodia appear too eager to accept any project in their countries. The Mekong Committee members were too overwhelmed by the foreign experts to play a major role in project selection and decision-making. The World Bank's recommended actions were to

- prepare and implement pilot irrigation projects, particularly in the Lao PDR and Cambodia, and test their viability before undertaking large projects; and
- explore small hydropower projects on tributary rivers for meeting local demand and possible export to neighboring countries.

The Mekong Committee and donor countries endorsed the World Bank's recommendations. A fund for financing a pilot project program was established and ADB and the World Bank agreed to act as executive agencies of the Mekong Committee to implement the program. Subsequently, the donor countries financed

installation of additional power units at the Nam Ngum Project in the Lao PDR for local use and export of power to Thailand.

The interest of the US, a major contributor of the Mekong effort, faded after the Viet Nam War. The invasion of Cambodia by Viet Nam engulfed the region in continuing wars. Donor countries and international agencies diverted their assistance to normal operations in the basin countries. The Mekong Committee and Secretariat focused increasingly their energy on the tributary rivers. However, due to the political instability and military situation in Cambodia, the Committee could not meet for 3 years (1975–1977). In 1978, Lao PDR, Thailand, and Viet Nam set up an Interim Mekong Committee to revise the Indicative Plan in the light of the changing economic, social, and political conditions in the region. The Interim Committee prepared a Revised Indicative Plan and presented it in a report entitled "Perspectives for Mekong Development". The report recognized that the Revised Plan was still indicative and should be modified to reflect the changing circumstances of the basin countries.

Thailand's rapidly growing needs for power led to its increasing interest in utilizing the enormous potential of the Mekong. The four countries, including Cambodia, met in Kuala Lumpur in December 1992 with the assistance of UNDP to consider a legal and institutional framework for cooperation to develop the Mekong's resources. The Kuala Lumpur Joint Communiqué established the political commitment of the countries to reach a new mutually acceptable framework for cooperation. A working group was set up in 1993 with the assistance of Dr. Radosevich, a UNDP consultant, to prepare this framework. It met five times between February 1993 and November 1994, culminating in the signing of the Mekong Agreement for Cooperation for the Sustainable Development of the Mekong River Basin in April 1995.

The 1995 Basin Institutional Agreement

The 1995 Agreement took 21 months to negotiate and only 3 months for ratification by the participating four countries (Radosevich, 1999). The purpose of the Agreement is to establish a basis for cooperation under an institutional framework robust enough to make operational decisions under a variety of future conditions.

The Agreement adopts the term "Mekong River Basin Waters" rather than "Watercourse System" because it was felt that the basin terminology was more comprehensive. It also adopts the "Principle of Reasonable and Equitable Utilization". It mandates the "Maintenance of Flows on the Mainstream" to ensure minimum monthly natural flows during the dry season and prevention of peak flows greater than would naturally occur during the wet season. It incorporates the "Obligation Not to Cause Significant Harm" and the "Principle of Notification and Negotiation on Planned Measures" by outlining the basic procedural requirements for water utilization. In addition to setting out substantive principles and objectives, the Agreement provides for the establishment of a new Mekong River Commission (MRC) with three permanent bodies:

- The Council, comprising one member from each state at the ministerial level, is empowered to make policy decisions on behalf of their governments;
- The Joint Committee (JC), composed of one member of each state at head of department level, acts as the technical decision-making and management body

for the MRC, and ensures implementation of the decisions of the Council; and
- The Secretariat (MRCS) which renders technical and administrative services to the Council and the JC. The Secretariat is located in Phnom Penh and has a staff of approximately 100 including both international and riparian staff.

The MRC has an annual budget of about $10 million –15 million, with $2 million –3 million administrative costs and $10 million–12 million program/project costs. Administrative costs are funded from contributions by member countries, donor grants, and an 8% surcharge on funded projects. The Commission was awarded the International River Prize at this year's River Symposium, an annual event held in Australia.

Each MRC member country also has a National Mekong Committee (NMC) that formulates national policy vis-à-vis the MRC, and provides coordination between national line agencies and MRC projects. Each NMC has an interministerial policy-making body, a management group consisting of key governmental departments, and a secretariat.

The Mekong River Commission's Strategy

With assistance from UNDP, the MRC Council—after intensive discussions with key stakeholders, including national line agencies—approved in 1998, the first Strategic Plan (1999–2003) that sets out visions, goals, and strategies. The Plan identifies four goals:

- Establishment and implemention of "Rules for Water Utilization and Inter-basin Diversions";
- Establishment of a Dynamic Basin Development Planning Process as a framework for natural resources management and sustainable development;
- Establishment and promotion of MRC environmental and socio-economic management systems and policy guidelines; and
- Establishment of an effective organization, capable of promoting, in partnership with other institutions, basin-wide development and coordination.

To achieve the goals, the work of the organization is oriented toward a multi-sectoral and basin-wide program approach aiming at integrated river basin management. Three Core Programs are the foundation for this Strategy (Mei Xie, 2002):
- the Basin Development Plan,
- the Environment Program, and
- the Water Utilization Program.

Five Sector Programs support the Basin Development Planning process:
- the Fisheries Program,
- the Navigation Program,
- the Agriculture Irrigation and Forestry Program,
- the Water Resources Management Program, and
- the Tourism Program.

Lessons Learned

The first 38 years—from the establishment of the Mekong Committee in 1957 to the signing of the Mekong Agreement for Cooperation for the Sustainable Development of the Basin in 1995—provided a series of lessons that may be of

interest to decision makers and their development partners in the Aral Sea basin. One of the lessons is the absolute necessity of involvement of the governments of the riparian states and their stakeholders in shaping development plans for the basin. While the participation of foreign experts may help to facilitate negotiations, it is essential that preparation of development plans, strengthening the capacity of existing organizations, and providing incentives for future financial contribution of donors are done by the key stakeholders in the countries concerned (Le Moigne, 1994). Although no structures were built on the lower Mekong basin mainstream, in spite of 38 years of investigations and planning, the period from 1957 to 1995 helped guide the preparation and implementation of the 1995 Agreement.

Negotiations for the 1995 Mekong Agreement were difficult and time-consuming. UNDP negotiation assistance proved most useful to the parties for reaching consensus on a new framework of cooperation (Radosevich, 1999). One lesson learned during the negotiations was "not to make the resolution of differences a <legal> battle of who is right and who is wrong, but rather to negotiate the points of common interest through both formal and informal meetings." As already mentioned earlier in this Workshop, Professor Radosevich also stresses the importance of "increasing public awareness and participation in water resources management in each member country in a manner that there is a more common awareness of not only their own needs and desires, but also those in other countries."

Early attempts in 1996 by the MRC alone to formulate subsidiary agreements related to water utilization were unsuccessful due to the disagreements on flow sharing between Thailand and Viet Nam. A structured and consultative approach—supported by UNDP, Switzerland, and Danida—to formulating the Basin Development Plan preparation process also provided some lessons. A two-phase approach to project preparation—(i) formulation of project concept and consultation to reach consensus between the MRC and the countries concerned, and (ii) subsequent formulation of detailed project component—has proven slow but reasonably successful even though the results were less than expected (Radosevich, 1999). Recently, the other donors have also introduced a similar two-phase approach to their project preparation.

Another lesson highlighted by Professor Radosevich (1999) that may be of interest to decision makers in the Aral Sea basin is the need to avoid duplication and to enhance coordination among agreed regional development programs and projects. The MRC has set up five major databases: wetlands, fisheries, socioeconomic, land use, and GIS mapping. It has also three ongoing monitoring programs on hydrology, water quality, and groundwater. These databases and information systems were reviewed and found sufficient to start developing a basinwide modeling package. The modeling effort should link the different MRC programs together and identify areas where further data collection is necessary to support management decisions. Developing and improving a highly integrated and networked information management system—including data base development and management, monitoring, modeling, planning, forecasting and decision support system—is a most effective tool to avoid duplication of efforts and to minimize differences and misunderstanding.

I would like to conclude this presentation of benefits of cooperation in the Mekong basin by mentioning the multisectoral and basin-wide program approach taken by

the MRC in its development planning process. Backed by ADB, the PRC, and Japan, among others, the program aims to reduce poverty and promote greater prosperity by improving road, rail, tourism, telecommunications, and power links among the Mekong River basin riparian states (*International Herald Tribune*, IHT 2002). In this connection, it is interesting to note the Agreement signed on 3 November 2002 (*Financial Times*, FT 2002) by the governments of the PRC, Lao PDR, Myanmar, Thailand, and Viet Nam to form a regional power distribution system that will lay the foundation for an ambitious program of hydropower development in this ecologically sensitive region. It must be pointed out that environmentalists worry that the creation of a regional power market will be the first step toward a fresh support of dam-building that they say will destroy the livelihoods of the poor people who live along the river and its tributaries. ADB is aware of the environmental issues and considers that the "most challenging task is joint initiatives to manage common natural resources and to protect the environment"(IHT, 2002). ADB, which is working closely with the governments of the Greater Mekong subregion, has nonetheless concluded that power development should be one of the key priorities for the region, one of the poorest in East Asia. It considers that power transmission lines will help attract private investments into much needed power-generating capacity.

Cooperation in the Nile Basin

The Setting

General Description

The Nile River is the longest river in the world. From its major source, Lake Victoria in East Central Africa, the White Nile flows generally north through Uganda and into the Sudan where it meets the Blue Nile at Khartoum, which rises in the Ethiopian Highlands. From the confluence of the White and Blue Nile, the river continues to flow northwards into Egypt and on to the Mediterranean Sea. About 85% of the Nile's water originate in Ethiopia. From its remotest headstream, the Ruvyironza River in Burundi, the Nile River is 6,671 km long. The river basin has an area of more than 3,349,000 km^2 and serves as home to an estimated 160 million people within the boundary of the basin. Ten countries (with a total population of about 300 million) make up the Nile River basin: Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. Out of these countries, 5 are among the 10 poorest of the world. Their state of poverty, coupled with population growth and environmental degradation, necessitate the development of the Nile Water resources by all riparian states (*UN Chronicle*, 2001).

The White Nile

The Ruvyironza is one of the upper branches of the Kagera River that follows the boundary of Rwanda northward, turns where the borders of Rwanda, Uganda, and Tanzania meet, and drains into Lake Victoria. The Lake, with a surface area of 68,800 km^2, is the world's second largest body of freshwater. Some 85% of the water leave the Lake through surface evaporation . The introduction of the Nile Perch as an exotic species some 30 years ago, overfishing, and oxygen depletion caused by nutrient inputs from adjoining catchments, have contributed to make the Lake environmentally unstable. On leaving Lake Victoria at the site of the Owen Falls,

the Nile rushes for 483 km over rapids and cataracts, until it enters Lake Albert. The section between the two lakes is called the Victoria Nile. The river leaves the end of Lake Albert as the Albert Nile, flows through northern Uganda, and the Sudan Border becomes the Bahr Al Jabal. As it enters Sudan, the river overflows into a shallow depression within the Kalahari sands creating the Sudd swamps, a large wetland of about 32,000 km^2. The floating, dense vegetation of the swamps choke the flow of water through the mainstream channel and prevent navigation (the Sudd successfully preserved the secret of the Nile's sources until modern times). At its junction with the Bahr Al Ghazal, the river becomes the Bahr Al Abyad, or the White Nile. Various tributaries flow through the Bahr Al Ghazal District. At Khartoum, the White Nile is joined by the Blue Nile (in Arabic Bahr Al Azraq). These are so named because of the color of the water.

The Blue Nile

The Blue Nile, 1,529 km long, rises at a spring site upstream of Lake Tana in the Ethiopian Highlands, where it is known as the Abbai. From Lake Tana, the river flows west then north until it eventually meets the White Nile at Khartoum. A length of 800 km is navigable during high water times. Some 80% of Sudan's electricity is provided by hydroelectric plants at Roseires and Sennar, and these dams provide irrigation water for over 1 million ha of the Gezira Plain.

The Main Nile

From Khartoum, the Nile flows northeast. It is joined by the Atbarah River 322 km below Khartoum. The black sediment brought down by the Atbarah and Blue Nile Rivers used to settle in the Nile Delta making it very fertile. This process historically occurred during the annual flooding of the Nile in the summer months. However, the opening of the Aswan Dam in the early 1970s allowed for control of the flooding and reduced sediment deposits in the river as these now settle in Lake Nasser. During its course from the confluence of the Atbarah through the Nubian Desert, the river makes two deep bends. From Khartoum to Aswan, there are six cataracts. The Nile is navigable to the second cataract, a distance of 1,545 km. The delta of the Nile is 190 km wide. The water level behind the Aswan Dam fell from 170 m in 1979 to 150 m in 1988, threatening Egypt's hydroelectric power generation.

Regional Cooperation from 1900 to 1992

History has shown that cooperation on resources management and development among the Nile riparian states has been difficult to achieve. In ancient Egypt, the Nile and its delta was worshipped as god. Several times throughout history, Egyptians have tried to unify the Nile valley under their rule by conquering Sudan. A legend says that during one particularly bad famine in Egypt, the Egyptian Sultan sent his ambassadors to the King of Ethiopia to plead with him not to obstruct the waters (ICE, 2002).

Modern history of cooperation among Nile riparian states began with the 20th century. In 1902, the British signed an agreement with the Ethiopians in order to assure themselves that the Nile would not be interfered with. In 1929, the Nile Waters Agreement was concluded with an exchange of notes between the British High Commission in Cairo and the Egyptian Government. The agreement allocated

48 billion m^3 water per year to Egypt and only 4 billion m^3 to Sudan, leaving 32 billion m^3 per year unallocated. The period 1954-1958 was characterized by political conflicts between Egypt and Sudan over sharing of the Nile waters (ICE, 2002).

In November 1958, three weeks before the Soviet Union formally offered assistance to Egypt for the Aswan High Dam, there was a military takeover in Sudan and the establishment of a regime more open to negotiations with the Egyptian Government. Within a year, the two countries re-negotiated the 1929 agreement and signed the 1959 Nile Waters Agreement that forms the basis for the allocation of Nile waters between Egypt and Sudan. This Agreement was based on the construction of the Aswan High Dam and on the assumption that there would be an annual mean flow of 84 billion m^3 at Aswan, of which Egypt was allocated 55.5 billion m^3. Losses were estimated to be 10 billion m^3 (Kirmani and Rangeley, 1994). The Agreement also stipulated that Sudan's yearly allotment would rise from the 4 billion m3 per year stipulated by the 1929 agreement to 18.5 billion m^3. Sudan was also allowed to undertake a series of development projects such as the Roseires Dam and, jointly with Egypt, the Jonglei Canal through the Sudd swamps.

The Agreement, still prevailing today, did not reserve any water for the upstream riparian countries. It did, however, establish procedures that Egypt and Sudan were to follow in settling the claims of the upstream riparian countries for a share of the Nile waters. The Agreement notes that:

> "As other riparian countries on the Nile besides the Republic of the Sudan and the United Arab Republic claim a share in the Nile water, both Republics agree to study together these claims and adopt a unified view thereon. If such studies result in the possibility of allocating an amount of Nile water to one or the other of these territories, then the value of this amount shall be deducted in equal shares from the share of the two Republics."

So far, there have been no formal claims from other riparian countries to put this procedure to the test. Ethiopian officials, however, regularly complained that the 1959 Agreement had been signed without consultation with them (although about 85% of the waters entering the Main Nile at Khartoum comes from the Blue Nile in Ethiopia) and refused to consider it as applicable. The upstream White Nile riparian states are less affected than Ethiopia by the quantity of water allocated to Egypt and Sudan because they usually have enough rainfall to meet their needs.

The Aswan High Dam was completed in 1968. Construction on the Jonglei Canal started in 1978 to divert about 25 million m^3 of water a day and channel it through a cut of 360 km to deliver about 4.7 billion m^3 annually at Malakal. Under the 1959 Agreement, this increment of water would be shared 50/50 by Sudan and Egypt. However, construction of the Jonglei Canal was interrupted in 1983 by civil war in the Sudan (in 1994, the President of Sudan, Omar El Bashir, announced a commitment to completing the project).

From 1967 to 1992, various efforts were deployed with the basic aim of forging cooperative agreements on a variety of issues. The first attempt was made in 1967 when, with the help of UNDP and the World Meteorological Organization (WMO), some Nile riparian states established Hydromet to evaluate catchments in the Great Lakes Region (Lakes Victoria, Kioga, and Albert) and analyze the flows downstream. Ethiopia joined the organization as an observer in 1971. At the time, Hydromet was

considered by some as "one of the most successful institutions in the Basin, being the first forum for cooperation, despite the fact that, in terms of area, it extended only to lake catchments of the equatorial region" (ICE, 2002). The Hydromet survey completed its work in 1992, but by that time, UNDP had been active in promoting other cooperation initiatives.

In 1983, UNDP supported the formation of Undugu (Swahili for "brotherhood") to forge cooperation in areas of infrastructure, environmental cooperation, culture, and trade. Undugu got its members from riparian states of Egypt, Sudan, Uganda, and Congo Democratic Republic (the former Zaire) and one non-riparian state, the Central African Republic. Ethiopia, Kenya, and Tanzania opted to remain as observers. In 1986, with UNDP assistance, water resources ministers from Egypt, Sudan, Tanzania, Uganda, and Zaire met in Bangkok and decided to promote and establish effective cooperation among riparian countries (Ethiopia was represented as an observer). These efforts did have sustainable success because the minimum degree of mutual trust and understanding required for cooperation among key stakeholders was lacking. Ethiopia in particular, with 85% of the Blue Nile waters in its territory, considered that these efforts had, for their main motive, the institutionalization of the status quo in the Nile waters as defined in the 1959 Agreement.

A New Era of Regional Cooperation since 1992

At the initiative of the Canadian International Development Agency (CIDA), a new era of regional cooperation started in 1992. A multitrack diplomacy was launched to develop and apply a strategy based on a three-pronged approach, each proceeding in parallel but collectively contributing to the objective of a comprehensive development of water resources of the Nile Basin (Shady and Grover, 1996). The idea behind this multitrack diplomacy was to create an environment for a peaceful and cooperative dialogue among stakeholders starting with the sharing of available information and ending with regional ownership of solutions. Success was considered conditional upon prevalence of mutual trust and understanding in a participatory process supported by political will.

The first approach was nongovernmental, comprising two activities:

- The formation of the International Nile Basin Association (INBA) that brings together professional and experts to share information, knowledge and experience; and
- The launching of the Nile 2002 Conference Series as an informal means to discuss management and cooperation among experts from the Nile Basin, international experts and external support agencies. These conferences started in 1992 and took place each year in a different Nile riparian State (Ethiopia hosted the 2002 Conference).

The second approach was intergovernmental approach. This approach took a few years to obtain the full and formal participation of all 10 riparian governments. It started in 1992 with the establishment of TECCONILE, an organization founded by the Ministers of Water Affairs of the Nile basin to replace Hydromet. TECCONILE organized meetings and acted to foster technical cooperation for the promotion of the development and environmental protection of the Nile basin.

The third was a multilateral donors approach involving all external support agencies to mobilize world resources to help with the development aspects.

In 1997, with UNDP support, the Nile riparian states established a forum for a process of legal and institutional dialogue. With three-person teams from each country (typically senior government lawyers and a water resources specialist), a panel of experts produced the draft text of a cooperative framework in early 2000. This encompasses general principles, rights and obligations, and institutional structure. The draft framework has moved the riparian states a long way and important compromises have been reached (Nile Basin Overview, 2002). However, some key issues remain to be resolved and, with continued UNDP support, the Nile Council of Ministers (that includes the Ministers of Water Affairs) agreed in August 2000 to extend the dialogue process to seek further agreements on the outstanding issues.

In 1998, all riparian countries, with the exception of Eritrea, joined in a dialogue to create a regional partnership to facilitate the common pursuit of sustainable development and management of the Nile waters (Nile Basin Overview, 2002). In 1999, the Nile Council of Ministers (Nile-COM) established the Nile Basin Initiative (NBI) to provide an agreed basin-wide framework to fight poverty and promote economic development in the region. The NBI comprises the Nile-COM, a Technical Advisory Committee (Nile-TAC), and a Secretariat (Nile-SEC) located in Entebbe, Uganda (to replace TECCONILE). The initiative is a transitional arrangement until a permanent framework is in place. It is guided by a shared vision "to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources".

In June 2001, the International Consortium for Cooperation on the Nile (ICCON) was formed in Geneva to bring together the international aid community and NGOs in support of the NBI. The Consortium is led by the Nile-COM. The ICCON is a forum for dialogue on the options and opportunities for management and development of the Nile basin. The June 2001 meeting also marked the launching of the ICCON Consultative Group (ICCONCG), a group of interested donors within the framework of ICCON, organized by the World Bank at the request of the Nile-COM. At the June 2001 meeting, the Ministers presented their Strategic Action Program (SAP) to the Consultative Group. This Program includes both basin-wide projects designed to lay the foundation for cooperative action, and two sub-basin programs (the Eastern Nile and the Equatorial Lakes Region) of investments that will promote growth and environmental management for the benefit of all people in the basin (Nile Basin, 2002). It is of interest to note that the SAP includes subsidiary action programs in infrastructure, trade and industry, health and environment, which will bring benefits "beyond the river" as described during the first day of this workshop. Among these programs are the Regional Energy Networks, Regional Transport, Regional Tourism Development[1], Promotion of Trade and of Private Investment and Joint Ventures.

In February 2002, the Nile-Com meeting in Egypt launched the implementation of the Shared Vision Program (SVP). Missions for projects such as Confidence Building and Stakeholders Involvement, and Transboundary Environment Analysis have

[1] The importance of tourism as foreign exchange earner and employment opportunity is evidenced in the case of Egypt. According to the World Bank (1997), tourism in that country provides directly and indirectly over half a million jobs.

finalized preparatory project documents. Missions for finalizing five other priority projects of the SVP—applied training, water resources, agriculture, power trade, and socio-economic development and benefits—are now taking place. The Nile-Com also decided to strengthen the Nile Secretariat by including in the SVP a separate project referred to as Shared Vision Program-Execution and Coordination Project (SVP-ECP).

The development partners have expressed an initial financial support of $140 million to finance the full program of the NBI. A trust fund is to be established by the World Bank for this purpose. Strong support was also expressed to underwrite the first phase of the $3 billion investment program in the sub-basins, once the projects are ready for funding.

Lessons Learned

While concerns still exist over potential instability in the region, the NBI may hopefully serve as an example of how international waters can become catalysts for cooperation, development, and stability. The NBI is based on a recognition that applies to many international basins, i.e., riparian states have a shared past and a shared future, an urgent need for development, and poverty reduction. The experience of cooperation in the Nile basin shows that success requires a deep commitment by all riparian countries to foster cooperation and to pursue jointly the sustainable development and management of the water resources for the benefit of all. When all riparian states participate in a joint dialogue as equal members, there is a good chance of a meaningful and comprehensive cooperation in the basin. To achieve this stage of cooperation is always a long and difficult process. The multitrack diplomacy developed in the case of the Nile basin proved most useful and can serve as a tool in other international river basins to achieve a shared vision program of sustainable development.

Another lesson learned from experience in the Mekong River basin relates to the role of development partners. While development partners should be consulted on the formulation of policies and associated strategies so that their resources can be made readily available for implementing development programs and projects, their support should be coordinated to avoid duplication. This coordination should be organized jointly by the riparian states and the aid community. Most important however, is the absolute necessity of ownership by the key stakeholders of a shared development vision for the river basin together with its associated implementation strategies.

Conclusions

Experience of cooperation between riparian countries in the Mekong and Nile basins shows that success requires a deep commitment by the states to foster this cooperation and to pursue jointly the sustainable and equitable development and management of the water resources for the benefit of all. To achieve such a cooperation often takes a long time because of the historic, cultural, environmental, and economic relations between riparian states in international river basins. The role of the aid community as development partners is important but should be adequately coordinated by the riparian states to avoid duplication of efforts while ensuring that the aid contribution is not an obstacle to ownership of the development plans by the key stakeholders in

the countries concerned. To facilitate a successful cooperation between riparian states, the multitrack diplomacy that led to the Nile Basin Initiative is often a good approach to create the required enabling environment.

In concluding this presentation, I would like to mention that—in my view—the Mekong and Nile basins are good examples of how to generate significant benefits of the types presented in the keynote paper in this Workshop. Environmental management is always a challenge and cooperation among riparian states of international river basins can enable better management of their ecosystems providing "benefits to the river." Focusing on "benefits derived from the river" provide greater scope and greater flexibility in defining cooperative and equitable management arrangements that are acceptable to all parties. For example, cooperative management of river flows to mitigate against endemic floods and droughts, and coordinate hydropower and agricultural production, with opportunity to construct shared infrastructure, can provide significant economic gains from the river.[2] As the waters of international river basins are perceived as central to its survival, each riparian state is concerned by the actions of other riparian states. The control of river flows is, to some extent in all international rivers, a source of tension and dispute, and an issue of sovereignty, strategic necessity, and national pride. Such tensions often color the geopolitical relationships between states in a basin and become obstacles to growth by constraining the regional political economy and diverting resources from economic development. Experiences in the Mekong and Nile basins have shown that far-reaching gains from cooperation may accrue as savings of the costs of noncooperation arising "because of the river." More important perhaps, is the challenge for international rivers to enhance relationships through shared opportunities, contributing to the benefits of cooperation and integration "beyond the river". The multisectoral and basin-wide programs approach taken by both the Mekong and Nile basin riparian states in their development planning process illustrate this type of benefits.

[2] The relationship between the flow of rivers and the economy has long been recognized: the early Egyptians built Nilometers some 5,000 years ago to measure the flow of the Nile River at Aswan in order to determine annual taxes for farmers.

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Developing IWRM Collaboration in Central Asia

V. Horinkova

Introduction

The critical water issues the region is currently coping with are closely related to the application of three Dublin (1992) principles: ecological (requiring holistic water management), to improve the ecology in Aral Sea Basin; institutional (asking for institutional changes with application of participatory water management, devolving responsibility to the lowest appropriate level), to manage water in agriculture and provide irrigation services; and instrument (requiring management of water as an economic resource), to develop options for water for irrigation and energy.

Historically, individuals and communities in the Central Asian region have shared water for irrigation and domestic use, taking it in rotation as needed, without any formal rules or laws. With intensified water use for large-scale irrigation schemes developed from the early 1960s to mid-1980s, the quantity and quality of water resources has changed. But under the central control and interdependency of the states, water scarcity has not yet become an issue. Competition for dwindling resources began after independence, when the states were under pressure to privatize and water became an economic good that could be tradable, marketable, profitable, and exploitable, with price and allocation being a matter of political choice and debate.

In the 1990s, water resources governance in the region started to change as the Central Asian states embarked on reforms, affecting primarily their water institutional arrangements.[3] Today the states find themselves at different stages of institutional and economic development. Some of the undergoing changes relate to application of innovative technologies, methodologies or techniques, adoption of new legal and regulatory instruments, but primarily organizational changes for operation and maintenance (O&M) of on-farm water management, and/or a combination thereof.

Concept of IWRM

There is a consensus among all major technical assistance and aid organizations that the concept of integrated water resources management (IWRM) practiced at the basin level is the best approach, to address the increasing population growth and demand for food, by utilizing all available water resources and sources that are acceptable in water quality, and sustain vital ecosystems as well. The basic tenet germane to IWRM is an "application of integrated policy framework implemented under revised legislation through coordinated organizational framework." This new approach also means utilizing participatory process—involving users— in planning and managing the available water resources, so that enough water would benefit farmers who are directly involved in the food production but also those who are dependent on irrigated agriculture for food.

[3] Under these we understand not only organizations, agencies, and entities involved in some way in water resources management, but also formal arrangements and instruments such as laws, rules, regulations, and written agreements, as well as informal mechanisms (traditions, religious or ethnic, or community customs), as they all comprehensively contribute to the way water is managed.

The IWRM principle lies in gradually adopting institutional changes coupled with technical innovations. If applied within each Central Asian state, and across the boundaries, the major institutional changes envisaged would constitute reforms in allocation and management of surface and groundwater and the supporting legal and regulatory framework, as well as setting up an effective water rights system that is equitable and flexible for all water sources[4]. Naturally, utilization of all available water sources places additional demand on the organizational arrangements and the legal and regulatory framework.

IWRM implies that the institutions that are ruling over the use of water need to be changed/reformed, and to some extent, new organizations developed so that water would be used in an effective, efficient, and accountable manner. In other words, IWRM is a conjunctive water management of multiple sources of water, while controlling surface and groundwater depletion, waterlogging and salinity, and meeting water demands for different sectors in the economy. It also includes integrated planning for the use of water resources.

To adopt the concept and principles of IWRM gradual reforms -- including policy, legal framework, and adjustment of old or creation of new organizations -- will be needed to support the change in water resources development and management, starting from the smaller hydraulic unit up to the river basin. Overall, IWRM at the basin level needs to be directed toward increase of water productivity in all water subsectors (irrigation, potable water supply, hydro-energy, fisheries, etc.) and only establishment of effective governance[5] can ensure an equitable and effective water management.

The governance affects the system at the top and bottom. At the top the changes constitute primarily policies, legal and regulatory framework concerning streamlining of the functions to manage the irrigation and drainage system, and changes in administrative aspects, e.g., replacement of procedures with more transparent arrangements. At the bottom the governance affects the operational nature of the system that is directly relevant to achieving more economical and effective operation and maintenance of the irrigation, drainage, and flood control. Such changes also introduced participation of water users and stakeholders in the O&M of the systems.

Once the framework for IWRM is established, water allocation, water use and management can be better planned and controlled, information systems more effectively applied, allowing for conjunctive use of all water sources and minimizing negative impacts (waterlogging, salinity).

IWRM and the Region

Considering the transboundary waters in the region, it is envisaged that the water needs of each state—as determined according to the need for economic development envisaged by each government—would be harmonized with the overall basin strategy for each river. This concerns maintaining water supply for population, industry, agriculture, and other sectors of the economy, as well as providing adequate water for environmental needs (e.g., minimum flows and levels). Since irrigation is the

[4] Water sources may include not only all types of surface water—rivers, dams, canals, groundwater, and surface runoff, but also groundwater, agricultural drainage, municipal sewage, and industrial effluent.

[5] Water governance refers to the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and the delivery of water services (Global Water Partnership definition).

major user of water, to achieve effective O&M of irrigation and drainage systems and step up water management toward more integrated management in irrigation, the objectives for an institutional development program need to be clearly defined by each government and their commitment secured (behind which is naturally a host of political and social factors, endemic to each situation). In addition, there needs to be compatibility among the legal frameworks of the transboundary states.

For Central Asia water managers and water users the water issues of the region present enormous challenges: water scarcity, deteriorated infrastructure, organizational gaps in the water delivery and distribution, lack of strategic planning, problems with soil salinity, waterlogging, territorial interests, and lack of unified social behavior. Therefore, to adopt IWRM may look relatively simple in theory, but it is difficult in practice, and represents a long process. The implementation of various ongoing reforms under numerous projects of donors confirms the complexity of the Aral Sea basin system and the fragmentation and gaps due to the past hierarchy of policies, laws, and institutional arrangements, as well as linkages between irrigation water management and administrative entities, government departments and agencies—a paradigm that is not easily overcome. IWRM is intended to help avert the water crisis that is faced by many countries. The main challenges in applying IWRM in Central Asia are institutional. As an impetus to pilot the concept, IWMI jointly with the Interstate Commission for Water Coordination and its Scientific Information Center (ICWC SIC) is executing a project tackling some of the organizational issues that would be a step toward applying the principles of IWRM in Ferghana Valley, involving three states—Kyrgyz Republic, Uzbekistan, and Tajikistan.

Fergana Valley Project

As a result of the project, increase in farmers' income and living standards would be expected. The project went through an inception phase and has only started early this year. Gradually, the project would introduce institutional changes along the hydraulic boundaries of "water units," engaging the participatory process of stakeholders and users. If stakeholders are involved, the end-result of the rather long process is more satisfying.

Water Management at Three Levels

In concrete terms, the project is intended to improve water productivity (cut water losses) and establish a new routine for on-farm water management. But primarily, the challenge is to introduce new management arrangements at three levels, based on a hydraulic-unit principle: (i) water users associations (WUAs) for end users' level and federations and (WUFs) for interfarm level; (ii) canal command level for trans-rayon, trans-oblast, and sometimes transnational level; and (iii) BVO SyrDarya (as existing—but in the long term modified into a new transnational level).

The new management forms WUAs and WUFs would take over irrigation management from previous large cooperative farms and be responsible for the takeoff from the main canal, cropping/water demand planning, and water allocation and distribution to either individual farmers or farming cooperatives along secondary and/or tertiary canals. They would be self-sustained units, raising funds for water delivery and services and O&M from farmers. They would be in charge of their own administrative and O&M management, as well as financial management.

The "canal water organization," being at one step higher level, would be responsible for water management along the main canals between the headworks and the offtakes to the farm level. If possible, and wherever technically feasible, the responsibility would extend over other rayons or oblasts—thus likely transboundary, or even transnational.

Capacity Building

Capacity building will be considered in many institutional and water management aspects. In the region the experience with WUAs exists in the Kyrgyz Republic, including the legal supporting framework for their establishment. The situation is different in the other states, where there is not enough support from the government for the establishment, development, and functioning of WUAs, so that their members can become truly independent farmers. Tajikistan is progressing quite quickly. In Uzbekistan, land reforms are not yet executed throughout the country. In the whole region, the newly emerging farmers or WUA members do not have the farming experience or confidence in their farming skills (they may be former cooperative members, but that does not mean that they know how to select seeds, cultivate land, use fertilizers, etc.). Therefore, they need support and advice, which the project program is providing.

It is noted that although advisory services for water management, agribusiness, and agricultural extension are often suggested in the program of foreign-financed projects, many such projects do not organize such support. The same is valid for changes in irrigation policies—projects do not seem to achieve the desired impact. What is primarily lacking is the basic government commitment and political will to support the various reforms.

Lessons Learned from the Inception Phase

1. Under the new conditions, water management along administrative boundaries cause fragmentation of management responsibilities, and cannot guarantee the required level of satisfaction of competitive demands for scarce water resources. Rather, it has caused problems such as lack of financing and creation of unfavorable local tendencies to interfere in management. Also, it cannot guarantee or enhance stakeholders' involvement based on democratic principles.

2. Land and water productivity in most parts of the valley remains below the potential. This is caused by the low incomes of rural populations and weakness of markets; lack of developed agricultural infrastructure; absence of agricultural extension services and opportunities for farmers to gain new knowledge; and inadequate government financial support for water supply and land reclamation for sustainability of the environment.

3. There is an absence of sufficient support and awareness of the need for institutional restructuring, as well as of enabling conditions at the local and government levels including comprehensive water resources management policy.

4. The legal framework is incomplete or inadequate for hydro-boundary based water management, as well as for WUAs Conflict-resolution mechanisms are weak.

5. Open, transparent, and participatory decision-making and dialogue among water managers and stakeholders are needed, as well as carefully planned, well-structured social mobilization methodologies and processes.
6. There is a strong need to identify and test alternative water management schemes, including allocation, distribution, maintenance, and rehabilitation mechanisms inside each state.
7. Water use is inefficient due to high water losses in the canal systems and wasteful irrigation practices at the field level.
8. Transparent data sharing arrangements and adequate data for hydro-boundary based units of analysis, and creation of a comprehensive information base for decision making are needed.

Exchange of Hydrologic Data and Information Among Aral Sea Basin States

V. E. Chub

Overall Objectives and Tasks of Hydrometeorological Monitoring

As is well known, hydrometeorological processes and climatic changes have no administrative boundaries. It is, therefore, important to provide monitoring of the processes occurring in the Aral Sea basin. The overall objectives and tasks of hydrometeorological monitoring in Central Asia are determined by the necessity of obtaining hydrometeorological information and forming prognostic/analytic conclusions with participation of the following actors:

- Intergovernmental regional organizations developing intergovernmental agreements on water resources use and environmental protection;
- Governments, ministries, and agencies of the countries of the region, shaping national economic development plans and undertaking urgent adequate measures, in case unfavorable hydrometeorological conditions take place;
- Structures designed to meet urgent situations by arranging and developing measures aimed at protection of population and various entities against extreme hydrometeorological phenomena; and
- National hydrometeorological services of Central Asia as members of the World Meteorogical Organization and following its by-laws and principles, providing free and unlimited hydrometeorological information exchange within the framework of the World Weather Service global telecommunication network.

Functioning of the Hydrometeorological Services of Central Asian Countries

The hydrometeorological services of Central Asian countries have been functioning within the framework of the "Agreement between member states of CIS on interaction in the field of hydrometeorology" and also the "Agreement between the Government of the Republic of Kazakhstan, the Government of the Kyrgyz Republic, the Government of the Republic of Tajikistan and the Government of the Republic of Uzbekistan on interaction in the field of hydrometeorology." In addition, within implementation of the regional projects on the "Program of urgent measures to improve socio-ecological situation in the Aral Sea basin" (Component D of the Global Environment Facility project on transboundary monitoring of surface waters), the "Project of improving water resources forecast system in the Aral Sea basin" was implemented with support by the government of Switzerland and the United States Agency for International Development (USAID). Heads of national hydrometeorological services have signed a number of agreements on information exchange. Thus, for the past years, the solid treaty-legal basis has been formed for free and unlimited information exchange as it applies to hydrometeorological and

forecast data in Central Asia, making it possible to carry out hydrometeorological monitoring in the Aral Sea basin.

Unfortunately, the economic situation in some of countries in the region does not allow realizing to the full extent the provisions of these agreements. For example, in June 2002 the Hydrometeorological Service of Tajikistan stopped transmitting all hydrometeorological information to the Hydrometeorological Service of Uzbekistan due to lack of funding to cover communication costs. Taking into account the current complicated hydrometeorological situation, this caused major difficulties in providing information and forecasts on the Amu Darya river basin, and not only for Uzbekistan, but also for Turkmenistan and Tajikistan itself.

Hydrometeorological Network in Upper Catchment Areas

The major obstacles to the provision of reliable hydrometeorological information on water resources to regional and national agencies in the Aral Sea basin is the collapse of the hydrometeorological observation network in the mountain upper catchment areas of the Syr Darya and Amu Darya rivers located on the territory of the Kyrgyz Republic and Tajikistan.

The densest hydrological observation net in the region, which included 559 hydrological posts, existed till 1985. The biggest number of meteorological observations made by 365 meteorological stations took place in 1980. After that, a steady decline started both in the number of stations/posts and in the amount of conducted observations.

At present, the number of points conducting observations in upper catchment areas have been reduced by 30-40%. Observations have stopped at meteorological stations, which used to be the sources of most reliable information necessary for assessment of icing processes in the mountains, especially at the Fedchenko (Gorbunov) Glacier, Chaartash, Kyzyldjar, Ters, Altyn Mazar, and other mountain areas. Terrorists destroyed the Abramov Glacier station.

Snow surveys in the mountains have (Uzbekistan excluding) ceased almost completely. In such situations, remote information provided by satellite images actually became the only source of information on dynamics of snow cover formation in the mountains. Methods of evaluating data obtained from satellite images of snow-clad mountain areas have been developed by specialists of Uzbekistan Hydrometeorological Service jointly with their colleagues from Switzerland. This made up for the deficiency of ground information. Forecasts of the Aral Sea basin river flows were issued with acceptable accuracy. This work has been carried out lately with the assistance of USAID.

Nevertheless, reestablishment and expansion of a ground hydrometeorological observation network, especially in upper catchment mountain areas, is a task of paramount importance for each Central Asian state and all international and regional organizations.

Another importance task to be worked out is technical re-equipment of the systems for collection, processing and dissemination of information in national hydrometeorological services that can actually to ensure free access to hydrometeorological information and forecasts in a real time mode for all hydro-met data users in the Aral Sea basin.

Re-equipping the National Hydro-meteorogical Services

I am confident that provision of necessary financial resources for maintaining and developing national hydrometeorological services in the region will facilitate exact execution of existing agreements and commitments as to free hydro-met information exchange in the interests of sustainable development of all countries of the Aral Sea basin.

Reestablishment of hydrometeorological stations in mountain flow formation zones such as Fedchenko Glacier, Abramov Glacier, and others has been an issue of vital importance for several years. All give the impression of concern and consider it necessary to accomplish this work, but the problem remains pending with every passing year. Yes, this task is really arduous, but it needs solving, if we are willing to preserve hydrometeorological monitoring in the Aral Sea basin.

Some institutions arrange training and install demonstration equipment at hydrometeorological stations near urban areas for easy public access. We—who are first of all interested in effective donor support, fail to make our exact requirements known and agree with any proposal made by countries and donors.

To date, the situation is so grave that the hydrometeorological service of Tajikistan does not have any technical means necessary for hydrometeorological information exchange. Donors should conduct priority activities in this area but they are not in a hurry to tackle this problem. As to the hydrometeorological service of Tajikstan, they seem to be in no need of funding. It is much easier to just notify the neighbors and stop transmitting information to neighboring countries, though Tajik colleagues are the first to suffer from the situation.

Establishing a Regional Center of Hydrology

One more ambitious task has been under consideration is the establishment of a Regional Center of Hydrology under the aegis of the Executive Committee of the International Fund for Saving the Aral Sea (EC IFAS), with financial support from the Government of Switzerland. There are no observations in flow formation zones, no means of hydrometeorological information exchange, but instead there will be a Regional Center. "Glavublhjmet" (The Main Hydrometeorological Service) of Uzbekistan has not supported establishment of the Regional Center under the aegis of the EC IFAS and cannot support creation of the Center with such status. We consider the Regional Center being formed on the basis of the Swiss Mission for the Aral Sea mainly as a training center to teach personnel of hydrometeorological services the skills of dealing with new technical means and computer software, observations, data processing, and dissemination.

All scientific coordination functions in the field of hydrology, hydrological forecasts, and research of the Aral Sea water resources should not be delegated to the Regional Center. These functions have been successfully carried out for more than 50 years by the Central Asian regional science-research hydrometeorological institute (SANIGMI).

In conclusion, I would like to appeal to other countries and organizations—donors, national hydrometeorological services of Central Asia, and respected members of the Interstate Commission for Water Coordination for facilitating transition to a more effective level of cooperation in order to successfully solve the vital problems of providing hydrometeorological support necessary for the economic development of our countries.

Future Issues Related to Long-Term Agreements Between States in the Aral Sea Basin

V. A. Dukhovny

The disintegration of the USSR did not come like a bolt from the blue for the governments of the Central Asian new independent countries. Right after they were established, heads of water management agencies of the five countries issued a statement to continue the Soviet principle of water resources management in the independent states. Preparation, discussions, and approval of the fundamental "Agreement on cooperation in the sphere of the interstate sources of shared water resources management, use and protection" took only 5 months. This Framework Agreement contains very important provisions that will guide the foundation of future cooperation, as follows:

- Creation of a parity water commission, with its members (one representing each country) having rights and responsibilities in providing water;
- A wide range of main functions, including water quality control and protection of transboundary water sources;
- Consensus in tackling all the issues addressed by the Commission;
- Commitment to the general postulates of water allocation and water regimes, which had been set by Rules and Schemes of the Soviet government; and
- Democratic order of working procedures in the Commission.

Approval of this document by the "Agreement of the Heads of States" on 26 March 1993 and the inclusion of the Interstate Commission for Water Coordination (ICWC) in the list of interstate organs of the Aral Sea basin validated the signatures of the water ministers of the five Central Asian countries. It also enabled developing successful cooperation in water resources management and setting water use limits, and instituting operational control and interaction between ICWC and its bodies.

Concurrently, ICWC and its bodies participated in the conception of a very important long-term document—the "Program of concrete actions on improving socio-economic and ecological situation in the Aral Sea Basin". The document was approved by the Heads of States on 11 January 1994 and accepted by donors as the foundation for international assistance on 24 June the same year. The period when the legal framework for cooperation was setup was marked by unity and openness in interaction between water management and political organs, as well as leading officials of the World Bank. All these facilitated accelerated achievement of consensus and approval of this long-term program of actions.

Under the influence of international consultants and organizations (e.g., the European Union Water Resources Management and Agricultural Production (WARMAP)

program, the World Bank, etc.), Central Asian water management agencies started developing the provisions of the Framework Agreement and transforming these into detailed agreements, regulating the order of activities within each direction of work defined in the Framework Agreement. At the same time, the initial 3–4 years of work experience (1992–1995) made it clear that ICWC succeeded in solving routine operational issues on a tactical scale and tried to advocate and disseminate ideas of future development in achieving forward-looking objectives of strategic nature.

The importance of strengthening the legal basis became clear to ICWC members in 1994, when day-to-day activities of international organizations started confronting cases of indecision and discordance as they apply to principal decisions made by governments of various countries. It was then that records in the minutes of the ICWC meetings started reflecting the concern of ICWC, making it necessary for ICWC members (and through them the governments they represent) to pay more attention to complexities occurring in the work of ICWC bodies and interactions between the countries (Table 3).

Table 3. Issues Discussed at ICWC Bodies

Appellation of the Issue	Discussed at Commission Meeting No.	Final Decision Reached Yes/No
On ensuring preferential tax, customs treatment and border passport control for water management agencies in accordance with clauses 9 and10 of the "Concrete actions program," signed by members of ICAS Board	Minutes 8 (1994), 12, and 13	No
On arranging regular information exchange between ICWC bodies and water management agencies; on creation of information system and its performance rules	Minutes 10 (1995), 12, 16, 19, 22, 24, 25, 26, and 30	No
On setting sanitary releases along the Amu Darya and Syr Darya rivers	Minutes 12 (1995), 33, and 34	No
On development and accepting agreed main provisions of regional water strategy	Minutes 12 (1995), 13	Yes
On maintenance of river channels and passing of floods	Minutes 13 (1995)	In part
Allotment of funds for maintenance of hydro structures on transboundary waters	Minutes 13 (1996), 18, 20, and 22	In part
Lack of a mechanism for expertise of interstate projects	Minutes 15 (1996)	No
Lack of order of interaction with donors	Minutes 15 (1996), 31, 32, 33, and 34	In part
Unsatisfactory interaction with hydromet services and unreliability of forecasts	Minutes 16, 24, 28, and 29	In part
Necessity of organizational and sequential work on agreements	Minutes 16, 18, 26, and 30	In part
Development of regional and national criteria on water use in the region	Minutes 17	No
Necessity of involving vice prime ministers in ICWC activities	Minutes 17	No
Necessity of establishing a water energy consortium	Minutes 17	No
Insufficient effectiveness of the 17 March 1998 Agreement	Minutes 19, 22, 25, 28, and 29	No
The Agreement on “Principles of shareholding participation in reimbursement of water management structures O&M costs”	Minutes 20	No
Observance of water delivery regimes to deltas	Minutes 21	In part
Inadequacy of mechanism for funding interstate organs	Minutes 23, 24, 25, 26, 27, and 28	In part
Necessity of preparing the Agreement on the Syr Darya river water resources management	Minutes 26, 27, and 29	No
Disproportions in water delivery levels between lower and upper reaches of the Amu Darya river	Minutes 27 and 31	No
Rotation of senior executives of ICWC organs	Minutes 28	No

ICAS = Interstate Council on the Aral Sea; ICWC = Interstate Coordinating Water Commission.

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The following statement appears in the memorandum on the results of the visit paid by the ministers/ICWC members, to the European Union (Belgium, Italy, Germany) on 6 December 1995: "ministers, realizing their responsibility for getting out of the crisis in the Aral Sea region which is unprecedented in history as to its scope and complexity, proclaim:

- ICWC member-countries are united in their understanding of common tasks to improve management of shared basin water resources for the welfare of their countries and the Priaralie as an acknowledged independent water user;
- ICWC member-countries on the basis of previous agreements between them, taking into account works and courses of action on the water strategy developed by joint efforts within the WARMAP program, clearly conceive the ways of solving these tasks and are firm of purpose in working out joint, synchronous measures to implement them at both interstate and national levels—measures, which allow not only justifying but also creating a mechanism of conflict-free water resources development and use;
- ICWC member-countries believe in developing a set of juridical and legal documents as common for all "rules of play", which all actors of water resources management and use should follow. Their development should be of evolutionary nature resulting in the emergence of "milestones," which would be directed toward the continuous search for stable consensus, taking into account national interests and oriented at the beacon of regional demands. The only condition here is willingness of each country to make concessions while evaluating national and regional aspects."

The conference-workshop on the results of this visit adopted the decision stating that "developing the legal and institutional basis for water resources management at the regional level is the imperative for our further joint activities. Taking into account ecological demands is a mandatory requirement agreement developed by us." The resolution adopted by this conference-workshop is stated as follows:

I. To develop in the first place the following interstate agreements:

(i) agreement on enhancing rights and augmenting responsibilities of ICWC;
(ii). agreement on water resources use in current conditions;
(iii) agreement on ensuring ecological sustainability in the region, water resources protection, rules for their quality control; and
(iv) agreement on joint water resources planning and use.

II. To strengthen and elaborate legal aspects of all ICWC bodies' status as to their full compliance with international water law provisions

III. The implication of legal and institutional documents should proceed from deliberation upon vesting ICWC to the full extent with authoritative and powerful functions so as to transform it into the Regional Water Government.

IV. While elaborating institutional provisions, consideration should be given to reinforcing participation of all countries in executive bodies and establishing their branches in every country."

Of great significance was the development of the "Main provisions of regional water strategy in the Aral sea basin" (1997), which oriented all participants in conducting major activities to strengthen the institutional capacity of interstate organs along the following lines:

- Internationalization and parity representation of all states;
- More precise elaboration of functions and responsibilities, sources of data duplication, and scopes of data collection;
- More complete coverage of water resources including underground and return waters as to managing not only quantitative but also qualitative parameters of transboundary waters; and
- Turning over all transboundary river channels, including deltas adjacent areas, to Basin Water Organization management.

With the purpose of improving transboundary water resources management, consideration was given at the said conference-workshop as to pursuing priority international agreements on:

1. Enhancing rights and augmenting authorities of ICWC;
2. Daily proceedings for transboundary resources use;
3. Joint water resources planning;
4. Sustaining the ecological balance in the region and protection of water quality;
5. Financing interstate organizations engaged in water resources management;
6. Protection, maintenance, and preservation of interstate hydraulic structures; and
7. Developing and implementing basin information systems.

All these agreements are designed to ensure an integrated approach to transboundary water resources management. This approach includes the following:

1. Integrated planning of shared water use of all regional states;
2. Integrated planning of joint water resources management on the basis of intersectoral and interstate analysis;
3. Joint planning of investment and funding of water resources development and management;
4. Integration of schedules regulating releases from water reservoirs, taking into account interest of energy sector, agriculture, tourism, fishery, and ecosystems; and

5. Integrated advisory councils—national water management committees with participation of NGOs.

The work had been started and organized within the WARMAP project. This allowed submitting the text of four agreements for consideration of the 16th ICWC meeting. They generally agreed and in accordance with item 3 of the ICWC decision the four agreements were later directed to the governments of the Aral Sea basin countries and Executive Committee of the Interstate Fund for the Aral Sea (EC IFAS) with the request to establish governmental groups for complex analysis and discussions at the interstate level.

Subsequent discussions (which became especially active after 1999) with direct participation of Mr. Altyev, Chairman of EC IFAS, allowed elaborating the texts of two draft agreements "On organizational augmentation of ICWC bodies" and "On information exchange." At least one of them was signed by the ICWC members. It was decided to divide the Agreement "On water resources use" into two parts for each of the Aral Sea basins and include issues of long-term planning in them. BVO Syr Darya and SIC ICWC immediately organized such work and the draft agreement was submitted for consideration of the 26th ICWC meeting.

To date the Agreement "On information exchange" signed by the ICWC members has been submitted to the IFAS Board members for signing; the Agreement "On organizational structures of the ICWC bodies" has been agreed in principle; the Agreement "On measures to sustain ecological conditions of Central Asian rivers" has been distributed among the countries for discussion; and the Agreement "On the Syr Darya water resources management" has been deferred till an uncertain date.

What is the obstacle preventing the signing of these agreements? Maybe there is no need whatever for these agreements at all! Life and elementary analysis will show that this is not the case. These agreements can put in good order abeyance, and facilitate in solving problems that emerge in the day-to-day work of ICWC bodies and water management organizations. Having a look at the dynamics of issues subject to discussions at the ICWC meetings is quite enough to understand that the urgency of the issues has not diminished—these issues are still vital. What is more, pending problems and delay in tackling them remind us of an urge to conceal the problem under a blanket, but it continuously emerges from under the blanket now here, now there. These issues are the source of concern and problems only for direct users—the ICWC bodies, and as to decision makers, they (political organs) are a long way off from them. Frankly speaking, we may say that the ICWC members, the key spokesmen who draw the attention of governments to problems, are so much preoccupied with tackling routine problems (they have learned to solve them rather skillfully, though at the expense of much time and effort) that in the long run they lack energy, persistence, and mandated authorities to settle vital issues at high governmental level.

EC IFAS, which will steer these draft agreements through authorized organs of the countries, also lacks steadfastness and adherence to principles. A relevant example is the Agreement "On the status of the IFAS organs," which was discussed in 1995 and signed by the Heads of States only in 1999, which could have solved, in major part, the problems pertinent to conditions that hinder ICWC from functioning. Probably there would not have been any necessity for the Agreement "On the organizational structure of ICWC," if all the questions (which were included at the

first stage) had been taken into consideration. The final discussion of this Agreement managed to settle the problems hindering operational activities only as they applied to the EC IFAS representatives, compelling the ICWC working bodies to overcome as before continuous obstacles.

Indisputably, there are certain contradictions and counteractions opposing conciliatory processes at the intersectoral level in every country, alongside specific interests of various countries in water management and use. But there is also the necessity of setting strict rules for joint work, without which it would not be possible to implement integrated regional water resources management. Hence, it will be impossible to provide the countries with a sustainable water supply. Deep understanding of this interrelation and the current situation in water relations depends in many respects on personal contacts between the present heads of water management agencies, who have been working (from Soviet times) together and now follow the inertia of previous relations.

There are certain postulates that are followed by those who are responsible for water management and use and this instills confidence that the appropriate legal framework may be and should be established at the level of the five—and later possibly at the six (including Afghanistan)—countries:

1. Increase in economic, ecological, and social demands, as well as the presence of certain destabilizing factors, combined with limited water resources in the region, determine the need for cooperation, teamwork and mutually fruitful water resources joint management as well as for developing along a common regional path, and the countries should follow this path if they really choose to ensure happiness and prosperity for their people. Water resources in the region exist in amounts sufficient for meeting the needs of both society and nature, if the countries are guided by joint effective and efficient water use that can be achieved through transition to integrated water resources management; and

2. ICWC is an authoritative and acceptable organ, which has been forming a certain pattern of joint work, permitting the solution of all these tasks, but it requires improvement, consolidation of collective efforts, and sustainable performance.

The main directions of such improvement include:

- Involvement in water management process of all the sectors interested in it (hydroenergy, nature protection, hydromet services, agriculture), as well as municipal (provincial) authorities;
- Participation of all sectors concerned not only in management, but in financing, too;
- Search for settlements through mutual concessions and taking into account mutual interests on a fair and equitable basis; and
- Taking into account the interests of nature and its water demands.

What kind of mechanism can ensure the success of activities to establish a legal framework for water relations between Central Asian countries?

1. It is necessary to analyze once again all aspects that require certainty and regulation and to reflect them in the agreements, which should be finalized. Concurrently those provisions of draft agreements that contain disputable matter should be analyzed. It is expedient within these activities to work out criteria for water

management and use— as the foundation for future analysis and development. This can be and must be done within the framework of joint IFAS-ICWC work by way of establishing a Working Group on Agreements.

2. A special political organ should be established consisting of representatives from ministries of foreign affairs, justice and government agencies who are responsible for water resources management, and who should be entrusted with organizing permanent work aimed at developing water cooperation and ensuring continuous succession in legal substantiation of water cooperation.

3. A kind of international judiciary committee should serve in the capacity of such a political organ, or it might be something similar to the organ established in the Nile River basin. It is important to ensure succession of this work and its progress in contrast to our current work on legal issues, which has been carried out at random. The example may be given of the experience obtained while developing materials for establishing an "international water-energy consortium," which is expected to be a financial economic instrument, designed to settle contradictions between water and energy sectors. As far back as 17 March 1998, the heads of Kazakhstan, Kyrgyz Republic and Uzbekistan governments signed the agreement and provisions on the international water-energy consortium, but unfortunately, this work failed to move further, though SIC ICWC tried repeatedly to revive the issue.

Having analyzed the positions of responsible country representatives, and the statements made by them in a number of publications, we can see the following:

Kazakhstan:
- Commitment to the Convention of 1992 as applied to river water quality and observance of other ecological requirements;
- Necessity to establish a water-energy consortium;
- Observance of irrigation water supply schedules; and
- Revision of the 1998 Agreement.

Kyrgyz Republic andTajikistan:
- Downstream countries must participate in operational costs of upstream hydraulic structures and reimbursement of flow formation zone maintenance costs;
- Necessity to sell electricity generated by reservoir draw-down through hydro-schemes on downstream countries' demand for irrigation; or
- Payment for flow regulation.

Turkmenistan:
- Problems of interstate collectors;
- Priority of water use for society; and
- Parity participation in irrigation water supply costs.

Uzbekistan:
- Following the principles of the previous water allocation at the interstate and national levels; and
- Positive role of the 1998 Agreement, but it needs additional elaboration.

Each of these positions can be discussed in detail from the point of view of all alternatives, by applying agreed criteria, and brought to the attention of the parties

for mutual agreement, provided country representatives and water managers begin working together persistently and effectively.

There is a need for support on the part of donors as it applies to participation of experienced specialist in the field of international and national water law, as well as their assistance in conducting pertinent activities and in organizing necessary discussions and Conciliatory Commissions' tasks.

The Water and Energy Nexus in Central Asia

J. M. Biddison

Introduction

This study provides an analytical basis for the Asian Development Bank (ADB) to formulate a regional strategy of timely assistance in the Aral Sea basin of Central Asia. It focuses on the interlinkage between water use management and energy trade with an action plan for the short to medium term (1–3 years). The study makes specific project recommendations and outlines an action plan for ADB to consider, which can be started in the immediate future and is logically consistent with the analysis of present and emerging issues, international financial institution (IFI) assistance, major investment needs, strategic approach and implications, and short- to medium-term project objectives presented in this study.

Present and Emerging Issues

The study has identified the following important issues that must eventually be resolved if the water and energy nexus of Central Asia is to more fully recover and properly develop:

- The "ownership" of the river water resources of the region are not adequately defined or agreed upon, both at the regional and local levels of individual farmers' water rights;
- There are major and developing international conflicts over reservoir operation for the generation of energy and water storage and release for irrigation;
- Management of the agriculture sector has entered a period of reform, but there is still a long way to go. The reform process is affecting the efficiency of water resources management, and water-related issues should receive proper attention when developing new policies;
- The institutional structure for regional water management is inadequate as responsibilities of the regional and national levels are unclear; decision-making forums are not working; and there is a lack of clarity in the information and database required for decision making;
- Water and energy national development planning is hindered by the failure to resolve regional issues, resulting in continued inefficiencies in resource use, and even in the possibility that governments will turn to grossly inefficient solutions that can be implemented nationally;
- Pollution of the natural water resources by agriculture, coupled with rapid deterioration of rural water supply infrastructure, is creating a rising health hazard in the downstream regions close to the Aral Sea. The irrigation system in these regions is used inefficiently to partly compensate for the lack of rural potable water supplies;

- The energy sector is still far from operating according to market forces, at the national level and especially in the regional exchange of energy;
- Energy transfers are inefficient because of the lack of a proper management and operations infrastructure;
- The basic infrastructure of both energy transmission and irrigation are in poor repair. Rehabilitation targeted at improved management, through the introduction of modern equipment and training, is urgently required; and
- The cadre of resource management professionals is severely depleted, requiring human development interventions.

Strategic Approach

The region is still within a period of reform since the breakup of the Soviet Union, which had considerable influence on the energy and water sectors. The extent of reform required means that political and institutional difficulties still hamper progress in improving the sharing, planning, and management of energy and water resources. Meanwhile, the infrastructure and institutions are declining and there is a risk of them entering a downward spiral. Falling revenues from industry (which is fed by energy) and agriculture (which is fed by water) do not provide the necessary operation and maintenance (O&M) funds, let alone investment, to enable these sectors to recover. Thus, although it would be preferable to realize a perfect political and institutional framework before embarking on investments, funding is urgently needed to reverse the decline in the basic infrastructure and institutions. After over a decade of appraisals and studies by IFIS, investments can be reliably identified rather quickly that will definitely fit within most likely future development scenarios.

Reform of these two sectors continues, with governments making strategic decisions based on their political and economic objectives and the realities that they face, both within the country and in relationships with their neighbors. However, changes in national and regional policies and institutional arrangements take time, as governments develop their strategies for the future based upon experiences to date. One objective in identifying specific projects has been to conduct "demonstration models" that will assist the governments to define their future strategies. It would be unrealistic to expect countries to embark on cooperative agreements that might have far-reaching economic implications without ensuring that they can be implemented through strong regional bodies. Thus, several of the proposed projects aim to build the infrastructure and institutions that are needed to implement improved regional cooperation in resource use.

Many IFIs are providing support to these sectors in Central Asia and it is emphasized that this support should be integrated as far as is practical. The recommended specific projects in this study identify the most suitable support to be provided by ADB, based on its strength and preference in funding construction, rehabilitation, and civil works and procurement of equipment and technology through loan mechanisms to counterpart governments. It is proposed that ADB partner with the United States Agency for International Development (USAID) in the replication, duplication, or expansion of specific types of projects already successfully conducted by USAID, World Bank, and the Swiss Development Cooperation (SDC) in the region. As ADB's partner in funding and managing these projects, USAID would emphasize its strength to provide technical assistance, training, and public outreach components.

By making use of the demonstration models provided by existing projects as well as the proposed ADB projects, IFIs will continue their dialogue within the region to assist in the reform process.

Investment Opportunities

The study recommends that the following specific projects be jointly undertaken by ADB and USAID in carefully chosen strategic locations and under jointly agreed goals and objectives:

Support Cooperation in Regional Water Resources Management

- Install forecast, data collection, and communication stations to collect accurate snowmelt information and improve stream-flow operational forecasting;
- Improve river water quality data collection and analysis by selectively upgrading key Central Asian laboratories;
- Rehabilitate, automate, and computerize basin-wide river management Decision Support Systems to reduce operational water losses;

Strengthen the Irrigation and Drainage Infrastructure

- Rehabilitate and provide automation and communication equipment on main canals in the Amu Darya basin to better allocate water to on-farm management schemes;
- Provide equipment to integrated on-farm water management schemes to improve the irrigation and drainage infrastructure;
- Construct and rehabilitate groundwater desalinization systems in rural villages and provide O&M equipment in Karakalpakstan;

Create Market Reform in the Energy Sector

- Provide technical assistance and training to the Tajikistan Ministry of Energy to strengthen its legal, regulatory, and institutional capabilities;
- Provide the Central Asia United Dispatch Center and the Syr Darya and Amu Darya Basin Water Organizations with computer, office, and communications equipment and software to improve energy and water use dispatch and coordination; and
- Extend the Central Asia United Power System into northern Afghanistan to create future energy trade markets with Central Asia.

Ten Years of Donors' Support for the Aral Sea Basin Program

V. A. Dukhovny

The history of cooperation between countries of the Central Asian region and the international community in the area of improving water resources management celebrated recently its 10th anniversary concurrently with the 10th jubilee of the Interstate Coordinating Water Commission (ICWC). The international community, immediately after establishment of the new independent states, started gaining insight into the essence of water relations in Central Asia, in the first place from a position of criticism concerning the ecological crisis in the Aral Sea basin. Afterwards, the international community focused on efforts to guide water management in the region along lines that seemed to be most effective from the point of view of experts representing external aid organizations and especially international financial institutions (IFIs).

The approaches chosen by the World Bank give credit to it and the high-level professionals who actively participated—first in perceptual, and then in creative—processes of developing the Aral Sea Basin Program (ASBP). Among them are Guy Le Moigne, Michael Petie, Peter Withford, Michael Rathnam, Janush Kindler, Jeremy Berkoff, Michael Cherny, Said Karmany, and others. Their experience and true apprehension of the situation in the region kept them from thrusting their opinions on local organizations and specialists, who by that time had already created ICWC and the International Fund for Saving the Aral Sea (IFAS) and had determined their major objectives and tasks. These specialists had chosen to try elaborating a common program and joint action plan. It was due to this very approach that the Program approved by the Central Asian Heads of States on 1 November 94 and the Aral Sea Basin Program submitted for consideration at the meeting of donors in Paris (April 1994) were absolutely identical (except the titles) and fairly understood by both parties. The countries of the Central Asian region unanimously supported the World Bank initiative to become the coordinator of the ASBP Program. It should count among the successes of the World Bank that during the first stage (1994–1997) it managed to put in motion the development of this program and ensure efficient coordination under the direction of a special office (P. Whitford), which initiated all seven directions of the ASBP implementation as well as involvement of a significant number of donors in activities within this program. It was at this moment that the assistance rendered in the first place by the World Bank and the European Union (WARMAP program) afforded an opportunity for representatives of newly independent Central Asian states to arrange joint work on developing the "Main Provisions of Regional Water Strategy" and creating the "Regional Information System." This assistance also made it possible to work out the feasibility study for improvement of water resources management in two basin organizations (Program 7) and to carry out a series of other important activities.

But as early as that time two principal lines of development, one differing from the other, had clearly begun to show themselves. One line of development is characterized by partnership between donors, beneficiaries, and organizations, contracted by such agencies with the help of local entities. In such partnership projects, local organizations, particularly ICWC and IFAS, represented themselves not only as beneficiaries, but they concurrently defined the major lines of development and substance of programs, and also identified local executors, who together with foreign consultants were put in charge of implementing works and ensuring their effectiveness. As the framework of these projects (European Union – WARMAP project – Stage 2, Canadian International Development Agency (CIDA) – Program 7, World Bank – major provisions of regional water strategy), the ideas were worked out by Central Asian regional and national water management organizations. Executors for these projects, in major part, were taken on from among local specialists and the share of expenses for local specialists was in the range of 30% (WARMAP program, CIDA) up to 50% ("Major Provisions of Regional Water Strategy" program). It was not by chance that these very projects had been completed with expected outputs: the "Major Provisions of Regional Water Strategy" had been developed and agreed among four out of five regional countries; the Feasibility Study of "Operational Water Resources Management and Control" for BVOs "Syr Darya" and "Amu Darya" had been developed and approved; and WARMIS regional and basin information systems had been created. At the same time the unique Water Use and Farm Management Survey (WUFMAS) system of observation, analysis, and improvement of the effective use of irrigated lands had been methodically developed and practically implemented. The WUFMAS system has set up the basis for understanding possibilities and practical feasibility of achieving potential levels of irrigated land productivity and it has been acknowledged by farmers' organizations with full approval. Another unique program—"Water saving" (GEF WEMP Component A.2) should be added to this series of programs; it was initiated and successfully carried out by local specialists, but it was turned down by the World Bank.

The second line of aid activities is characterized by the practice (habitual for donors, but unusual for local conditions) of employing contracted consulting organizations ("newcomers"), who were acceptable for such donors, but turned out to spend most of their time apprehending local, complex water management systems and interrelations between their actors. The bottom line of such foreign specialists' activity was delivery of "lifeless" projects of multi-million dollar costs, which simply remained on the shelves of both beneficiaries' and developers' offices.

A separate stand was taken by certain categories of donors, in the first place by the United States Agency for International Development (USAID), which in their work proposed some of their own objectives, followed their own principles, gave not very much consideration to the interests of direct beneficiaries, and spent tremendous (according to our standards) funds, giving little attention to effectiveness, practicality, and outcomes.

Many examples of such activities could be given: "Simulation of water resources management in the Syr Darya river basin" (USAID), which never worked out expected models; Program 4.1 - without success, made a mess of by a Holland firm "EuropeConsult" at $3.8 million being spent; "The right bank collector along the Amu Darya river" ($3.8 million), which has failed to suggest for 5 years any new

solution except those that were recommended during the USSR times; and many other examples.

Unfortunately, when this second type of aid activity reached its height, it coincided with the decrease in attention paid by the World Bank to the Aral Sea problems, shutting down the special office headed by P. Whitford in the headquarters (1997). This was combined with actual lack of coordination between donors in implementing the Aral Sea basin program. It was not by accident that (Table 4) this program got successful implementation only in regard to those items which were connected with direct loans given by the World Bank and other donors. Especially, it refers to the "Water supply, sanitation and health" program. As to Programs 2 and 3, and a major part of Programs 4 and 6, they actually have come to a standstill followed by very little attention given by donors.

ICWC in its analytical notes repeatedly pointed out the main drawbacks and low effectiveness of such projects. In this statement we cite the list of shortcomings given in the working report of the "Medecins Sans Frontieres" program in 2001 as follows: "… it was not possible to determine that the international community had achieved any of its stated goal (of the Aral Sea programs), … a gradual retreat has occurred from early ambitions,…the international community has gone from serious engagement with highest levels of regional political power to resolve health, environment, development and water use issues to … improving piped water systems." The authors identify the following causes of such situation:

- Agencies dependent on donors for financial support are free to propose any program they choose, and they are largely free to discontinue it as it suits them without consultation with beneficiaries;
- There is currently no accountability to the beneficiaries;
- The volume of aid is extremely insufficient;
- Programs are not coordinated between themselves;
- Activities within programs get insufficient coverage in mass media, are insufficiently discussed between donors, executors and beneficiaries; and
- There are cases of contradictions, duplication of facts, and parallelism.

The last 2–3 years have been marked by a really new type of donor support – the partnership cooperation between ICWC and: - CIDA, in creating the ICWC Training Center, which is of great importance not only from the point of technical view, but politically too; - Swiss Development Cooperation (SDC) as it applies to the pilot project "Integrated water resources management in the Fergana Valley" and a number of projects within Program 7; - North Atlantic Treaty Organization (NATO) on development of an ecological activities scheme in the Amu Darya delta; - International Water Management Institute (IWMI) on the program of water saving and the best practice in improving land productivity. The characteristic features of these programs are equal distribution of responsibilities between local executors, technical advisers, and the customer, a strict system of financing on the basis of assessments of completed works, orientation toward final results, and a high level of practicability. A high degree of such programs' effectiveness should also be noted. For example, more than 400 specialists have been provided 7–10 days training courses for 2 years of ICWC

Table 4. Information about the Implementation of the Aral Sea Basin Program
As of 01 September 2002

Name of Project	Actual Contribution		Loan ($M)	Outcome
	Source	Grant ($'000)		
1	3	4	5	6
1.1. Regional water (RW) resource strategy	GEF	4,988.50	–	- Principal provisions of RW strategy;
	NTF	1,891.00	–	
	EU	6,500.00	–	- Draft of 4 agreements;
		13,379.50	–	- 5 national and one regional strategic draft not completed
1.2. Dam safety	GEF	130.00	–	10 dams surveyed and monitoring equipment procured
	SIDA	970.00	–	
		1,100.00	–	
1.3. Reservoir management	USAID	1,600.00	–	Agreement from 1998
2.1. Hydrometeorological surveys (transboundary stations)	UK	200.00	–	Installation of 40 stations
	GEF	1,280.00	–	
	SWISS	2,200.00	–	
	USAID	580.00	–	Forecast not completed
2.2. Regional information system	EU	4,300.00	–	Regional information system on the level 7 points Methods for ISEAM transferred
	EU	2,250.00	–	
3.1. Water quality management	NTF	1,100.00	–	–
3.2. Uzbekistan drainage	PHRD NTF	1,400.00 2,200.00	–	3 stage FS and EA
4.1. Wetland restoration of Amu Darya delta	NTF	3,800.00	–	-
Sudochye Lake	GEF NTF	2,860.00	–	Project close to completion
Scheme of wetlands on Amu Darya delta	NATO	240.00	–	Prefeasibility study close to completion Construction ongoing
	IFAS	250.00	–	
4.2. Restoration of Northern part of Aral Sea	ITA	500.00	60.00	Tender for construction of 1 stage prepared
	WB	130.00		
4.3. Environmental study on Aral Sea	NTF	700.00		
4.4. Syr Darya River lower reach	WB	450.00		Prefeasibility study completed
5.1. Water supply, sanitation, and health in Uzbekistan	NTF	300.00		Development of water supply is ongoing; successful
	WB	150.00	75.00	
	SWISS	5,500.00		
	KFW	800.00	9.40	
	KFAED	800.00	19.80	
	Japan	800.00		
	DN	300.00		
		8,650.00	104.20	
5.2. Same in Turkmenistan	WB	-	30.30	-do-
	Japan	406.00	–	
		406.00	30.30	
5.3. Same in Kazakhstan	KFAID	-	11.50	-do-
	KFW	1,250.00	7.70	
	WB	-	7.70	
		1,250.00	26.90	
5.4. Same in Tajikistan	SWISS	300.00	–	Project started
	WB	-	30.00	
5.5. Water supply in medium term	-	-	–	
5.6. Water supply in long term	-	-	–	
6. 0 Upper watershed	NTF	1,000.00	–	-
	Finland	300.00	–	
	Turkey	306.00	–	
Operational water management on BVOs	CIDA	1,500.00		Prepared Financial Study on Program 7; equipped 4 structures
	USAID	220.00		
	SDC	200.00		
	IFAS	110.00		
Support IFAS and ICAS	WB/NTF	1,300.00	–	Support SDC, IFAS board
Aral Sea CB	UNDP	2,400.00	–	
Training Centre	CIDA	1,600.00		Activity of TC ICWC organized
Integrated water management in Fergana Valley	SDC	1,600.00		Project started on the territory of 5 states
Public opinion (Component B of GEF Agency)	GEF	1,150.00		
TOTAL		**59,811.5**	**251.40**	

Training Center operations, with total costs of $360,000 at the expense of donors and $80,000 at the expense of ICWC. There is another example. The cost of automation of large hydraulic structures on the Syr Darya carried out by foreign firms came to $30,000 per gate, whereas the cost of the same work done by local organizations and financed through the USAID/ EPIC project came to $6,000. At the same time, other donors continued displaying distrust on the technical expertise of our specialists and engaged foreign companies that employ specialists, who get salaries 20 times more than local specialists, but turn out to be incapable of implementing solutions set by the performance specification (e.g., "Haskoning", component A-1).

So far, ADB has supported two activities in the area of regional water resource management: (i) a study on the "Transboundary Water and Related Energy Cooperation for the Aral Sea Basin Region of Central Asia" (joint work with USAID); and (ii) Regional Consultations for Shared Water Resources in Central Asia under a regional technical assistance project. Aside from that ADB is promoting efficient usage of water, and protection of the environment through the implementation of a number of investment projects in Kazakhstan, Uzbekistan, and Tajikistan.

Undoubtedly, significant defects in the work of local organizations, first of all in the IFAS activities, have had a negative impact, as it is the case with EC IFAS, when donors often do not see clarity and purpose in the work of the regional organ, which should be one of the main local agencies coordinating our programs. Continuous rotation of the EC IFAS location and personnel do not create a foundation for successful interaction. Engaging every 2 years new people leads to gaps in succession, loss of knowledge base and communication and resources base necessary for interaction. It should be noted that cooperation between independent countries does not function as something that is stable and exists only in itself. Cooperation even between two countries undergoes periods of decline and upgrade, successes and failures, since it depends on external and internal political, economic, and social peculiarities of each country, its political willingness to cooperate as well as on complex fluctuations of all these factors. The example of relations between two economically powerful countries, United States (US) and Canada, proves that though they are not quite equal as partners, they cooperate successfully; whereas, relations between the US and Mexico, which have quite different political and economical potentials, are inconstant, economically unstable, and ecologically waning. Therefore, these factors, as applied to our countries, should be taken into account far more objectively, having in view not two, but five countries with different political, economic, social and natural conditions, priorities, and opportunities. Because of these circumstances it is very important that our countries have been cooperating, and the organs created by us have been working, in spite of all complications, and the people with all their hearts try to strengthen this cooperation at the level of organizations and individuals directly participating in joint work.

The role of donors in the Central Asian region is extremely important. It is conditioned on the following existing specific features of water resources management in the region:

- The mighty water resources management system, which had functioned, been used, and maintained on a centralized basis by the former Union of Soviet Socialist Republic (USSR) government. The system included complex hydraulic structures with unique dams, hydropower stations, canals, pumping stations and reservoirs

reservoirs, as well as irrigated lands with modern systems of drainage and anti-filtration coatings;

- Disintegration of the former USSR and establishment of five independent states was followed by weakening of the economic and financial basis, a sharp decrease in irrigated agriculture productivity (by two times per hectare) and at the same time an increase in water demand (especially in upstream states), considering water as a market commodity and equating it with oil, gas, and other mineral resources;
- The political independence of five countries and the ensuing economic difficulties resulted in new priorities and a revaluation of water factors by politicians. In Soviet times subsidies for annual capital investments and operational costs comprised not less than $220 million per year. To date, they do not exceed $15–20 million per year, including running costs of interstate and intersectoral organizations;
- This situation has led to deterioration of capital assets, which in many cases are not subject to repairs, and as a result there is a considerable reduction of water management potential, especially in irrigated agriculture; and
- Incipient water user associations (WUAs) and new privatized farms cannot achieve the level of effectiveness sufficient for financing renovation of assets, funding the WUA themselves and the higher hierarchical levels of the water management system. The situation has turned for the worse also due to reduced world prices for cotton (the major item of export of Central Asia) during the years of independence by 40% (from $1,700–1,800 per ton down to $1,000–1,100 per ton).

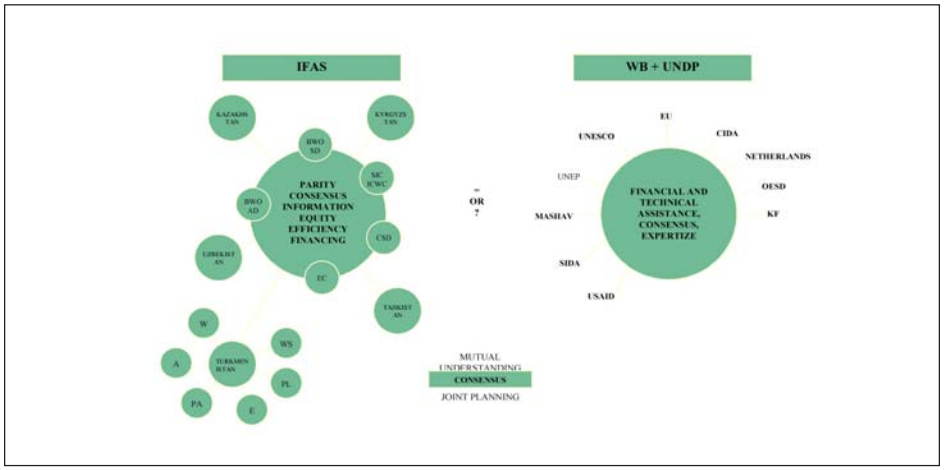
In such a situation the support of donors is of great importance both from the point of view of interstate problems and national irrigation/water management potential. There is no doubt that if the past productivity of irrigated agriculture could be reconstituted—the former $1,600–2,000 per hectare against the current $500–900 per hectare (the same stands for water productivity), then farmers would be able to develop and self-sufficiently sustain their production capacities. However, according to our forecasts, this will take more than 10 years and require large foreign investments. In other words, the future is unpredictable for the region, where 52–53% of the population lives in rural areas and whose welfare depends on irrigated agriculture. The decline in living standards of these people may affect politics and lead to dissatisfaction of the population and social tension.

Political and economic aspirations of the countries are presently aimed at ensuring survival and achieving at least the initial level of the living standards of 1990. During conditions when national income per capita in all countries of the region is lower than the initial level by 1.5-8 times, it is natural that the water sector is maintained to the extent possible, and it cannot be the paramount priority, but the socioeconomic and economic significance of water management in the region is immense. This especially applies to maintaining regional infrastructures and organs, which have been funded on the basis of "get the remains" principle. Also of priority is the regional system of water saving and productivity, in the capacity of a single integrated consulting service, designed to assist farmers and WUAs in their efforts to achieve high land and water productivity.

Taking into consideration "the heritage" of the Soviet period (i.e., high level of technical, scientific knowledge and engineering skills, but lack of experience in the field of market economy and appropriate knowledge of democratic environments, delays in equipment supplies), donors should render assistance to the region in "sore spots", but refrain from attempts to arrange an exchange of knowledge between local and foreign specialists. What is more, many of our water management specialists clearly understand the necessity to adapt their knowledge and skills to new independent and market conditions on the basis of their own experience and training provided by foreign specialists. Thus, the region needs financial assistance, training on legal and market economy issues, provision of new technologies, equipment and consulting support—all these should not be followed by dictation of terms. In this case support from donors will be effective and useful.

It is necessary that donors adhere to the principle of "four requirements for consensus (see figure)." Actually, transboundary water management and strategy involve four groups of key actors at the decision making level: countries, sectors within the countries, local (municipal) organs, and donors. Well-coordinated management and development require achieving consensus between all these groups. We have named it as "four consensuses – the basis of hydrosolidarity".

Figure. Four Consensus Principles Between Regional and International Organizations



- Consensus between countries (there are 5 to date, then 6 countries—including Afghanistan);
- Consensus between sectors (and municipal organs) within the country (at a minimum—6 sectors in each country, 3–8 provinces in each basin);
- Consensus between donors;
- Consensus between donors and regional national organs (Fig.1);

FIGURE: Four consensus principles between regional and international Four consensus principles between regional and international

Evidently, donors in our conditions determine a considerable proportion of the success of cooperation and not only are certain efforts needed to ensure it, but efficient coordination is needed too. Previously, one of the donors assumed the leading role in coordinating aid activities for financing and support in accordance with the position

agreed between IFAS and an international organization to avoid duplication, deviation from the common line, and conflict of interests between donors and states. But the weakness of this approach was revealed by the example of the World Bank, and in addition, it caused latent competition and aversion on the part of other donors. Bearing in mind democratic principles of cooperation between our countries, obviously it would be more expedient to establish on the decision of donors a coordination board to be headed on a rotational basis in turns by representatives of major organizations sponsoring the Aral Sea program. This body, which will meet periodically would discuss the progress of activities, issues of financing projects, coordination of projects and their interfacing, and disseminate positive results of some projects among others. Such an approach would allow implementation of purposeful, systematic development of activities by all program participants. It would also enable maintaining the spirit of continuous and effective cooperation between them, including donors. At a meeting between donors in Bastyry (Kyrgyz Republic), on 28–30 August 2000, they expressed the opinion that it would be advisable to hold meetings with ICWC members twice a year. Cooperation between the states is a delicate issue and this aspect should be constantly taken into consideration in their work.

Joint planning, especially of regional programs, is very important when donors are engaged, since sometimes their spheres of interests are of a specific nature and do not coincide with the needs of beneficiaries. If that is so, beneficiaries are compelled to adjust to policies carried out by sponsors, which very rarely results in effective decisions. Therefore, planning of donors' interests and meeting the needs of beneficiaries should be considered by the Coordination Board while looking for mutually acceptable and agreed decisions. The Coordination Board members may meet as required, invite representatives of regional and national organizations, but at the same time they should work out uniform rules of interaction with donors to ensure comprehensive effectiveness of international subsidies.

Selection of priority projects is a very important element of interaction, in particular keeping in mind the projects, which are to be carried over. For example, ICWC submitted for consideration of donors seven priority projects—the water saving program being most important stipulates the establishment of a permanent consulting Decision Support System (DSS) network for farmers and water management organizations. After the European Union and the World Bank stopped supporting WUFMAS, this project now barely exists owing to some support rendered by IWMI as a partner. Meanwhile, it is this very project that enables reduction of annual water use by 1.5–2 km^3 per year and renders significant assistance to farmers in sustaining yields on irrigated lands with annual costs of $150,000–200,000.

Another such priority project put forward by ICWC is Program 7 - automation of operational control at the headworks of the BVOs, but it has gotten only one-time support from CIDA, USAID, and SDC. Unfortunately, consideration of proposals submitted by ICWC has been delayed. The list of priority projects recommended to donors was approved by ICWC in late 2001. The projects were discussed by donors together with ICWC in Almaty (February) and Bukhara (April 2002). They supported certain projects verbally, but to date only one has given consent to arrange preparatory work on these projects. Information on the projects was delivered at the X OSCE Forum in Prague, where interest was indicated in two projects, but there is no indication of further progress.

Implementation of joint activities should be carried out by local organizations in accordance with the program and with participation (observation) of foreign consultants or agencies strictly on a parity basis. The indispensable conditions for implementing such kind of work should be the joint elaboration of specifications, a plan and elements of the project, and a time table of work progress and outputs, according to which payments and further funding are to be carried out.

While providing technical assistance, grants and loans, more confidence should be exercised as to capacity of beneficiaries. Such confidence should serve as the basis for relying upon local human potential; favoring companies of developed countries or their selected representatives should be excluded from IFI "procedures." At the same time, donors must reserve to themselves the functions of continuous control over final results and general monitoring of the progress of project implementation, refrain from engaging in constant control over every step of the works, which in essence turns into bureaucratic procedures. Donors could, by reducing the time they spend on detailed control, reorient themselves to arranging control over final results; providing advanced funding for intermediate stages would eliminate regulation of the beneficiaries' daily activities, thus making local specialists more responsible for expected outputs.

A transition to effective engagement of local consultants into the process of project implementation will turn the commitment of beneficiaries into an engine moving to the final results, making them responsible for each project's success. Foreign consultants should be engaged only for conducting certain advisory services for local executors and only along the lines of assistance chosen by the beneficiary and under the mandatory requirement that the consultant proves appropriate knowledge of local conditions in the countries where they have been invited, with due regard to specific domains of responsibilities for the final results as they are defined in the project specifications.

Concurrently with this, it necessary to consider as effective measures openness and public awareness about project implementation combined with the involvement of NGOs and public opinion.

Developing cooperation with donors requires strengthening the status and authority of EC IFAS, which is responsible for relations with donors. The knowledge and skills of EC IFAS personnel should be augmented, and work with ICWC organs coordinated and certain internal rules regulating activities of this IFAS organ should be elaborated. Regional priorities, worked out jointly are also of importance. From this point of view, the "Program of concrete actions" (ASBP), which was approved earlier, has retained its significance. It is especially vital taking into consideration the extent to which its separate components have been implemented so far, and it should not be dismissed, but some of the provisions should be better developed and supplemented–this is the approach that should be taken by EC IFAS.

Recommendations of National Focal Points and NGO Representatives on Cooperation in Shared Water Resources in Central Asia

Regional Cooperation of Central Asian States on Water Issues: Experiences and Current Realities

N. K. Kipshakbaev

Introduction

The growing demand for water in various sectors of the economy and the water deficit emerging in this connection, all-round contamination of water sources as a result of economic activity, the lack of appropriate attention to issues of reasonable management, and water resources conservation and protection in the Aral Sea basin—all these have brought about serious tensions in the socioeconomic situation, and resulted in an upsurge of awareness about the intensity of water problems. The increasing water deficit has been caused not only by growing demand for water and scarcity of resources, but also because of ineffective approaches to water use and unskillful management of multipurpose water resources schemes in the Aral Sea basin.

In the beginning of 1992, immediately after the disintegration of the Union of Soviet Socialist Republic (USSR), the ministers of water management agencies of the new independent states, on the instructions of their respective governments (all of them were at that time government members), signed the "Agreement between the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Uzbekistan, the Republic of Tajikistan and Turkmenistan on cooperation in the field of joint water resources from interstate sources use and protection management." The parties made the historic decision, which had no analogue in the centuries-long practice of interstate relations, on establishing the Interstate Coordinating Water Commission (ICWC) dealing with issues of rational use and protection of transboundary surface water resources.

At present ICWC successfully sustains the situation in the region and prevents the possibility of conflicting situations occurring in the sphere of interstate water distribution. Its major activities are directed at maintaining sustainable water resources management in the Aral Sea basin and, concurrently, handling issues of long-term development. During a short period of time (especially at the initial stage) quite a lot was accomplished, and what is important, the guidelines for joint management of shared water resources were elaborated, taking into account the interests of each state. Regional institutions were created with the purpose of implementing agreed decisions such as the Amu Darya and Syr Darya BVOs, and the Scientific Information Center (SIC).

Giving credit for what has been done by ICWC, some slackening of work should be noted. It is noticeable that the role of ICWC members has become less active; there is deviation from tackling some major, present-day water problems and tasks. At present there is no alternative to ICWC; as stated above, it determines and implements

the strategy of transboundary water resources management in the Aral Sea basin and, in general, it has proven not only its necessity, but also its effectiveness. At the same time, analysis of the current interstate structure for water resources management indicates the following shortcomings:

- Water management bodies in Kazakhstan, Kyrgyz Republic, and Uzbekistan, in spite of the complexity of water problems in the region, have lost their independence lately, belonging now to the Ministries of Natural Resources and Environmental Protection and the Ministries of Agriculture. In each state, the chief executive of water management is not now the first line head of the sector in the Republic, which negatively affects independent and responsive decision making related to vital water issues;
- Water management organs within each state do not represent an interagency body coordinating regulation of water resources use and protection; and
- Tendencies and practices inherent in the past command-administrative system are still showing up on the part of current executive authorities at the republican, provincial, and district levels, thus hindering implementation of agreed decisions taken by regional and interagency bodies on issues of water resources allocation between water users and states.

Vectors of Regional Cooperation

Improvement of Water Resources Management Organizational Framework

Water management and ecological problems of the Aral Sea basin require an integrated approach and decision making. Negative socioeconomic consequences of ecological disaster in the Priaralie call for more responsible attitude toward deciding the issues of joint water resources use and protection in the Aral Sea basin. The Aral Sea water resources and environment should be acknowledged as a whole for all the countries and related activities must be regulated taking into consideration the interests of all the people living in the region. Since water sustains life, effective management of the hydroeconomic system requires holistic approach that would interlink interests of socioeconomic development and protection of natural ecosystems. As such, interstate controversies induced by giving priority to local interests would be reduced to a minimum. Water resources allocation and use should be carried out with an allowance for getting the highest possible profit not only by oneself but also by one's neighbor.

The water share for sustaining the Aral Sea (or some part of it) and Priaralie should be determined for each state, within ecologically appropriate parameters, and these amounts of water unconditionally must be transported to the Sea.

It is necessary to work out and implement legal and normative documents, regulating water relations between Central Asian states; giving priority to local interests cannot be allowed while undertaking activities and making decisions.

The level of responsibilities and rights of ICWC and its bodies should be raised to strengthen their role as important interstate organizations mandated to execute the basin water resources management. Assigning heads of regional organs should be done from among representatives of states on a rotation basis.

The legal and financial status of regional organs should be strengthened to ensure

unhindered execution of their activities on the territories of Central Asian countries, in terms of overcoming restrictions on the part of the customs, border guards, visa processing, etc., as well as to provide adequate funding for maintenance of operations by interstate organizations of hydraulic structures regulating water use and transporting flows.

It might be useful to have an advisory center or advisory panel attached to ICWC, and to engage in its activities authoritative, independent professional specialists and scientists from Central Asia and other countries. It would give ICWC the possibility of getting "opinions from outsiders" while considering important decisions on vital problems.

Water management balance of the Aral Sea basin is very strained; water resources are in use to full capacity, there is no free runoff. Therefore, it is necessary to introduce strict water quota setting and water use limitation for all users without exception. All efforts must be directed at reconstruction and improvement of existing irrigation and collector-drainage systems, and perfection of application of water techniques with the purpose of water saving and water resources conservation.

A high level of regional cooperation and integration in the field of agricultural production should be maintained in every possible way.

It is expedient to establish some set-up attached to SIC ICWC to coordinate activities of national hydrometeorological services. Without reliable forecasts SIC ICWC is deprived of the opportunity to take effective measures while solving day-to-day water problems.

Development of Regional and National Information Systems in the Aral Sea Basin

The main task of an information system is application (on the basis of modern technical, computing and telecommunication means) of a uniform tree-structured information system designed for keeping records of water resources formation and use, and assessing various aspects of their utilization effectiveness. Such a system is intended for providing forecasts and working out measures aimed at achieving potential levels of effectiveness, thus enabling implementation of sustainable water resources management and execution of control over their utilization from the lowest administrative unit up to republican and inter-republican levels. The information system permits solving the following tasks:

- establishing the current water use structure;
- establishing boundaries of water resources allocation and water demands determined by such allocation;
- providing key data necessary for economic analysis of regional issues;
- developing analytic information as the basis for regional agreements;
- establishing regular communication and information exchange between member organizations;
- developing monthly, annual and long-term data bases of water resources management; and
- institutionalization of data collection and information exchange between regional and national data base sites.

Modelling of Water Resources Management on the Transboundary Amu Darya and Syr Darya Rivers

Improvement of the current system water resources management in transboundary rivers in Central Asia should be directed at preventing possible conflicts between states and satisfying to the optimal extent water demands of all water users, taking into account natural water bodies under existing conditions and with a view to long-term changes. The major tasks to be solved by water resources management in the Aral Sea basin are as follows:

- forecast, planning, and allocation of river runoff;
- reduction of organizational and channel losses; and
- management of natural water quality.

The low level of reliability of forecasts, assessment of available water resources, impact analysis of water scarcity, information on actual river discharge, water withdrawals, and current deficit in the basin lead to making inadequate decisions, which provoke water intakes over the agreed limits. Such actions are the major cause of irregular provision of water supply necessary to meet demands, resulting in catastrophic consequences in the rivers' lower reaches. A package of models should be developed oriented at shaping and substantiating such types of management to eliminate of major causes of water management problems existing in the Aral Sea basin, including obviation of intersectoral contradictions, prevention of possible conflicts between states, and negative consequences of water scarcity. Among the priority tasks for today and the future are improving water quality, water saving, rational regulation, and optimal water allocation. Solution of these tasks will make it possible to minimize water deficit in the region and save water resource surplus for sustaining the Aral Sea ecosystems and river deltas.

Basin simulation as an instrument of ICWC and the BVOs for decision-making permits:

- Carrying out management of river water quantity and quality in a rational (optimal) manner throughout the basin on the whole and its separate sections;
- Elimination of possible losses from runoff, caused by ineffective water resources management;
- Swift response to changes in water management situations (due to shortage of water, disproportionate distribution of water deficits along the river channel and among water users, sharp changes in operational regimes of water reservoirs, hydropower stations, and consequently in river flow regimes);
- Making decisions on ensuring the long-term sustainable development of the basin, considering various scenarios on national and regional levels;
- Substantiation and demonstration of advantages of water saving approaches and effective use of existing water-land potential (in contrast to tendencies to develop new lands);
- Application of progressive (advanced) computer technologies, which enable correctness of mission formulation, participation of the user (a decision maker) in the process of simulation, as well as effectiveness of computation.

Automation of processes of water resources allocation, protection, and control over them

Under the current organizational structure of management, the extent to which water management structures in the Aral Sea basin are provided with technical and technological means results in the level and quality of direct annual and day-to-day management of regional transboundary water resources remaining rather low at present. Therefore an important task is to improve the Aral Sea water resources management system, including interstate allocation, protection and control of transboundary water resources implemented through equipping the BVOs Amu Darya and Syr Darya with modern technical systems.

The process of improvement should consist of the following activities:

- Inclusion in the sphere of management all surface transboundary waters of the Amu Drya and Syr Darya channels and tributaries;
- Assessment of return waters that influence quality of the river basins' water resources;
- Inclusion in the sphere of management river deltas and the whole of the Priaralie;
- Monitoring the Amu Darya and Syr Darya basins' water resources;
- Establishing water resources quality management concurrently with ensuring ecological sustainability of water and other natural systems in the river basins; and
- Engagement of water users and NGOs in water management.

Automation of processes of water resources allocation, protection, and control, will achieve the following results:

- Meeting the demands of Central Asian water users in the Aral Sea basin both in terms of quantity and quality in coordination with activities aimed at settlement of contradictions, caused by departmental requirements;
- Minimizing damages caused by lack of coordination between states and agencies;
- Conservation of water resources—thus forming the basis for gradual augmentation of water discharges to the Aral Sea and Priaralie; and
- Normal performance of water management system in the Aral Sea basin.

Implementation of the above-listed activities, on conditions of close interstate cooperation, will guarantee sustainable performance of water management system of the basin in general, and of each Central Asian state.

For the last decade many countries worldwide have come to understand the necessity of cooperating in the field of interstate water protection and sustainable development.

Only partnership and coordination of activities between Central Asian states in the Aral Sea basin can facilitate effective solution of regional water problems that increase ecological tension in the 21st century.

Cooperation Between Central Asian Countries on Water Flow Formation Zones Issues

A. Sh. Djailoobaev

Introduction

Water problems, especially in the Central Asian region, have represented for centuries a significant factor in determining the development of various processes within the region. These issues remain vital at present. For the population of our region, water and water allocation have been one of the major spheres of interstate relations. In our region water should be considered not only as a natural resource, falling under social, ecological and economic categories, but it should also be viewed as a political issue with all the ensuing consequences.

Heads of water management organizations and other speakers have already mentioned the key strategic problems of cooperation between Central Asian countries in the field of water resources use. I would like to dwell upon some aspects of this cooperation as they apply to tackling the problems, which are essential for countries located in the flow formation zone, for the Kyrgyz Republic in particular.

The Kyrgyz Republic possesses substantial resources of ground and surface waters stored in rivers, glaciers, and snow massifs. The total volume of water supply in the Kyrgyz Republic constitutes about 2,460 km^3; however it is still necessary to obtain more specific information on return waters and groundwater. It should be noted that according to some forecasts global warming may lead to a reduction of glacier areas in Kyrgyzstan by 30–40% by the year 2025 and consequently to a decrease in water supply.

The Soviet limitation of water use in the Kyrgyz Republic to 24.7% of available water resources has not allowed the extension of irrigated land areas and will be a constraint for developing irrigated lands in the future. Comparison of actual water withdrawals for the last few years with an average weighted design irrigation norm (taking into account the current crop patterns) reveals that up to 40% of irrigated lands are suffering from lack of water supply. In reality, the situation of water supply for irrigation is even worse since the unregulated runoff of small rivers provides the major portion of water supply to irrigation systems in the republic.

The natural conditions of the Kyrgyz Republic allow practicing only irrigated agriculture on the greater part of the territory; and agriculture is the main water user. Irrigated lands are characterized by specific natural conditions, with specialized zonal varieties of agricultural production, the amount and quality of lands usable for irrigated agriculture, the degree of natural moisture, and the state of irrigation systems.

Land and Water Resources Use

Analysis of official data leads to the conclusion that during the last years all indicators of land and water resources use in the republic have decreased, thus preventing an increase in agricultural production or improved efficiency in agriculture. The area of arable lands has decreased by 60,000 ha over the last 5–6 years, and the area of irrigated lands by 125,000 ha for the same period (a significant part has reverted to nonirrigated lands). The area of sown arable lands has decreased by 86,000 ha compared to 1990; there has been a significant reduction of lands under forage crops; the area of irrigated pastures has decreased by 30,300 ha (almost threefold). Volumes of water withdrawal and water delivery decreased throughout the republic by 1.5 km^3 per year.

Population growth and continuous changes in water use patterns cause an increase in demand for water, reducing the annual amount of resources available per capita. While availability of resources per capita specifies the potential of the country, the state of resource use indicates the level of development and effectiveness.

The indicator "Arable land per capita," developed by the UN Sustainable Development Commission, estimates the level of land resources use in agriculture, and it constitutes 0.3 ha per capita in the Kyrgyz Republic. This signifies that the country has already fallen into the zone of unsustainable land use. Calculations reveal that at a population growth rate of 1.4% per year, the area of arable land per capita will be reduced to 0.2 ha per capita by the year 2025, and at a level of cereal yields on cultivated lands of 25–26 metric centners per hectare, the country will lose food self-sufficiency. If the decrease reaches the level of 0.15 ha per capita, a food catastrophe will set in—the country will be on the brink of famine.[6] Considering the high land degradation rate, entering the zone of risky agriculture will occur 5–7 years earlier. If the poverty level remains at 51%, Kyrgyz Republic will enter the zone of risky agriculture 3–5 years sooner. Though the country has a seemingly high potential for agricultural land use, the remaining unused lands are located high in the mountains and are in the zone of risky agriculture. At present, the Kyrgyz Republic fails to provide its population with enough food due to the water constraints of the last decades. Therefore, having an available reserve of 1 million ha for possible development of irrigated land, the country will have to develop irrigated agriculture. This undoubtedly will cause an increase in water use within the territory.

The level of sustainable water resources use is measured by the following international indicators:

- Annual surface and ground water withdrawal in % of available supply—12–17% in the Kyrgyz Republic;
- The percentage of irrigated arable lands—60–67% in the Kyrgyz Republic; and
- Domestic water use per capita.

[6] These calculations have been made on the assumption that calorie content of the daily allowance of able-bodied citizens should be not lower than 2,600–2,700 kcal—according to the medical forecast, 3,000 kcal—per capita. Reduction of calorie content to the level of less than 2,000 kcal means a food catastrophe or simply famine. About 0.2 ha of arable land per capita can provide in the Kyrgyz Republic 2,600–2,700 kcal, at average cereal yield of 25–26 metric c/ha and net calorie content of 2,000 kcal from 1 kg of cereals. As to 0.15 ha of arable land per capita, this can sustain daily calorie content at a level of not more than 2,000 kcal.

The first two indicators assess sustainability of water use for irrigation needs. The Kyrgyz Republic does not use all the freshwater runoff generated within the country. According to the current interstate water allocation in Central Asia, the Kyrgyz Republic's share of this runoff is 24.7%, of which Kyrgyz 80% is used out of this amount. The buffer stock of 20% would neither cover the water demand in case of drought, nor the needs of the country striving for 100% irrigation of arable lands. Hence, the current water use is already in an unsustainable mode.

Domestic water use in the Kyrgyz Republic exceeds by more than 2–9 times the necessary minimum of 40 liters per capita per day (as determined in Agenda 21). However, according to expert estimates, about 20% of the population has no access to this minimum standard. One of the indicators of sustainable water use is access to good quality drinking water. Less than 75% of the Kyrgyz population has access to good quality drinking water. The conclusion is that one quarter of the population use poor quality water—and this takes place in a country that is immensely rich in high quality drinking water resources.

Water Management and Land Use in Upper Catchment Areas

There are very complex problems related to water management and land use in mountain and upper catchment areas. Floods, mudflows, underflooding, salinity, pollution of groundwaters, and ineffective water use systems are the factors exerting negative impacts on irrigation and agricultural productivity in flow formation zones. The big problems are soil erosion, mountain pastures degradation, landslides, and mudflows. Unfavorable topographic conditions (indented relief, steep mountain slopes, inclination of land plots used for agricultural activities) and lack of forest tracts, combined with man's impact contribute to the erosion processes on mountainsides.

The recent economic crisis makes it difficult to withstand natural disasters (mudflows, landslides, etc.) without support in the form of investments. Erosion is aggravated by mudflow phenomena caused by the rain showers and a sharp increase in the air temperature resulting in water flowing rapidly down ablated and steep slopes. Lack of vegetation and forests accentuate water runoff and contribute to mudflows. Mudflows destroy irrigation schemes, settlements, roads, bridges, transmission facilities, and other economic entities. There is no doubt of the positive effects of afforestation in terms of combating land degradation under such climatic and geographic conditions. In recent times, forest tracts covered considerable areas, but through unwise management, intensive deforestation, pasturing and ploughing, the percentage of forestland sharply decreased. Forests of this region, growing on mountain slopes, play a significant role in soil and water conservation, and water and climate regulation. Thus, augmentation of forested areas in the upper catchment zone might exert a positive effect on the whole basin.

Operation and Maintenance Cost Allocation

Logic and human development suggest that any natural person, legal entity, or state making use of services provided by other persons, or states, including delivery of water, must compensate the costs of these services, including operation and maintenance (O&M) expenses of jointly used hydraulic structures on a shareholding basis. Taking into account mutual interests of neighboring countries in continuous renewal of water resources, execution of joint measures in river basins should be recognized as necessary to

- protect and rehabilitate river water from desiccation and pollution;
- protect and maintain forest resources in the flow formation zones;
- protect against floods;
- prevent and eliminate adverse impacts exerted by water; and
- monitor water resources condition and use.

Neighboring countries should share costs to compensate for the following kinds of activities related to water supply in accordance with ownership and property rights based on joint share financing:

- Operation of joint water facilities taking into account personnel allowance costs, minor and major repair expenses, as well as maintenance costs;
- Depreciation of water facilities;
- Annual damage to agricultural production due to floods and waterlogging of lands caused by reservoirs, allotment of land for canals or other water facilities;
- Elimination or alleviation of damage from floods or mudflows due to river regulation;
- Water resources monitoring in flow formation zones of shared rivers; and
- Maintenance of river flow formation zones (afforestation, exclusion of economical activity, creation of sanitary protection zones, etc.).

The basic principle (based on world experience) of interstate water facilities O&M is shareholding established with the purpose of joint participation in:

- Reimbursement of all kinds of expenses made by a service provider for maintenance, accounting, protection from desiccation, pollution, precautions against adverse impacts exerted on settlements and other objects by water, as well as for O&M of hydraulic structures and facilities; and
- Shared reimbursement of losses and damages pertinent to joint water relations.

Implementation of this principle is insured by accepting, on a mutually agreed basis, all kinds of expenses, damages and losses applied to every water facility and hydraulic structure that is of mutual interest. Moreover, necessary values are defined in monetary terms regardless of water availability in a year. Applying mutually developed and agreed methods may regulate the determining and accounting of expenses, damages, and losses. To establish and implement this approach to interstate water relations, the following should be developed:

- Methods for determining all expenses and damages, which water service providers incur as applied to all water facilities of interstate significance. These should be commonly accepted, simple, and comprehensive and they should be made separately by each water facility and section line of the interstate water allocation;
- Methods for allocating these expenses and damages between state-water users; and
- Rules for settling accounts between the state-water users in compensation of water service providers' expenses and damages.

All expenditures must be determined, not by de-facto, but by current (agreed) standards and only if they refer to O&M of specific water facilities. Annual damages caused to a republic are the result of land allotment (and loss) for water reservoirs, hydraulic structures, canals, roads, electricity transmission and communication lines, as well as of underflooding of territories (cultivated land, settlements, industrial enterprises) resulting from adjacent water retaining constructions and canals. The amount of damage may be determined approximately by average lost income in agriculture. These losses are a combination of the yield losses and, respectively, income on flooded and expropriated lands and the corresponding losses on waterlogged lands. Losses on waterlogged lands can be determined either by the expenditures necessary for drainage of these lands, or (if drainage works are not carried out) by the reduction of income in the waterlogged zone.

At present, all water facilities of interstate significance, located on the territory of the Kyrgyz Republic, are maintained and operated at the expense of the republican budget. The total amount of expenses and damages calculated in accordance with agreed methods by each water facility and section line of interstate water distribution, should be allocated to corresponding state-water users in proportion to income gained by them from the use of this water facility and its water resources, i.e., the total amount of income from (1) production and selling (at world prices) of additional produce (agricultural, energy, industrial); (2) reduction of expenditures on flood control measures; and (3) development of navigation, fishery, hunting grounds, recreation, etc.

Such an approach to cost allocation (proportional to benefits) between water users is necessary for water facilities of multisectoral use. These are, mainly, the Naryn River with the Toktogul cascade of multipurpose reservoirs. For single purpose water facilities (in the Kyrgyz Republic these are mainly for irrigation) the allocation of expenses and damages between states may be calculated in proportion to water use volumes.

The estimated expenses of interstate facilities do not depend on the level of water availability for each specific year. For a stable, agreed interstate water allocation (average over several years with different degrees of water availability) the estimated allocation of expenses will also remain stable. Adjustments will be required only in case of major structural changes (and consequently, operational costs) in water facilities, or if agreements on the interstate water allocation are changed.

Further disregard for the issue of shared participation of state-water users in reimbursement of O&M expenses for interstate water facilities will inevitably lead to conflict situations. They might be caused by:

- Technical factors – reduction of reliability and sustainability, leading eventually to failure of large reservoirs and other hydraulic structures located in seismic activity zones; and
- Economic and political factors – the Kyrgyz Republic cannot bear additional responsibility and incur additional expenses for operating these facilities which provide benefits to other state-water users.

Unfortunately, the Kyrgyz Republic has been compelled to incur immense costs related to rehabilitation of such water facilities as the Papan, Orto-Tokoy, Kirov, and

other reservoirs at the expense of foreign credits, hoping to evoke understanding on the part of their neighbors and subsequent shareholding with their participation. The essential aspect is protection of river channels of interstate significance from adverse impacts of water, meaning protection of downstream settlements against floods, mudflows, and other natural phenomena. Understanding the danger of inactivity in this respect, the Kyrgyz Republic has established a special organization "*Selvodzashita*" (Protection against mudflows) hoping that it may find understanding on these issues and participation of neighbors in proportional cost sharing.

The Kyrgyz Republic bears all these costs on its budget, which actually allots for O&M of water facilities less than 1/5 of what is needed. Under this critical situation we are compelled to divert a part of the budget funds from other internal water facilities, thus contributing to degradation of our own irrigation systems. We have been forced to resort to foreign investment for rehabilitation of reservoirs, canals, riverbank protection, and other works in the amount of about $80 million for 1999–2005.

The above indicates that if neighbors and first of all their water management agencies fail to undertake adequate actions for concluding an agreement on participation in reimbursement of expenses, then the Kyrgyz Republic, to the detriment of ensuring security for the population and its own interests, will not be able to provide the guaranteed water supply from these facilities for both agriculture and technological/household needs.

These issues must be reflected without fail in long-term agreements on water and energy resources use. A draft agreement should also reflect solution of the following:

- Lack of appropriate experience in water use pricing in Central Asia; and
- Water pricing cannot be effectively implemented without establishing rights for water.

Interstate agreements are implemented by sovereign states on terms agreed between the states. The agreements determine the administrative structure of their implementation. However, such structures were formed in Central Asia before the development and signing of treaties or agreements. In this context, it is necessary to develop proposals for the reorganization of the current executive bodies, which were created before regional ones existed, which have not undergone any change since the former Soviet Union.

Experience gained during the past years teaches and reveals that there are good opportunities for fruitful cooperation between countries of the region. This is a solid foundation for the development of mutually beneficial collaboration in resolving the issues stated above during the succeeding period.

Water Conservation – the Most Important Component in Strategic Water Resources Planning in Central Asia

N. K. Nosirov

Introduction

I do not want to draw your attention to the reasons of water-related, economic and demographic tension in the region because they are well known to everybody. Water resources of the Aral Sea basin are fully used. It is enough to mention that water availability per capita is now about 2,500 m^3 per annum; twice that of Egypt, and Iran and six times that of Saudi Arabia and Israel. Though there is a huge land fund in the Central Asian region, irrigated area is 0.19 ha per capita and this limited resource is used ineffectively.

During the last 70–80 years interdependent water and power infrastructure was formed. There are cascades of dams, reservoirs of seasonal and long-term regulation, and hydroelectric power stations (HEPS). The previously established allocation of water, based on seasonal exchange of water, electric energy and fuel, is still maintained. This order was very effective in a unitary state. These conditions are maintained for the most part, but due to the political transformation of recent years, existing economic mechanisms have been distorted and this reflects on water supply stability and the technical state of water-related structures of regional importance. A contradiction of interests (e.g., between irrigation and power engineering) and failure to keep interstate agreements have led to unproductive water resources losses. Formation of new approaches to collaboration in water resources use is the only way to find a solution. Other water losses at the interfarm water system and onfarm irrigation network levels amount to 20% of total water intake. Losses due imperfect irrigation technique and technology amount to 45%.

Under present conditions and in the future water transfer to the basin from outside is unexpected. That is why water conservation is critical for water demand satisfaction in the long run. To improve water availability it is necessary to reduce losses and that requires long-term and large-scale investments.

According to many authors, the average cost of 1 m^3 of additional water is as follows:

	$ Million
Territorial water resources redistribution	300–1,600
Reclamation system reconstruction	700–900
Saline water demineralization:	
Distilling	600–1,600
Reverse osmosis	400–700
Wastewater treatment	100–150
River flow regulation by reservoirs	50–80
Introduction of water conserving irrigation methods	2–5

Obviously, the least expensive alternative is for measures introducing water conservation technology (N.R. Khamraev, Potential of surface irrigation improvement).

Interstate Water Allocation

It is necessary to define the amount of water resources that can be used by each state and to take this amount as a base for undertaking water conservation measures. That is why interstate water allocation is a starting point for the solution of all other problems. Without establishing an economic mechanism for water use, both at the national and regional levels, it is impossible to say anything about water conservation. Adequate attention has not been paid to water conservation issues in Central Asia. One of the serious shortcomings is lack of national water legislation and legal provisions regarding water conservation. At the regional level these issues are being developed within the Water and Environmental Management Project, financed by the Global Environment Facility and the Special Programme for the Economies of Central Asia (UN SPECA) project.

An economic mechanism of interstate water use is being still formulated and covers mostly the Syr Darya basin since it is the more regulated one. But it is due time to think about the Amu Darya basin since many countries experience water scarcity because of its poor regulation. Water conservation should encompass both the interstate and national levels. At the regional level water conservation can be achieved through a balancing of interests, construction of reservoirs, and achievement of optimal management.

Interstate problems of water conservation require long and hard work of many specialists and politicians along with practical steps at the national level. The region's water resources deficit will grow in time. It is linked with population growth and the demand of priority sectors of the economies (municipal needs, rural water supply, industry, recreation, fishery, etc.). Due to economic difficulties, irrigation systems are significantly worn out, for instance, in Tajikistan, by 50%. Seepage from canals is increasing (up to 45–56% of withdrawal), and water allocation among farms and provision of crop water requirements has become more difficult. These all lead to the need for an interfarm and onfarm water rotation system.

Techniques of Water Conservation

Studies conducted by many research institutions in the region show that under water rotation, water losses can be reduced by 16–20% on flat lands and by 20–23% on hillsides. According to preliminary assessments, introduction of water rotation in the regional water use plan will allow savings of 20 km^3 of water per annum.

Many countries presently facing water scarcity have reduced and continue to reduce water utilization. Some countries with a high water deficit, like Israel, have introduced drip irrigation. Economic incentives for water users must be created in order to introduce water-saving irrigation techniques. Under the current economic conditions in Central Asia, staged transition in the following directions is realistic:

- Stage 1 – transition to organizational and partially technical and technological water-saving measures that do not require great investments; and
- Stage 2 – irrigation network reconstruction, drip and sprinkler irrigation introduction, zoning and approbation of basic water-saving technologies.

Table 5. Water-Saving Technologies in Central Asian Countries

Technical	▪ Complex or partial modernization of irrigation systems ▪ Canal lining ▪ Irrigated plots leveling ▪ Improvement of water measurements on irrigation systems
Technological	▪ Water accounting improvement ▪ Use of collector-drainage water for irrigation ▪ Introduction of modern irrigation techniques ▪ Agro-technical methods application to improve soil fertility and soil moisture retention ▪ Water allocation organization and technology improvement ▪ Irrigation in shortened furrows ▪ Tier irrigation ▪ Alternate furrow irrigation ▪ Plastic film application ▪ Recharge irrigation ▪ Deep loosening of soil profile ▪ In-contour use of releases ▪ Differentiated water supply (selected irrigation according to crop status) ▪ Sowing on ridges ▪ Variable irrigation stream
Organizational	▪ Improvement of management structures improvement under market conditions ▪ Establishment of water user associations in irrigated agriculture ▪ Crop pattern optimization (crop rotation with draught-resistant and salt-resistant crops) ▪ Crop pattern adjustment to limited water use ▪ Onfarm irrigation organization under limited water use (fields-indicators) ▪ Concentrated irrigations ▪ Organization of interfarm and onfarm water rotation ▪ Irrigation during nighttime ▪ Implementation of water requests only under field readiness to irrigation
Economic	Economic incentives for water conservation under strict limitation of technological water requirements, charging water consumers a share corresponding to “normative” – biologically needed crop consumption and a higher share for overconsumption due to poor water management at farm-field level

Table 6. Practical Water Conservation Technologies

Applied Water-Saving Technology	Essence of Technology	Water-Saving Effect Compared to Ordinary Irrigation Technology	Zone of Actual Application
1. Alternate furrow irrigation	Under this technology during the period of blooming, fruit formation furrows are cut each 120 or 180 cm, respectively, depending on spacing 60 or 90 cm. Dry furrow is kept loose, providing favorable air-gas exchange in rooting zone. Fertilizer application to the dry furrow prevents their washing up outside rooting zone, thus providing increase of their use efficiency. Such irrigation facilitates crop growth and development balance. Cotton bushes are low with well-developed roots.	Water-saving effect is reflected in wetting stripes of 1.3–1.4 m (at a spacing of 0.9 m) and 0.9 m (at a spacing of 0.6 m) due to lateral capillary moisture spreading outside irrigated furrow. Stripes of 0.4–0.5 m (at a spacing of 0.9 m) and 0.3 m (at a spacing of 0.6 m) remain dry and loose and unproductive losses through physical evaporation are close to nil. At expense of physical evaporation 20–25% total water consumption is also reduced. Compared to each furrow irrigation, water savings is 20–25%.	Applied widely in the following oblasts: ▪ Ferghana ▪ Kashkadarya ▪ Sogd ▪ Osh ▪ Jalalabad ▪ South ▪ Kazakhstan
2. Tier irrigation in furrows with in-contour use of releases	Under tier irrigation irrigated field is divided in 3–4 tiers with spacing determined by furrow length. Furrows are usually short (60–100 m). There are several schemes of tier irrigation organization. Most popular scheme is where "shoh-arik" (carrying furrow) is cut at the center of irrigated plots. Irrigation in short furrows is started from the first tier. After the flow advancing up to the distribution furrow of the second tier, formed release complements discharge taken from "shoh-arik". In such succession irrigation is performed on other tiers. This irrigation allows reach uniform wetting and substantially cut down surface release.	Water-saving effect is reflected in the reduction of water losses by 15–20% through surface release outside irrigated field because release is made only from the last tier. Under steep slope release is directed to lower positioned canals. Irrigation water use efficiency under this scheme is close to 1 within large farms.	Applied widely on land with high slope gradient in the following oblasts: ▪ Kashkadarya ▪ Sogd ▪ Osh ▪ Jalalabad ▪ Khatlon
3. Concentrated irrigation and water rotation	Irrigation succession is established between irrigated plots. All discharge of on-farm canal is directed to next irrigated plot. Sowing is planned in such a way to provide timely irrigation of each plot. Water rotation is used under irrigation of large water use units.	Due to concentrated water supply organizational losses (usually 30–35%) are reduced by 10–20 % (of water supply).	Applied widely in oblasts: ▪ Fergana ▪ Kashkadarya ▪ Sogd ▪ Osh ▪ Jalalabad ▪ Khatlon ▪ South Kazakhstan

Table 6. Practical Water Conservation Technologies (cont'd)

Applied Water-Saving Technology	Essence of Technology	Water-Saving Effect Compared to Ordinary Irrigation Technology	Zone of Actual Application
1. Irrigation with variable stream	After flow advancing up to the end of furrow the irrigation stream is reduced twice in accordance with suction intensity. Uniformity of wetting increases along furrow. Conditions are created for uniform crop development.	Water-saving effect is reflected in surface outflow reduced by 15–20% (of inflow).	Applied widely in oblasts: ▪ Fergana ▪ Kashkadarya ▪ Sogd ▪ Osh ▪ Jalalabad ▪ Khatlon ▪ South Kazakhstan
2. Plastic film cover	Ridges are covered by polyethylene film (thickness of 8-10 mk and width of 60 cm) during sowing. Due to top soil temperature rising, sowing and harvesting are possible 2–3 weeks earlier. Harvesting can be completed before fall rains. Temperature and moisture regime under film permits seeds sprouting based on natural moisture without irrigation. Besides, favorable conditions are created for fast crop growth; fertilizers are applied more effectively. This made it possible to increase yield by 25% with fiber of high quality.	Water-saving effect is reflected in total reduction of cotton water consumption by 20–25% due to decrease of physical evaporation from soil surface. Number of irrigations is reduced 1.5 times. Compared to ordinary sowing technology irrigation water saving amounts to 30–35%.	Applied widely in oblasts: ▪ Fergana ▪ Surkhandarya ▪ Sogd ▪ Tashkent ▪ Osh ▪ Jalalabad ▪ Khatlon ▪ Dzhizak ▪ Ghissar
3. Collector-drainage water use for irrigation	To increase water availability of irrigated lands with low availability, mobile pumping stations are installed on collectors to pump water into irrigation network. To prevent land salinization mixture of collector and irrigation water is controlled.	Water-saving effect is reflected in irrigation water use efficiency increase up to 1.	Applied widely on rice systems and in tail part of irrigation network as well as on flooded zones in oblasts: ▪ Khatlon
4. Deep loosening of compacted soils	Deep loosening to depth of 0.6 m is used to loosen up ploughed soil created under long-term irrigation and annual soil tillage (10–15 times during growing season), which compacts soil and negatively impacts cultivated crop.	Moisture stock in soil increases, early soil ripening is provided (20 days earlier), soil air regime is improved, number of irrigations is 2 irrigations less and 800–1,200 ì3/ha of water is saved.	Applied in all oblasts where surface irrigation is used and soil plough is created.

Table 7. Reduction of Water Withdrawal

Oblast	Year	Irrigated Area net, ha	Established Limit million m^3	Specific Volume According to Limit thousand m^3/ha	Actual Water Supply million m^3	Actual Irrigation Water Specific Expenses thousand m^3/ha	Saved Water (compared to limit) million m^3	Actual Specific Water Saving (compared to limit) thousand m^3/ha
Kyzyl-Orda	1999	68,717	1,811.20	2,636.00	1,688.40	2,457.00	1,228.00	1.79
	2000	132,016	3,379.10	2,560.00	2,717.90	2,059.00	661.20	5.01
South Kazakhstan	1999	184,878	2,499.10	1,352.00	1,793.30	9.70	705.80	3.82
	2000	203,527	1,861.00	9.14	1,068.00	5.25	793.00	3.90
Jalalabad	1999	47,223	451.20	9.53	354.20	7.50	27.00	2.05
	2000	86,587	775.80	8.96	617.50	7.13	158.30	1.83
Osh	1999	91,497	994.60	10.87	764.00	.35	230.60	252.00
	2000	83,022	918.60	11.06	753.00	9.07	165.60	1.99
Sogd	1999	39,851	757.80	19.02	559.10	14.03	197.80	4.99
	2000	69,949	1,460.40	20.88	1,057.10	15.11	403.20	5.76
Khatlon	1999	49,802	769.50	15.45	737.10	14.80	32.40	0.65
	2000	79,870	1,461.90	18.30	1,337.60	16.75	124.30	1.56
Fergana	1999	85,454	594.60	6.96	621.30	7.27	-26.60	-0.31
	2000	79,144	501.00	6.33	504.20	6.37	-3.20	-0.04
Kashkadarya	1999	111,478	679.50	6.15	684.50	6.14	- 4.90	-0.04
	2000	106,030	853.00	8.04	558.90	5.27	294.10	2.77
Region	1999	678,900	8,557.50	12.60	7,201.80	10.61	1,355.70	2.00
	2000	840,145	11,210.70	13.34	8,614.30	10.25	2,596.40	3.09

In this context, generalized results from the Water Use and Farm Management Survey (WUFMAS) project (part of WARMAP-2) are very useful (Table 5). A range of comparatively simple, but expensive, water-saving methods can increase water use efficiency and irrigation productivity but large-scale water conservation and land quality improvement is possible only through greater investments in irrigation infrastructure and technologies (Table 6). Reduction of water withdrawal compared to set limits is shown in Table 7.

The difference between physical and current water use efficiency reaches 3–13.7% for Tajikistan (Table 8). The water-saving potential is not fully realized in municipal water supply. Our lag in water conservation can be seen from the following example. Each Tashkent resident consumes about 1,000 liters of water per day, while the same consumption values are 577 liters in Shanghai, 402 liters in Hong Kong, and 354 liters in Kuala Lumpur. Many countries fully utilize wastewater, but in our region about 6 km^3 of wastewater remain out of use, thus creating a load on the environment.

Table 8. Water Use Efficiency

Oblast	Year	Irrigated Area (thousand ha)	Average-Weighted Norm Net-Field (thousand m^3/ha)	Established Limit, Specific Withdrawal (thousand m^3/ha)	Actual Specific Withdrawal (thousand m^3/ha)	Water Use Efficiency in Irrigation System (%)	Actual Water Use Efficiency in Irrigation System (%)	Difference between Limit and Actual Withdrawal (%)
Kyzyl-Orda	1999	68.72	113.6	26.40	24.60	51.70	55.50	3.80
	2000	132.02	15.50	25.60	20.60	60.70	75.40	14.80
South Kazakhstan	1999	184.88	5.10	113.50	9.70	37.80	52.60	14.90
	2000	203.53	5.30	9.10	5.30	58.30	101.40	43.20
Jalalabad	1999	47.22	4.70	9.60	7.50	48.70	62.90	13.30
	2000	86.59	4.80	9.00	7.10	53.70	67.50	13.80
Osh	1999	97.50	4.80	10.90	8.40	44.50	57.90	13.40
	2000	83.02	3.70	11.10	9.10	35.50	43.30	7.80
Sogd	1999	39.85	7.30	19.00	14.00	38.60	52.30	13.70
	2000	69.95	7.30	20.90	15.10	34.80	48.10	13.30
Khatlon	1999	49.80	6.30	15.50	14.80	40.50	42.30	1.80
	2000	79.87	5.90	18.30	16.80	32.10	35.10	3.00
Ferghana	1999	85.45	3.90	7.00	7.30	56.10	53.70	-2.40
	2000	79.14	4.00	6.30	6.40	62.90	62.50	-9.40
Kashkadarya	1999	111.48	5.00	6.10	6.10	81.70	81.10	-9.50
	2000	106.03	5.10	8.00	5.30	63.50	96.80	33.40
Region	1999	678.90	5.90	12.60	10.60	47.20	56.00	8.90
	2000	840.15	6.80	13.30	10.30	50.90	66.30	15.40

The environmentally sound level of total water consumption in the region is 80 km^3/year. This limit is given by nature and we should follow it. Experience of the countries that obtain 4 t/ha of cotton under water use of 5,000 m^3/ha under similar natural-climatic conditions indicates the huge potential of water conservation.

Water saving is not saved irrigation water only. Water saving increases the productivity of irrigated agriculture. The WUFMAS analysis of water and land use productivity shows that the average irrigation "gross-field" norm for cotton is 7,243 m^3/ha, including 2,039 m^3/ha for leaching and 5,204 m^3/ha for irrigation during the growing season. Average cotton yield is 2.33 t/ha, and average irrigation water use is 3,110 m^3/ha resulting in water use productivity of 0.32 kg/m^3 (these indicators can fluctuate within 1,600–10,340 m3/t and 0.1-0.63 kg/m^3, respectively). For winter wheat average irrigation "gross-field" norm was 4,575 m^3/ha with an average yield of 2.23 t/ha, irrigation water use of 2,080 m^3/t, and productivity of 0.49 kg/m^3.

High water supply leads to decrease in land productivity because, on the one hand, it washes out nutrients from the soil and, on the other hand, under lack of drainage, causes the groundwater level and soil salinity to increase. According to WUFMAS data, nutrient losses reach 65% of initial phosphorus content, and potassium, 50%. Soil salinity increased on average by 51% during the last 2 years.

An example of water saving in the dry year of 1997 was shown by farmers of Jetisai rayon in Kazakhstan. They received twice less water and obtained 0.6 t/ha more cotton compared to the adjacent rayon of Uzbekistan. During recent studies in the Syr Darya oblast 3.6 t/ha of cotton were obtained on newly leveled irrigated fields under an irrigation norm of 3,200 m^3/ha. On plots with deviation up to 10 cm irrigation norm increased to 4,200 m^3/ha and yield decreased to 2 t/ha. Selection of

a rational size of irrigation plot facilitates effective use of irrigation water. In Khorezm oblast yield losses were reduced by strict observance of technological rules of crop cultivation. Comparative analysis of irrigation water productivity calculated through gross income shows the following: $0.52/m^3–Israel; $0.06/m^3– Uzbekistan; $0.14/m^3–South-Kazakhstan oblast; and, this value is even lower in Kyzyl-Orda oblast. Though these data reflect local market conditions, they are indicative. The same picture can be seen in comparing water use for fish breeding in Central Asia and Israel or the Netherlands.

Water Saving Concept Realization under Market Conditions

The introduction of a water-saving ideology as a base for a regional water strategy and for all future actions on water resources development and management requires huge preparatory work. The following indicators and factors should be analyzed and evaluated on each planning zone, river site, and irrigated area inside a country and within the basins:

- Potential land and water productivity based on advanced experience, particularly for dry years;
- Specific water consumption under minimum water discharge for biological production by using common methodological approaches according to the CROPWAT-FAO program;
- Causes of low production (linked with reclamation and water-related factors) and possibilities of their elimination, and consideration of priority of measures undertaken;
- Salt and water balance of planning zones based on previous data, possibility to reach parameters meeting environmentally sustainable development of processes (minimum salt exchange between the river and irrigated area as well as between unsaturated zone and groundwater, with gradual decrease of salt stock in aeration zone and in planning zone as a whole); possibility of maximum involvement of own return water and its utilization in place of origin;
- Possibility to use unused currently waste and groundwaters as well as all local sources;
- Possibility to reduce organizational water losses in all chains of the system;
- Unproductive losses in all chains of irrigation network, firstly on irrigated field, assessment of which will allow us to define cost-effective measures on water conservation;
- Availability and capacity of zones with high permeability on adirs' slopes and high valleys that cause both water losses and high costs of water lift; their negative impact on lowlands;
- Reduction of return water release to river and water bodies and water quality improvement as a result of water saving.

Analysis of organizational water losses is a separate task. Those are caused by mistakes during water allocation and in water management, due to unreliable information in particular. These include high losses in river channels, irrevocable losses in desert depressions, as well as ineffective efforts to improve the natural complex in lower

reaches. Regional and national experts should reveal these losses and develop mechanisms to prevent and eliminate them.

Based on the analytical developments and calculations mentioned above, clear information should be prepared to convince all strata of society, including decision makers, ecologists and water users to follow water conservation principles. Water saving is more beneficial to water consumers than water delivery from outside. If the productivity of water is \$0.03– 0.15/m^3, its delivery costs are about \$0.1/m^3. Water resources formation cost through complex reconstruction or desalinization exceeds \$0.3–0.5/m^3. All these should be taken into account in view of increasing annual consumption under 2.5% population growth.

It is proposed to introduce the following measures, as economic tools of water conservation:

- Increase water charges for water withdrawals exceeding the biological consumption level;
- Bonus for water saving, fiscal and tariff privileges (such payments should stimulate agricultural production and new introduction of technologies);
- Permission to trade water limits to other water users;
- Bonus to water-related organizations personnel for water saving;
- Organizational measures on water conservation:
- Gradual reduction of limits at water user level;
- Creation of public opinion through water conservation propaganda;
- Establishment of water user associations (WUAs) at the level of aggregated private farms (municipalities in the cities). Special task of WUA is to participate in organization of strict water rotation and limited water use and to fulfill financial obligations to the water supplier; and
- Gradual transition to planned water use based on water expenses per product unit.

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Socioeconomic Development of Turkmenistan on the Basis of Water-Energy Resources Use

A. Hatamov

Population and Economy

The population of Turkmenistan (National Institute of Statistics and Forecast) was 4,587,400 people in 1995 and 5,369,400 people in 2000. It is forecast to reach 6,936,200 in 2005, and 8,630,400 in 2010. The gross domestic product (GDP) of Turkmenistan from 1995 to 2010 is indicated in Table 9. GDP per capita was $820 in 2000 and is predicted to be $1,481 in 2005 and $2,806 in 2010. The GDP distribution by sectors of the economy during 1995–2000 is shown in Table 10.

Table 9. Gross Domestic Product of Turkmenistan (%)

	1995	1996	1997	1998	1999	2000	2005	2010
GDP ($billion)	5.927	2.538	2.677	2.546	3.269	4.404	10.273	24.222

Table 10. Distribution of Gross Domestic Product by Sector (%)

Sector	1995	1996	1997	1998	1999	2000	2005	2010
Industry	52.80	54.40	32.90	27.50	31.40	37.60	43.20	32.30
Agriculture	16.10	12.60	20.00	25.20	24.80	25.80	21.80	15.40
Construction	5.80	10.30	11.30	13.10	12.20	9.60	8.70	7.20
Others	25.30	22.70	35.80	34.20	31.60	27.00	26.30	45.10

Agriculture and water management constitute the most important part of Turkmenistan's economy. Successful development of these sectors is of critical significance for the future of the state in terms of economy, and social and political development, since half of the population lives in rural areas and about 40% of the labor force is employed in these sectors.

Special attention is being given to issues of land reform, improvement of management systems, reorganization of ownership rights, deepening integration processes, betterment of economic relations, and enhancing the legal basis for state support to agricultural producers. A class of private land users and entrepreneurs has been emerging, and favorable economic conditions have been created for commodity producers with various forms of ownership in order to increase volumes of agricultural production.

For the purpose of stimulating production of agricultural produce, prices have been liberalized for meat, milk, and eggs; prices have been released for all kinds of fruits and vegetables; farmers are exempt from taxation on profit and value added; and benefits have been introduced for agricultural producers affecting the supply of grain and cotton within the state order. Approximately 1.5 million ha of irrigated land have been transferred to about 400,000 leaseholders and private farmers (Table 11).

Table 11. Structure of Irrigated Areas in Turkmenistan (thousand ha)

Crops	2000	2005	2010
Wheat	743.60	677.20	705.20
Rice	4.30	26.00	36.30
Vegetables	22.40	19.80	32.10
Melons and gourds	11.80	14.90	19.90
Potato	18.20	19.60	22.60
Fruits	13.40	14.40	16.80
Grapes	12.00	40.20	59.20
Sugar-beet	0.00	25.00	45.90

This constitutes almost 80% of the total irrigated lands. Further development of agriculture will be directed at food security, industries for raw materials, and enhancing export potential of the country. The agrarian policy planned for the near future includes the following:

- Ensuring sustainable high rate of growth in agriculture production;
- Development of a more effective agriculture sector through improvement of selection, breeding and seed growing services, and increased crop yield and cattle productivity;
- Improving the structure of national agriculture, to bring it closer to the consumers' market, introducing scientifically based crop rotation techniques for sustainable improvement of land fertility;
- Extending the degree and improving the quality of agricultural production processing and refinement;
- Development of export capacity;
- Renewal of the state's material and technical basis; and
- Development of specialization and improvement of territorial arrangement of specific types of agricultural production.

The average annual growth rate of gross agricultural production will be 14.3% for 2000– 2005, and 10.1% in 2005–2010.

Turkmenistan Water Resources

The total volume of Turkmenistan's water resources in an average year is 25 km^3, which is formed by the Amu Darya, Murgab, Tedjen, Atek rivers, as well as by minor watercourses on the northeastern slopes of the Kopetdag mountains and a small amount of underground and collector-drainage waters. Of the total water resources, 22 km^3 (or 88%) come from the Amu Darya River. The rest is provided by the Murgab River – 1.55 km^3 (6%); the Tedjen River – 0.77 km3 (3%); the Atrek, Sumbar, and Chandyr rivers – 0.17 km^3 (0.7%); and underground waters – 0.47 km^3 (1.9%).

The Karakum River is of great importance for water resources accumulation and distribution. Currently its length exceeds 1,300 km. The area of lands irrigated from the River constitutes about 1 million ha. The headwater intake structure of the Karakum River is located on the left bank of the Amu Darya river close to the Mykry gorge where 11.6 km^3 are withdrawn annually. The canal has 115 hydraulic structures and 32 transport facilities, as well as three reservoirs with a total capacity of 2.4 billion m^3.

Around 130 aquifers are located in Turkmenistan. These groundwater resources are partly used at present to meet the demand of the population for drinking and household water. The total amount of underground water withdrawal fluctuates within the range of 470– 670 million m^3 /year depending on specific conditions of years. More than 45% of this volume is used for drinking and household water supply, about 30% is allocated for irrigation, the rest is spent on satisfying other needs (application of water to pastures, balneology) (Table 12). The permitted withdrawal of underground water is 3.4 million m^3/day, explored reserves are up to 6 million m^3/day, and probable reserves constitute 9 million m^3/day. The portion of underground water used in the water balance is 2.0–2.5%. Reviewing water use, as it applies to various kinds of users, shows that 91.2% of total water use is in agriculture, 6.3% in industry, 1.9% in municipal needs, 0.1% in fisheries, and 0.6% in other demands for water.

Table 12. Water Demand (million m^3)

Use	Year		
	2000	2005	2010
Irrigated area, thousand ha	1,860	2,167	2,638
Total water resources, km^3	21.939	24.104	24.688
Water for irrigation (plan), km^3	19.116	23.833	26.089
Water for other users (plan), km^3	1.476	2.749	7.533
Total amount of water (plan), km^3	20.592	26.582	33.622
Degree of water supply adequacy, %	107	91	73
Deficit (-) or surplus (+) of water resources, km^3	1.347	-2.478	-8.934
Specific water delivery, thousand m^3 per ha	10.28	11.00	9.89
Efficiency of irrigation system	0.58	0.68	0.75

ha = hectare; km^3 = cubic kilometers; m^3 = cubic meters.

Interstate Water Management Problems

Turkmenistan solves its interstate water management problems on the basis of existing Agreements. Withdrawal of water from the Amu Darya river is regulated by the "Agreement between Turkmenistan and the Republic of Uzbekistan on cooperation in the solving water management issues" of 16 January 1996, which states (Article 6) that "The parties have established Amu Darya river water allocation (correct to the hydrometric station at the section line Kerky) on the basis of equal shares (50:50)…. " Allocation of the flow of the Amu Darya, Murgab, and Kushka rivers on their boundary sections between Turkmenistan and Afghanistan has not yet been regulated.

Along the Tedjen river the "Agreement between the Soviet Union and Persia on shared use of transboundary rivers and waters along the state borders from the Gery-Rud river to the Caspian Sea" of 20 February 1926 remains valid. According to Article 1 of this Agreement, "All water of the Gery-Rud (Tedjen) river … is divided into 10 equal parts, three of which are given for use to Persia and seven parts – for use to the USSR." It should be noted that the given Agreement is valid until the completion of construction of the Dustluk water reservoir in the vicinity of Pulikhatun. The two countries –Turkmenistan and the Islamic Republic of Iran – carry out these construction works. As to the Araks and Atrek rivers, allocation of their runoff volumes between Iran and the former USSR in the 50:50 proportion was regulated by the "Agreement between the Government of the USSR and Shakhinshakh Government of Iran on developing preliminary projects of equitable and joint use of boundary sections of the Araks and Atrek rivers for the purposes of

irrigation and electric power generation" of 20 February 1926. Effectiveness of this Agreement between Persia and the USSR is confirmed by the Article 4 of the "Memorandum between Turkmenistan and IRI on boundary issues."

Water and Environmental Management Project

Turkmenistan, along with the other countries of Central Asia, participated in works within the Global Environment Facility Water and Environmental Management Program Component A-1 "Water resources and salt management on the regional and national levels." The main objective of this project was development of plans for water resources and salt management in the Aral Sea basin. One of the tasks to be solved was providing an agreed set of policies, strategies, and action programs for the Basin as they apply to the following issues:

- Water resources protection and reduction of soil salinity;
- Rehabilitation and improvement of irrigation and drainage systems; and
- Improvement of operation and maintenance of main and onfarm irrigation and drainage systems.

Another task that was to be solved is the development of a framework enabling interstate cooperation in the field of water resources and salt management, as well as the preparation of international agreements on the following issues:

- Norms for river water mineralization;
- Investments in regional water management systems; and
- Funding of basin organizations responsible for water resources management.

The whole work was based on an assessment of possible scenarios for development of agriculture and water management for the period up to the year 2025. By scenarios, development variants had been implied as they apply to individual components of economic sectors. They are used for demonstrating expected outcomes resulting from separate choices while assessing development during the period of 25 years. Four scenarios of development were considered:

- Change for the worse scenario (do nothing); the current situation remains (Table 13);
- Consolidation scenario – performance of the water management system facilities is ensured in a secure for the system mode (Table 14);
- Recovery scenario – provision of conditions necessary for sustainable performance of the water management system facilities and implementation of the "Program of socio-economic development for the period till 2010" for a more long-term perspective (Table 15); and
- Combined scenario – combination of conditions for the second and third scenarios (Table 16).

Under this scenario, maximum production of agricultural produce is reached. However, significant investments necessary for implementation of the third scenario constitute a significant risk factor.

Table 13. Results of the "Change for the Worse Scenario"

Indicator	Unit	2000	2005	2010	2015	2020	2025
Efficiency of irrigation system	x	0.58	0.58	0.58	0.58	0.58	0.58
Area	th. ha	1,860	2,023	2,476	2,882	3,352	3,921
Total water resources	mln.m^3	21,939	23,831	23,831	23,831	23,831	23,831
Water demand for irrigation	mln.m^3	19,116	21,266	25,812	29,925	34,639	40,325
Water demand for other needs	mln.m^3	1,475	1,691	1,925	2,138	2,376	2,645
Total demand	mln.m^3	20,592	22,956	27,737	32,062	37,015	42,970
Losses	mln.m^3	4,993	4,993	4,993	4,993	4,993	4,993
Reuse of water	mln.m^3	210	210	210	210	210	210
Balance	mln.m^3	-3,435	-3,908	-8,689	13,014	-17,967	23,922
Degree of water supply adequacy	%	86	86	73	65	57	50

mln. m^3 = million cubic meters; th. ha = thousand hectares.

Table 14. Results of the "Consolidation Scenario"

Indicator	Unit	2000	2005	2010	2015	2020	2025
Efficiency of irrigation system	x	0.58	0.58	0.58	0.58	0.58	0.58
Area	th. ha	1,860	2,004	2,080	2,208	2,353	2,514
Total water resources	mln.m^3	21,939	23,953	24,104	24,279	24,467	24,688
Water demand for irrigation	mln.m^3	19,116	21,656	22,614	23,933	25,496	27,213
Water demand for other needs	mln.m^3	1,475	1,863	2,349	2,856	3,485	4,262
Total demand	mln.m^3	20,592	23,519	24,963	26,788	28,981	31,475
Losses	mln.m^3	4,993	4,693	3,961	3,408	2,940	2,547
Reuse of water	mln.m^3	210	388	646	972	1,303	1,633
Balance	mln.m^3	-3,435	-3,871	-4,174	-4,946	-6,151	-7,701
Degree of water supply adequacy	%	86	86	85	83	80	76

mln. m^3 = million cubic meters; th. ha = thousand hectares.

Table 15. Results of the "Recovery Scenario"

Indicator	Unit	2000	2005	2010	2015	2020	2025
Efficiency of irrigation system	x	0.58	0.63	0.70	0.72	0.73	0.75
Area	th. ha	1,860	2,000	2,167	2,328	2,478	2,638
Total water resources	mln.m^3	21,939	23,953	24,104	24,279	24,467	24,688
Water demand for irrigation	mln.m^3	19,116	20,639	20,313	20,936	21,716	22,490
Water demand for other needs	mln.m^3	1,475	1,863	2,349	2,856	3,485	4,262
Total demand	mln.m^3	20,592	22,502	22,662	23,792	25,201	26,752
Losses	mln.m^3	4,993	4,693	3,961	3,408	2,940	2,547
Reuse of water	mln.m^3	210	388	646	972	1,303	1,633
Balance	mln.m^3	-3,435	-2,854	-1,873	-1,949	-2,372	-2,979
Degree of water supply adequacy	%	86	89	93	93	91	89

mln. m^3 = million cubic meters; th. ha = thousand hectares.

Table 16. Results of the "Combined Scenarios"

Indicator	Unit	2000	2005	2010	2015	2020	2025
Efficiency of irrigation system	x	0.58	0.63	0.70	0.72	0.73	0.75
Area	th. ha	1,860	1,978	2,095	2,243	2,384	2,536
Total water resources	mln.m^3	21,939	23,953	24,104	24,279	24,467	24,688
Water demand for irrigation	mln.m^3	19,116	19,832	18,845	19,458	20,124	20,820
Water demand for other needs	mln.m^3	1,475	1,863	2,349	2,856	3,485	4,262
Total demand	mln.m^3	20,592	21,695	21,194	22,313	23,609	25,082
Losses	mln.m^3	4,993	4,693	3,961	3,408	2,940	2,547
Reuse of water	mln.m^3	210	388	646	972	1,303	1,633
Balance	mln.m^3	-3,435	-2,047	-405	-471	-780	-1,308
Degree of water supply adequacy	%	86	92	98	98	97	95

mln. m^3 = million cubic meters; th. ha = thousand hectares.

Table 17. Investments Necessary for the Four Scenarios

Years	"Change for the worse"	"Consolidation"	"Recovery"	"Combined"
2001-2005	183	1,805	3,657	3,636
2006-2010	496	1,143	3,052	2,979
2011-2015	456	1,182	923	898
2016-2020	528	1,202	906	883
2021-2025	640	1,219	920	904

Issues Related to the Amu Darya River

Several issues related to the Amu Darya river affect Turkmenistan and they should be mentioned:

1. It is necessary, without delay, to put maximum effort into establishing a system of monitoring along the river. The indicators of the monitoring system must include not only quantitative parameters, but also without fail qualitative ones;
2. Information on the flow formation in the Amu Darya basin must be gathered. For several years due to the absence of data from the *"Hydromets"* (hydrometeorological services), there has been a lack of information on the glaciers in the basin, making it impossible to forecast real volumes of water flow and plan on this basis our activities in both the water and agriculture sectors;
3. It is necessary to repeatedly consider the issue of joint funding of the activities in the flow formation zone (monitoring, reforestation, cleaning works, etc.); and
4. It is necessary to sustain the existing basin organizations BVO Amu Darya and Syr Darya in terms of strengthening their material and technical bases, providing them with devices for monitoring amounts and quality of water discharges, computer and communication equipment enabling more responsive operational management of water withdrawal regulation and water accounting.

Collector Drainage Water Reuse

As evident from the information presented above, under certain scenarios of development a water resources deficit occurs. In this connection, the problem of water reuse has become vital, and there is no alternative to this approach. It is difficult to overestimate practical significance of augmenting the resources through water reuse. In this capacity, sewage and collector-drainage waters (CDW) could be considered. The wastewaters formed due to industry-communal and household flows, their amount is insignificant in Turkmenistan (0.25–0.30 km^3/year) and they will not exert an influence on augmentation of the water resources balance. The total volume of the CDW formed on the irrigated lands of Turkmenistan fluctuates within the range of 4.5–6.8 km^3/year. In addition, the CDW of Uzbekistan are discharged through the territory of Turkmenistan in the volume of 5.2–6.6 km^3. Some part of this volume, 4.0–4.8 km^3, is transported to the Sarykamish lake, and 1.2–1.8 km^3 to the Amu Darya river in the Lebap province. Part of the CDW of Turkmenistan (1.8–2.7 km^3) is discharged to the Amu Darya, and the rest to a depression in the Central Karakum desert, flooding large areas of distant pastures. In total, 3–4.5 km^3 of CDW are discharged to the Amu Darya.

The monitoring of CDW quality is not organized, but information indicates that CDW quality considerably differs from that of irrigation water in both degree of mineralization and pollution composition. CDW formed in the Lebap province and discharged directly to the Amu Darya river has average annual salinity of 2.5–2.7 g/l. However, it increases the mineralization of the Amu Darya downstream by

up to 1.2–1.5 g/l, and this has negative impact on conditions of irrigated lands and their productivity in the Khorezm, Dashoguz provinces, and Karakalpakstan, due to the increasing level of their salinity.

The irrigated zone of the Mary province is divided into two parts: the Murgab river basin and the Karakum River zone. The system of collectors in the Murgab river basin diverts about 1.2 km^3 of CDW annually to local depressions with average mineralization of 2.2–7.6 g/l. About 0.5 km^3 of CDW with mineralization of 12.2–21.3 g/l is diverted by the collector-drainage system from irrigated lands in the Karakum River zone. In the Tedjen oasis the CDW flow is 0.3 km^3 with average mineralization of more than 20 g/l and it is diverted to the boundaries of the oasis.

The Dashoguz province is included as part of the Aral Sea zone of ecological disaster. More than 65% of the annual CDW flow is formed in the Khorezm province of Uzbekistan and transported, with discharges exceeding the design, through the interstate Ozerny and Daryalyk collectors to the Sarykamysh depression, where a closed water body has emerged. The volume of Sarykamysh Lake has reached 59 km^3 with a surface area of 3,670 km^3 increasing every year and flooding pastures. It should be noted that transporting CDW flows exceeding the design flows from the territory of Khorezm province of Uzbekistan leads to a series of negative consequences in the territory of the Dashoguz province of Turkmenistan:

- Rising of the water level in the main collector intakes—thus decreasing the effectiveness of horizontal drainage in the zone of its influence;
- Gradual silting of collector drainage systems;
- Rising of groundwater tables on irrigated lands combined with irrigation water quality deterioration, speeding-up soil salinization processes and causing a sharp decrease in soil fertility;
- Elimination of the possibility to improve land quality, since normative soil leaching does not bring good results;
- Waterlogging and salinization of lowlands, which are converted to the category of very high level soil salinity and become unusable for further agricultural production; and
- Ecological problems.

The total volume of CDW flow formed on irrigated lands of Turkmenistan is 6 km^3, and, taking into account the amount transported from Uzbekistan, this figure may reach 11 km^3. The discharge of these waters to rivers and other water bodies results in their pollution with mineral salts, fertilizers residues, herbicides, pesticides, etc. However, the volume of CDW use for irrigation constitutes about 0.2% of the total water balance. Thus, if the problems of CDW treatment and reuse could be solved, these waters might become a significant resource for Turkmenistan's agricultural and technical water needs.

Turkmen Lake of the Golden Century

For the purpose of solving the problem of effective CDW use, creating a surplus reserve of water and improving the ecological situation in the country, the President of Turkmenistan made the decision in April 2000 to create the Turkmen Lake of the Golden Century. The Lake, with a capacity of 132 km^3, will be created in the center of the Karakum desert, in the Karashor depression. The first water will be transported to the Lake by the end of 2004, and annually about 10 km^3 of CDW will be discharged to it. It is presumed that effective methods of CDW treatment will be developed, allowing the development of a new zone in the Karakum desert.

The Turkmen Lake of the Golden Century Project is characterized as follows:

State support: necessary governmental decisions were made by the President and the Cabinet of Turkmenistan in 2000 which allow the states of the first priority works regarding creation of the Lake;

Regional scope of the project: Problems of CDW will be tackled not only within the territory of Turkmenistan, but also in Uzbekistan and Kazakhstan through application of positive experience to be gained in improving irrigation water quality of the Amu Darya downstream zone;

Large scale and uniqueness: the creation of the Lake will surpass the Karakum canal project, but also any other water management projects that have been implemented in Central Asia in the last decades; and

Ecological and social significance: Taking into account the forecasted high rate of population growth in the country, demands for water of good quality will increase. Implementation of the project will facilitate solving the problem of drinking water quality and health of the population in the zone of ecological disaster and in the whole Aral Sea region.

The overall objective of the Lake's construction is aimed at solving the following important economic, ecological, and social tasks:

- Collecting and diverting to the Lake of all CDW discharges from irrigated lands of the Lebap, Maryi, Ahal, and Balcan provinces and a significant part of the Dashoguz province of Turkmenistan;
- Returning more then 4,000 km^2 of pastures flooded by CDW to agricultural rotation;
- Providing normal operational mode for collector-drainage systems of the Dashoguz province due to recession of groundwater levels by 1–2 meters near the Ozerny and Daryalyk collectors;
- Improving of lands conditions in an area of 2.2 million ha;
- Increasing in crop yield on 2 million ha, water supply, and forage capacity of pastures on 1.3 ha;
- Improving water quality in the middle and lower reaches of the Amu Darya river;
- Securing water storage of the country designed for their reuse in the interests of the national economy;

- Reducing the danger of destruction of transport, gas supply facilities, power transmission and communication lines in the Dashoguz province; and
- Increasing the level of employment in all provinces of the country.

The site for the Turkmen Lake has been chosen at the Karashor depression, which has a bottom that is covered by a salt marsh. It is length is 100 km and breadth in the northwestern part is 15–20 km, and the deepest mark of the salt marsh surface is -25 m (by the Baltic system). The total capacity of the water body at the design level of +44 m is 132 km^3. The Lake will receive CDW through two drainage collectors—the Dashoguz intake in the north and the Main collector of the Golden Century (*Transturkmenian*) in the south.

For improvement of CDW quality, biological methods are envisaged utilizing higher vegetation (from forage crops up to trees and bushes), as well herbivorous fishes. These water treatment methods will be implemented as "travel bio-plateaus" along the collectors, and at the Lake inlets as "estuary bio-plateaus." Developmental works related to creation of the bio-plateaus and utilization of salt-resistant crops are expected to be carried out based on available experience (Europe, Israel, US, Egypt) and ecological studies which have been recently conducted in Central Asian countries. Such systems of CDW reuse are likely to be applied in other countries facing problems of their utilization.

The only pending problem in implementing the given project is lack of financial resources, to which I would like to draw the attention of the Asian Development Bank. The reuse of CDW will:

1. Prevent further deterioration of the ecological situation;
2. Cover the deficit of water resources necessary for normal and sustainable development of the economy and improve the living standards of the population;
3. Improve amelioration conditions of irrigated lands and increase land and water productivity;
4. Establish a monitoring service for continuous control of CDW quantity and quality; and
5. Utilize inevitable consequences of irrigation in the form of CDW.

In summary I would like to express the aspiration for development of further close and fruitful cooperation, which will certainly lead to solving vital problems arising in water management systems both in Turkmenistan and in Central Asian countries in general. The water management tasks to be solved in Turkmenistan are monumental! Turkmenistan is interested in accomplishing these tasks and we realize very clearly that only together, through open dialogue and with good intentions, can they be solved.

The Socioeconomic Situation and the Action Plan for Sustainable Agricultural and Industrial Development in the Downstream Areas of the Aral Sea Basin

M. Mirkhodjiev

The Aral Sea basin is located in the center of the Turan plain, formed by valleys of two large rivers, the Amu Darya and Syr Darya, surrounded by the Pamir, Tien Shan, and Kopetdag mountains in the South and the vast Kyzylkum and Karakum deserts in the North. The territory belongs to five states of the former Soviet Union: Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan; a part of Afghanistan, which now draws the attention of the world community, is included in the basin. Arid to semi-arid conditions and sharp continental climate make water a major factor of existence and development of all these countries.

At present, after the disintegration of the Soviet Union, the five countries are trying to find ways of socioeconomic progress while oriented toward various political and economic approaches. The countries are at different levels of development, but there is a tendency of economic recession in all of them. Like many other countries in transition from a centralized economy to a market economy, they face such problems as productivity slowdown in industry, construction and agriculture, lack of necessary funding, and substantial population growth. The situation causes degradation of natural and human resources, augmentation of poverty, and degradation of the environment.

The contribution of the agriculture sector to the economy of the region is about 40–50%. Water plays a very important role—about 50% of the past economic activity engaged 60–70% of the population in activities connected with land and water resources use. Land and water resources management strategies for each country of the basin have not been fully developed so far. Such strategies should be developed taking into account political and economic conditions in each country to create the basis for restorating and augmentating the economic and natural potential of the Aral Sea basin.

The area adjoining the epicenter of the Aral Sea catastrophe is mostly agrarian, without large deposits of natural resources, with a low level industrial production (in major part related to agriculture) and is the most exposed to socioeconomic and

ecological threats. The lower reaches of the basin (Kyzyl Orda in Kazakhstan, Dashgouz in Turkmenistan, and Khorezm and Karakalpakstan in Uzbekistan) have suffered from the disaster most of all. Income has dropped down here to $300 per capita. Studies have revealed that the annual socioeconomic damage in the coastal zone in comparison with that of 1960 constituted $144 million.

Recent Agriculture Sector Performance

Water has been scarce during the last 2 years, which has brought about new problems. As a result of irregular water distribution between the upper and lower reaches, especially in the Amu Darya basin, the downstream area got only 54–26 % of its planned water delivery—which has affected more than 5 million people.

Under such circumstances, carrying out an analysis of the socioeconomic situation and development of an action plan for this region has become a vital political task aimed at rendering assistance for ensuring sustainable development. At present there is no universally recognized view of the notion of sustainable development. The most frequently used definition is the following: "Sustainable development is such development when demands of current generation are met without damage to successive generations in meeting their demands" (World Commission on Environment, 1987). To make the definition more clear the World Bank suggested the following key indicators of sustainable development: econoimic growth, poverty reduction, and environmental improvement. According to "Vision 2000," sustainable development is possible in a society where: (1) every individual has enough food for healthy and sufficient existence; (2) there is no hunger and poverty, food prices are moderate; and (3) where there is an effective reprocessing system.

A sharp reduction in agricultural yield has been noted in the last several years, with some exception. The decrease in agricultural production coupled with national income decline, which limit the capacity to import food products, has had a strong impact on food security and nourishment standards of the rapidly growing population in the region. GNP has declined since 1991: by 40% in Kazakhstan, by 46% in the Kyrgyz Republic, by 17% in Turkmenistan (the small reduction due to other natural resources), and by 11% in Uzbekistan (the small reduction because of the relatively quick revival of the agriculture, mining, and energy sectors).

Agricultural development in the Aral Sea basin has been, and will be in the future, closely related to regional water resources of the basin. Water use for irrigation constitutes about 90% of the basin water resources volume. Historically, the expansion of cultivated lands in the basin was connected with irrigation development, and first of all with cotton growing. The general pattern of expanding irrigated areas is similar for all the republics: small expansion between 1914 and 1940; acceleration in the 1950s, and a sharp increase up to the 1990s.

About 57% of Aral Sea basin irrigated lands fall in the Amu Darya basin and 43% in the Syr Darya basin.

Economic difficulties caused by the transition to a market economy under different privatization strategies in the countries of the region has resulted in slack irrigation management and in the emergence of many problems, including overuse of water (leading to secondary soil salinity); lack of infrastructure, investments, and subsidies for farmers designed for maintenance and rehabilitation of irrigation networks; low efficiency of water use at the field level; large water losses in the system; and irregular

water distribution between water users. Problems of efficiency are reflected by the large water losses in amounts that could be used for sustaining the Aral Sea. Improvement of water use efficiency would allow decreasing soil salinity, waterlogging, and increasing productivity of agriculture. Though not all return waters are lost for reuse, they are highly contaminated by salt and chemicals—thus reducing their potential for drinking water or downstream wetlands, and reducing their productivity for irrigation.

Though activities carried out by ICWC and the BVOs are directed at water allocation and distribution on an equitable basis and conducted on behalf of all five countries, setting limits for water and environmental protection has caused a reduction in the amounts of water allocated to the downstream zone. Especially striking is the water scarcity that manifests itself during low water years, when the lower reaches of the Amu Darya receive only 24–58% of the planned delivery. This has caused immense socioeconomic and ecological damage because of the water deficit and failure of local authorities to find ways out of the emergency situation.

The following measures have been suggested to improve the situation: (1) change crop patterns; (2) promote new farmers' initiatives to establish small and medium agricultural processing enterprises; and (3) develop new methods of fish farming in dam ponds. These alternatives depend on investments that require feasibility studies and comparison between the variants.

Capacity Building in the Agriculture Sector

Taking into account the limited nature of funding by Uzbekistan to the International Fund for Saving the Aral Sea (IFAS) and the increasing number of people in need of public assistance due to the 2-year drought, there is a vital need for investment in procurement of agricultural/livestock product processing equipment, as well as in the establishment of small workshops designed to produce consumer goods. Conditions under which financial means, equipment and machinery are to be turned over to farmers will be agreed with investors in the course of negotiating mechanisms and methods of specific joint projects implementation.

The Nukus branch of the Executive Committee (EC) of IFAS is launching in 2002–2003 a new project—"Organization of social facilitation for the Priaralie population adaptation to market economy in the ecological disaster zone." The objective of the project is to extend social aid to the area by granting small and short-term loans to those who are willing to carry out private business and farming on their own, as well as to provide chargeable services to the population or produce consumer goods for local markets. The major terms for granting such loans are business activities carried out on the basis of private ownership, establishment of small and medium businesses, creation of new employment possibilities, and gaining profits and guaranteed repayment of a loan according to the terms of the debt contract.

In the process of this project implementation it is expected that the following objectives will be accomplished in the field of socioeconomic development and environmental sanitation:

- Reduction of unemployment rate;
- Increase of pecuniary gains and income in kind of the population;
- Improvement of living standards;

- Involvement of the population in private business activities and provision of pertinent training to them;
- Strengthening the economic potential of the region due to introduction of newly created small and medium enterprises;
- Saturation of markets with consumer goods and services;
- Development of competition in the field of quality improvement and decline in prices of goods and services; and
- Reduction of specific water use needed for output of produce and services.

One of the important results of this project is the formation of entrepreneurs' perception of heir economic rights under current legislation, and development of their aspiration to utilize these rights for improving their social status through effective arrangement of business activities.

The present social and environmental situation and the need for development of agriculture and water resources reveals the necessity of analyzing these important elements in an integrated manner. An ecologically sustainable increase in agricultural production that can ensure food security is impossible without appropriate water resources development and management strategies on a regional scale. Conversely, the incorrect development of the agriculture sector will cause ineffective regional strategies on water resources development.

Ecological degradation with long-term consequences exerting negative impacts on human health, soil condition and yields combined with economic activities will create problems for the population in the Central Asian region. The states are confronted with extraordinary problems in their economic and agriculture sectors related to developing sustainable agricultural policies and improving the environment.

Efforts are needed that focus on the immediate problems described here as well as long-term socioeconomic policies and strategies of agricultural production processing and sustainable water use as well as development of agriculture and other sectors. All these are necessary in order to meet long-term demands, ensure food security, and prevent ecological and social degradation in future. These are the following primary objectives that should be achieved:

(1) Gain insight into the linkage between agricultural policy, water resources policy, agricultural development, and environmental sustainability in the Aral Sea basin;
(2) Assess State strategy impacts on the agriculture sector;
(3) Assess the impacts of alternative strategies on agriculture, food security, and environmental sustainability;
(4) Assess the ecological impact of agricultural development and other activities under alternative ways of development;
(5) Forecast water and other natural resources supply and demand and inter-sectoral competition for provision of these resources; and
(6) Assess the impact of political reforms, investments in technology, and infrastructure development on food security, demand for food and water, and environmental sustainability.

In order to understand the influence exerted by economic and agricultural development on environmental sustainability in the Aral Sea basin downstream zone, it is necessary to solve three sets of problems:

1. What is the influence exerted by implemented state policy—both direct and indirect—on the economy of the region? Policy instruments include
   - trade and macroeconomic policies;
   - price formation policy as to agricultural produce and resources input into production;
   - investments in research, technology, and infrastructure; and
   - direct non-price policy of resources management implying such instruments as market quotas, water allocation policy, and soil protection programs.

2. What is the influence exerted on agriculture and rural economy by alternative political reform packages? This requires systematic analysis of changes caused by State policies in the area of market prices on finished products and input resources at sufficiently low levels as well as in the area of non-price agricultural policy. Key prices include those in the exchange between agriculture and other sectors, as well as between crops in the agriculture sector. The latter will include corresponding changes in prices between food and technical crops, and between crop prices and inputs.

3. What are the ecological consequences of farming and other activities and how are they interlinked to ensure feedback in agricultural economics? For example, deterioration of the natural resources base might cause negative impacts on future agricultural production. It is necessary to identify causes and the degree of such aggravation, as well as future consequences of productivity growth.

State policies carried out by Central Asian countries form the basis for solving problems related to sustainable development. The objective of programs implemented by the State is creating conditions for the transition of the economy and society to sustainable development and this is the attitude that should be taken to determine the requirements and directions for securing growth of national potential.

First of all, these programs should be based on a real assessment of untapped productive reserves. Some enterprises producing output that is not in demand should be shut down and either redesigned or sold to private business for future reconstruction on mutually beneficial terms. State privatization auctions (very popular at present) are not the best way to achieve sustainable economic growth, since most buyers are not professionally savvy in their chosen businesses. The quest for investors should be carried out at the State level, as it is done at present in the automobile and petroleum industries.

One more problem is mobilization and allocation of our own financial resources. A big mistake has been made in most Central Asian countries of abandoning state support of agriculture—this will result in collapse of agricultural production. The government should find its own sources for funding or engage foreign investors to provide support for key sectors of the economy, and in the first place for agriculture. Only in this way and by application of tax remissions, customs facilities, currency exchange and other benefits would it be possible to stop economic recession and increase GNP per capita (at least, 2–3% during initial years with future growth up to 5–8% annually).

Efforts undertaken in the field of natural resources use and agricultural development are the main means to meet demands for food. For this purpose, from our point of view, the following measures should be accomplished:

- Improvement of scientific research works in such fields as agriculture, farming techniques and biotechnology, which are at present conducted in poor conditions. There is a need for experience exchange, transferring low-toxicity and highly productive technologies from other parts of the world to the region;
- Development of pilot projects, which may facilitate implementation of modern market technologies and maintaining contacts between scientists and farmers;
- Selection and provision of seed stock with participation of foreign companies, as well as through establishing joint ventures;
- Development of educational and training programs designed to disseminate modern technologies;
- Development of biotechnologies;
- State investments and certain financial benefits given to private investors contributing to agriculture, food production, infrastructure, and natural resources use.
- Establishment of legislative and economic framework for appropriate natural and agricultural resources use;
- Support for land rehabilitation and erosion control at the account of partial State credit; and
- Financial assistance and provision of pesticides, fertilizers, and equipment.

Development of privatized agriculture is a very important means of agricultural growth. Abolishment of former collective and state farms and transition to small private farms in Central Asian countries has failed to improve the agro-industry and it has led to decline of agricultural productivity. Farmers are deprived of opportunities and support in terms of funding and equipment, fertilizers, and fuels. They have to rely upon themselves only and spend most of their time tackling administrative problems, but not on actual farming activities. It is important to identify the best structure of privatization. There are proposals in Uzbekistan too on reorganizing all state farms into small corporations with distribution of basic production facilities between shareholders, except for land. Only the establishment of a sustainable administrative structure will enable farmers to make use of all the advantages of private business. In addition, it is necessary to develop several pilot projects in each Central Asian country.

Sustainable Development and Some Issues of Water Resources Management in Central Asia

B. Annaev

Introduction

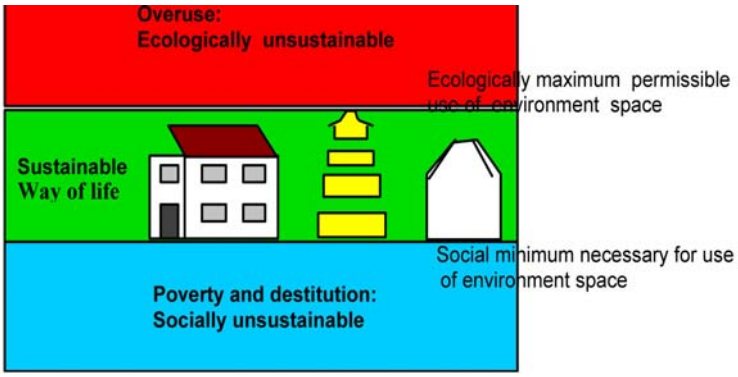
The term "sustainable development" appeared for the first time in the report "World Nature Protection Strategy" made by the International Union for Nature and National Resources Protection (1980). The major resources necessary for development of humanity were for the first time interlinked in this report, among them: human, financial, natural—renewable and nonrenewable ones. The objective was to improve living standards while at the same time ensuring the preservation of the natural environment. The natural environment is considered to be the resources necessary for the development of future human generations. It is this type of development that has been termed "sustainable development."

Formation of the conception of sustainable development had been preceded by research activities, and international and domestic political decision making—all determining the progress of further world events. Issues of correlation and interaction between modern civilization and the environment were considered at the World Conference on Environment in Stockholm in 1972 with the participation of 133 states. The discussions resulted in adopting the United Nations Environment Programme (UNEP) objectives. The UN Conference on Environment and Development, held in Rio de Janeiro in 1992, recommended establishing the Sustainable Development Commission all the countries of the world community as members. It was expected that this organ would promote global management in the socioecological sphere, harmonizing national and global interests when the world community would start achieving sustainable development. Agenda 21 contains a list of measures aimed at providing sustainable development in various fields of international, state, and human activities.

At present, there are two major interpretations of "sustainable development"—a narrow sense and a broad sense. The narrow understanding of the term implies focusing mainly upon its ecological component, which is associated with optimization of activities as they apply to the biosphere. In the broad sense of the notion, sustainable development is interpreted as the process symbolizing a new type of human society development, based on radical changes in its historically evolved trends (economic, social, ecological, cultural, etc.). Though the nature of sustainable, balanced development is universal and global, this notion, when applied to a specific region, country, and particular area, has both a global and a local character. Agenda 21 has emphasized the necessity of establishing a national coordinating structure for transforming the objectives and aspirations of a country in achieving sustainable development into specific programs and actions. This structure should follow the programs outlined in Agenda 21.

Many countries experience general scarcity, gradual elimination, and increasing pollution of freshwater sources. Among the reasons causing these phenomena are sewage wastes and industrial wastewaters, loss of natural water catchment areas, disappearance of forestlands, and improper farming methods, which wash out pesticides and other chemicals into watercourses.

Figure 1. Environment Space as Measure of Sustainability



Food production for the increasing population of the planet depends on the availability of freshwater, whereas irrigation systems have been suffering from waterlogging and salinity resulting in land productivity deterioration. Water demand has been growing rapidly; 70–80 % of water withdrawals are for irrigation and less than 20% are used to meet industrial demands, and only 6% for domestic needs. More efficient water resources management will require implementation of new technologies including improvement of existing indigenous technologies to use limited water resources effectively and exclude further water pollution. Water resources management must be included, as an integral part, in national economic and social policy, which also embraces land use planning and mountainside/riverbank protection. Monitoring of efficient water management should be of the highest level. Water use programs must provide for broad public participation, including womenfolk, youth, etc.

In the new millennium significant ecological changes might occur because of population growth and consequent increases in water and nonrenewable fuel-energy resources use. This problem bears direct relation to Central Asian countries, where for the last 10 years efforts have been undertaken by governments, NGOs, and the international community to improve the situation in the Aral Sea basin. Tackling the Aral disaster problem is a very complex task. Assuming there is rapid economic development in Central Asia, it is not feasible to expect a notable decrease in water use. Therefore, creation of effective economic and legal mechanisms related to water resources use becomes a paramount objective of Aral Sea basin management.

It has already been acknowledged that the Aral Sea basin water resources misallocation and mismanagement constitute a far more important problem than any water deficit. While being used for irrigation, significant amounts of water are lost due to the low level of onfarm water management. Inefficient use of high quality drinking water in urban areas has been noted as well, where water use per capita exceeds world standards. Water-saving measures and technologies are very important elements of this problem. Improvement of irrigation management and consequent reduction of drainage flow and lowering of groundwater tables on irrigated lands will help to save water resources.

Scientific studies have shown that a significant part of water withdrawn from rivers for irrigation is wasted from seepage and replenishment of groundwaters, leaving only minor volumes of water for crop use. Water losses occur in main, farm, and interfarm canals, as well as on irrigated fields. In addition, water resources are wasted because of collector drainage water (CDW) discharges to desert depressions and failure to reuse them. There are several causes of irrigation water losses: seepage from unlined main and onfarm canals; operational losses in the form of water discharges from canals back to the source or to the CDW system; ineffective methods of water application and imperfect methods of determining optimal irrigation regime and effectiveness; lack of farmers' and irrigators' necessary knowledge and experience; seepage losses from irrigated fields.

For effective and optimal water use and reduction of losses, the following issues should be decided:

- Introduction of incentives for utilizing water-saving technologies and methods;
- Optimization of operation processes;
- Education of the population and promotion of advanced water use culture;
- Establishment of limits and strict control of water use; and
- Introduction water charges and tariffs for water use.

Provided that these issues are decided, retrenchment of water use will follow.

The Aral Sea level has been declining rapidly for years. For preservation of at least some part of the Sea political willingness and decisions of the basin countries are necessary on issues of water use optimization and the annual allocation of sufficient volumes of water designed for achieving sustainability of the ecological situation. Appropriate decisions must be made based on objective, reliable and complete information, analysis and calculations. Assessment of water resources, including detection of potential sources, implies determining sources, amounts and quality of water resources as well as consideration of influences exerted on these resources by human activities. Assessment serves as a practical basis for effective operation and a precondition for evaluating the feasibility of their development. However, it is becoming increasingly impossible to obtain exact and reliable information on water resources. Hydrologic services and other relevant organizations fail to properly provide such information, especially data on underground waters and water quality. Major difficulties are connected with lack of funding for conducting water resources assessment, the dissociated structure of hydrologic services, and the inadequacy of skilled personnel. At the same time, access of developing countries to advanced techniques of data collection and management is becoming more complicated. However, the necessity of developing national databases, to be used for water resources assessment, and alleviation of impacts exerted by floods, droughts and desertification, is quite obvious.

The Scientific-Information Center of the Interstate Commission for Sustainable Development (SIC ICSD) in the countries of the Aral Sea basin was established in Ashgabat, Turkmenistan with branches in all countries of the region. This center should play an appropriate role in dealing with regional and interstate ecological problems. The necessity of integrating decision-making processes in the field of

environment and development has been acknowledged as being in keeping with economically effective, socially equitable, and reasonable water resources utilization.

Decision making is a dynamic process carried out at various social levels and embraces social, economic, institutional, political aspects, and environmental issues. Every stage of the decision-making process cycle requires application of different types of information and development of various indicator sets. However, making mutually acceptable and well-grounded decisions is possible only on the basis of complete qualitative economic, social, ecological, and political information of the countries' development. To date, this information lacks uniformity and it is dispersed among different sources. Free access is needed to updated and reliable information. The public at large should have appropriate opportunities of getting access to information sources, the Internet included. The major objective of providing fair access to ecological information is to ensure effectiveness of decision making in environment management and improvement of public awareness.

To support competent decision making in the field of sustainable development in Central Asia, a decision support system (DSS) is now being elaborated. A set of indicators are being implemented as the most significant tool for evaluating decisions. The UN Millennium Declaration, adopted by heads and governments of 147 states in 2000, supports 48 indicators aimed at maintaining global development process for 1990–2015. The Declaration confirmed that progress is based on sustainable economic growth focusing on the poor, and problems related to human rights. Out of eight objectives, the DSS can contribute to achieving Objective 7—"Ensuring Sustainability of the Environment," which implies integration of sustainable development in policies and programs carried out by countries, as well as complete elimination of natural resources degradation. The indicators are to be determined after a series of consultations with the United Nations, World Bank, International Monetary Fund, European Bank for Reconstruction and Development, regional groups and experts, through application of national poverty reduction strategies. Availability of indicators by each country depends on capacity of national statistical services. Without stakeholder participation the initiative to create and apply sustainable development indicators would be ineffective and short-lived. The information on sustainable development should be addressed to those who need it, when they need it, and delivered in a form comprehensible to them. Countries should see to it that local communities and resource consumers have the information and skills necessary for ensuring sustainability of the environment and resources.

Establishment of DSS is one of the first stages of creating an intellectual expert system. The main objective of the system is to improve the workmanship of average level specialists up to the level of those who are considered to be an indisputable authority in their field of activity. Computer systems are easy to replicate, making any knowledge base loaded in them the general property of the people, they may be quickly changed, they can accumulate an immense amount of information for decades.

The suggested DSS scheme is based on the provisions of Agenda 21 (Chapter 40). It will integrate sector data of official national statistics into a complex regional data base through application of database management methods and geographic information system (GIS) technologies. At the informational level, it will utilize indicators of performance efficiency and progress based on sequential data series. At

the level of decision making, reports will be produced for senior executives based on the database, ensuring the decision-making process to the full extent. All information users, and those who provide it, will be combined into one single information network at both national and regional levels. Thus, the creation of the decision support system in the interests of sustainable development and environment protection based on combining existing dispersed national and regional nets into one single expert-informational network will be an important step in Central Asian regional cooperation development.

Role of NGOs and Other Stakeholders in Interstate Water Resources Management

Å. Ì. Rodina

Central Asia is located in an arid zone where evaporation exceeds precipitation. Under such conditions freshwater predetermines the possibility of processes in the economy, the social sphere, and the environment. Water allocation risks in Central Asia are caused mainly by institutional aspects and the risks are rather high in spite of long-term activity by the International Coordinating Water Commission (ICWC). The risks are present on two levels: regional and national.

Risks at the regional level are caused by issues of water allocation between state-water consumers. This is aggravated by differences between irrigation and power engineering requirements. These contradictions have turned from the ordinary intersectoral to the political interstate level. The largest hydraulic structures with power plants and irrigation systems are found on opposite sides of borders. Serious problems have emerged because upstream countries need water for energy generation in winter periods while downstream countries need water for irrigation in the summer time. Consensus has been achieved by short-term agreements on water-power resources use in Naryn-Syr Darya basin based on mutual supplies of gas, coal, and electric energy instead of water. These agreements are imperfect and the Kyrgyz Republic's losses of millions US dollars caused by Toktogul reservoir and the Naryn-Syr Darya cascade operation in an irrigation regime are not fully covered. Thus, the immediate development of modern approaches is necessary to resolve these contradictions.

Indicators of states' share of surface water in the Aral Sea basin (Table 18) as well as specific water consumption and specific irrigated land availability per capita (Table 19) are of interest for risk assessment in water allocation and new water strategy development. Indicators given in Table 18 and Table 19 show the level of irrigated agriculture as the most important economic sector in the region and indicate the lag between upstream and downstream countries in specific water consumption and irrigated land availability per capita.

The existing system of transboundary water allocation does not meet the sovereign status of states and is in contradiction with their constitutions and water laws. Established limits restrict opportunities for development in upstream countries in order to provide the growing population with food at the level of biological needs. Limited water allocation imposes restrictions on energy generation enterprises and leads to high losses in energy generation during the winter time and the necessity to buy additional power resources from the downstream countries. The principles of

Table 18. Shared Participation of Central Asian Countries in Surface Water Consumption

State	Surface Water Used (in km³)	%
Kazakhstan	10.50	10.40
Kyrgyz Republic	4.59	4.50
Tajikistan	11.06	10.90
Turkmenistan	23.35	23.10
Uzbekistan	51.68	51.10
Total, Aral Sea Basin	**101.18**	**100.00**

km³ = cubic kilometers.

Table 19. Specific Surface Water Availability in Central Asia

State	Population (million)	Withdrawal from Surface Sources (km³)	Specific Withdrawal (thousand m³/capita	Irrigated Area (thousand ha)	Specific Availability (m³/capita)
Kazakhstan	2.60	10.50	4.00	786.20	0.30
Kyrgyz Republic	2.53	4.59	1.80	429.50	0.17
Tajikistan	5.62	11.06	1.97	719.20	0.13
Turkmenistan	4.90	23.35	4.75	1,744.10	0.36
Uzbekistan	22.00	51.68	2.34	4,280.60	0.19
Total, Aral Sea Basin	**37.67**	**101.18**	4.00	**7,959.60**	0.30

ha = hectare; km³ = cubic kilometers; m³ = cubic meters.

an integrated approach to resource management and use are not considered in the current system of water resources management.

The management sphere is limited by surface water being distributed for irrigation and this ignores the interests of other water consumers, thus provoking conflict situations. The interests of natural aquatic ecosystems are not taken into account at all. Ground and waste waters are not managed, as well as water quality. The location of all administrative divisions of regional water management for the Aral Sea basin in one state does not facilitate full and equitable consideration of the national interests of other countries.

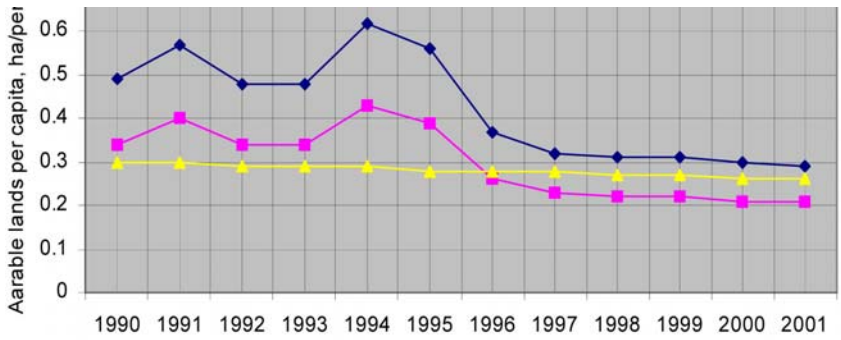
The legal base of interstate management is not developing and legislative acts from the Soviet period are still in force and they do not meet the sovereign status of states. The Aral Sea Basin Program and a set of later statements and agreements on regional water strategy and economic development have not been implemented yet. Obviously, only an agreed regional strategy of water allocation based on legal and economic mechanisms can reduce the risks in transboundary and national water use. Presently, risks in the water sector of Central Asia caused by institutional factors are very high.

At the national level, risks caused by the institutional sphere are also rather high. This is explained by the fact that there is neither a single master nor a coordinating structure in the water sector. At a minimum three ministries manage water: the Ministry of Agriculture and Water Resources, the Ministry of Environment and Emergency and Ministry of Health, as well as several other agencies. This situation does not make it possible to create a single system of water management, monitoring, and rational use and it does not prevent the degradation of water and other resources.

What can be done in the civil sector to reduce the risks? More than 100 ecological NGOs are registered in the Kyrgyz Republic but only a few of them are involved in water allocation issues. Among them are: Sustainable Use of Natural Resources,

Young Ecological Movement (BIOM), and Ecological Expertise. The NGO Sustainable Use of Natural Resources actively participated in discussion of the report National water requirements and alternatives of their management in the Kyrgyz part of the Aral Sea basin within the GEF-financed Water and Environmental Management project, component A-1. The report was criticized for the absence of an integrated approach to national water demand definition.

Figure 2. Dynamics of Actual and Necessary Levels of Arable Land Available Per Capita



For example, interests of natural aquatic ecosystems were not taken into account, but the Aral Sea catastrophe has shown that visible changes in the ecosystem started when more than 50% of the available water was extracted. Existing and future issues of food security were also not taken into consideration. Assessment of agriculture sustainability, performed on the basis of international indicators of sustainable development, shows that the country is close to the critical level of arable land availability per capita, hardly providing 2,100 kcal/day per capita (average is 3,000 kcal/day) (Fig. 2). That is why the food self-sufficiency issue is very critical and can be solved both through the increase of crop yields and the expansion of irrigated lands, but that requires a significant amount of additional water. For example, irrigated lands constitute 65% of total arable area in the Kyrgyz Republic, and development of 700–2,000 ha of new land will require that water supply for irrigation must be increased by 80–200%, i.e., this goes beyond the established water allocation limits. Thus, the trend of risk growth is evident in irrigation.

While NGOs, through their scientific potential, try to influence decision-making process, such water organizations as water user associations (WUAs) practically determine the water use regime. Analysis of Table 20 shows that in spite of the increase in population density such oblasts as Jalalabad and Osh (together with Batkent) reduced per capita water withdrawal by 30% compared to 1990.

Figure 3 illustrates these facts clearly. In these oblasts 46 and 69 WUAs, 8 and 10 watereconomic associations have been established. The coordinated activities of such new associations, under the support of the GEF-financed Water and Environmental

Figure 3. Dynamics of Population Density, Arable Lands, and Water Withdrawal 1999 vs. 1990

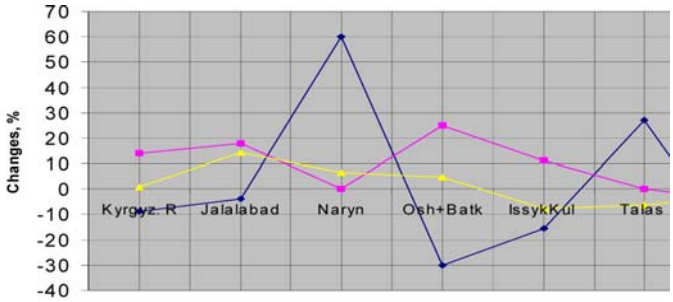


Table 20. Dynamics of Water Withdrawal, Population Density, and Arable Lands

Indicator	Change (%)	1990	1995	1997	1998	1999
Water withdrawal per capita (m^3)						
Kyrgyz Republic	-8.8	2,054.4	1,635.7	1,801/.5	1,733.5	1,873.3
Jalalabad	-3.8	2,047.5	1,568.8	1,440.0	1,572.5	1,276.7
Naryn	60.0	2,220.0	2,216.7	3,300.0	3,190.0	3,555.0
Osh, Batkent	30.0	2,730.0	2,341.8	2,127.3	1,786.7	1,917.5
Issik-Kul	-15.4	3,422.5	2,837.5	2,370.0	3,103.3	2,895.0
Talas	27.2	4,990.0	3,995.0	3,380.0	3,730.0	6,350.0
Chu	-29.3	4,441.0	3,350.0	3,147.5	2,901.3	3,140.0
Population density (persons/km^2)						
Kyrgyz Republic	14.0	21	22	22	23	24
Jalalabad	18.0	22	23	24	25	26
Naryn	0.0	6	5	6	6	6
Osh, Batkent	25.0	32	35	37	38	40
Issik-Kul	11.1	9	8	9	9	10
Talas	-5	40	36	37	37	38
Arable lands (thousand ha)						
Kyrgyz Republic	-0.7		1,199.8	1,192.0	1,175.6	1,208.8
Jalalabad	14.2		144.0	162.5	160.0	164.4
Naryn	6.4		113.5	115.0	115.7	120.8
Osh, Batkent	4.6		230.2	229.4	236.5	240.8
Issik-Kul	-7.8		191.2	180.9	170.3	176.2
Talas	-6.4		105.7	101.4	97.7	98.9
Chu	-1.5		411.1	399.1	387.5	404.8

Source: Environment in the Kyrgyz Republic, *Statistical Collection,* Bishkek, 2001, 155 pages.

Management Project, Component B "Formation of Public Opinion about Rational Water Resources Use," undoubtedly are fruitful. Risk reduction in water resources management, from our point of view, is possible only in case of partnership between public and societal sectors, which is directed toward

1. The creation of a legal base for interstate water relations;
2. The development and introduction of economic mechanisms of regional and national water use; and
3. The implementation of research works to assess land and water use sustainability in Central Asia on the basis of SIC ICWC and SIC SDC together with specialists from public and societal sectors of all Central Asian countries and perhaps the People's Republic of China.

Role of NGOs and Other Concerned Parties in Interstate Joint Water Use

S. Aknazarov

Regular, adequate, potable water supply is one of the basic human needs and often a condition for survival. Water is extremely important not only for human health but also for food security and economic development as a whole. Along with increases in water demand, water becomes a more limited and vulnerable resource and management is aggravated by economic, social, and ecological factors. Therefore, water resources management and protection are the first priority for any policy of sustainable development of water resources.

In spite of certain successes achieved in the water sector, there are many issues of intersector interaction, ambitions of governmental structures, access to information, nontransparency in decision making, lack of harmonized legal base (laws of direct action). The absence of a coordinated regional convention on water issues is a critical problem.

In this connection, the problem of water partnership and interstate joint water use is very topical. Though the Global Water Partnership is an international network of water-related organizations existing since 1996, public and stakeholders' involvement has started only recently. "It is very important that private sector, civil society and other participants play effective and important role in water resources management" (Draft of Johannesburg Declaration, 2002).

To solve these problems an integrated approach is needed that is acceptable for all aspects of water resources management and all water users. This is caused by the growing international recognition of the necessity of achieving global water quantity and quality security stressing international collaboration and transboundary watercourse management as well as complex approaches to water supply.

Water resources management is difficult for many countries. The main goal is to provide sustainable and equitable access to safe water. In the strategy, interstate joint water use and management and inter-sector issues should be taken into account as well as aspects of economic, social, and ecological sustainability. Governance at the river basin level, participation of civil society and other concerned parties in the decision-making process, knowledge dissemination, and information exchange promote institutional sustainability and help to avoid conflicts. It is worth underlining the necessity of interstate water resources management as an inseparable part of a strategy directed at combating poverty, for instance through a strategy of food security, sustainable agricultural development, and regional integration and collaboration. Water resources management and services connected with water use for livelihood is extremely important for providing social, economic, and political well-being. Recently, this simple fact began to draw attention at the international level. The water sector is of high priority for the Central Asian region. There are two interconnected directions: social policy and water resources management/protection.

At the international conference in Dublin on water and environment, at the Rio conference in 1992 and at the Earth Summit in Johannesburg (2002) the main principle of water as a finite resource, which should be managed according to acceptable economic and ecological criteria, was underlined again. All water user groups agree that integrated, joint management providing optimal utilization of water resources is extremely important for sustainable water supply and ecosystems protection (Agenda 21, Article 18). Analyzing the progress gained since the Rio conference the UN Commission on Sustainable Development developed an action plan on freshwater resources management applying to international community to include this question in the list of development policy priorities. One of the priority tasks is water supply, which should be acceptable on quantitative, qualitative, and sanitary characteristics through constructing and rehabilitating systems meeting real needs of population, its technological and financial possibilities. In order to fulfill this task, it is necessary to help countries in the definition and realization of common policies of water resources management directed at satisfaction of basic population needs, particularly those of the poor, creating conditions for improved health within general the concept of sustainable and equitable resources development.

In the policy of interstate joint water use it is necessary to take into consideration existing water resources, including the real value and needs of different sectors (freshwater consumers, agriculture, industry, power engineering, etc.). Effective resource management depends on the possibility of data gathering in all countries and uniting them in a common database. Desirable development is based on resources conservation and water saving. Approaches based on river basin management are the most acceptable for water resources management. Principles of sustainable and equitable water management are applicable at the regional level in case river basins are extended across the borders of one state.

The need to raise the efficiency of water use (in particular, to reduce losses) should be noted as one of the priorities. Attention should be paid to proper governance and maintenance and attracting concerned parties including the private sector, civil society, and NGOs. The main role of NGOs is to promote public awareness, underlining the value of water and involving local communities, in particular women, at all stages of water use, in the process of management and maintenance in close collaboration with health organizations. Human resources development and capacity (technical and institutional) strengthening at all hierarchic levels are critical components of any program of interstate collaboration in the water supply area.

Interstate collaboration including NGOs and other societal strata participation in water resources management determines the necessity of revising and changing some principles:

- Institutional and managerial aspects;
- Social aspects;
- Economic and financial aspects;
- Ecological aspects;
- Information, educational and communication aspects; and
- Technological aspects.

All these aspects should be revised in light of transboundary water use. The following main directions of activity can be defined for interstate water use:

- Assessment and planning of water resources use;
- Major water supply and sanitary services (in rural and sub-urban areas);
- Municipal services in water supply and sanitary (in cities); and
- Water use and management in agriculture.

The main priorities of interstate collaboration are as follows:

- Provision of the population with safe water, in particular the poor, under adequate sanitary conditions to improve the quality of life through its health and hygiene improvement; and
- Introduction of national and regional policies in water resources management in order to make it sustainable and equitable for all groups of water users keeping water systems viability.

Thus, priority actions of NGOs and other concerned organizations in interstate joint water use are as follows:

1. In drinking water supply:
   - Participation in infrastructure construction and rehabilitation;
   - Involving persons who benefit from the water supply;
   - Facilitating human resources and potential development; and
   - Participation in management systems and technical services creation.

2. In water resources use policy:
   - Support to institutional development and legislative initiative, common platform for improvement of coordination, and communication in water-related issues;
   - Transparency of existing and future actions in water-related area for more effective official assistance to development; and
   - Establishing monitoring and strategic assessment system.

3. Special attention has to be paid to:
   - Institutional development and capacity building;
   - Structures providing wide participation of civil society, NGOs, and other concerned parties in decision-making process;
   - Public participation in natural resources management;
   - Participation in major knowledge improvement and dissemination;
   - Participation in governance and pricing policy; and
   - Promotion of public awareness and communication improvement.

To achieve success it is important for NGOs and other concerned organizations including the local population to take part in the interstate joint process of safe and sustainable water supply. Therefore, the NGOs and civil society's roles in a new strategic partnership on water and sanitary-related issues are to

- Improve process transparency;
- Establish priority of water resources and sanitary conditions in ecological strategies and programs of sustainable development in adjacent countries;
- Support an integrated approach to river basin management for transboundary watercourses and basin organizations as well as regional legal base strengthening;
- Facilitate introduction of water pricing sensitive to needs of poor; and
- Actively participate in development of specific components of strategic partnership regarding public participation in the decision-making process and action program prepared for the Ministerial meeting "Environment for Europe" in Kiev in May 2003 and for the Third World Water Forum in 2003 in Kyoto.

To strengthen the integration process and involve all concerned parties, the Central Asian governments proposed an initiative on sustainable development in Central Asia (Agenda 21), which was supported at the Earth Summit (Johannesburg, 2002). The main idea of this proposal is the creation of a political, legal, and institutional platform for integration. Because of that it is necessary to integrate this interstate joint water use initiative in the Central-Asian Agenda 21, which already has a political foundation – Head of States Declaration, Statement of Ministers of Central Asian Region, European Economic Community, and United Nations Economic and Social Committee for Asia and the Pacific that will promote joint efforts with regard to financial means, human resources, and potential to avoid creating new separate programs.

Role of NGOs in Solving Water Management Problems in Central Asia

Y. Kurbanbayev

Many professionals that were concerned with the water use problem foresaw that Central Asia would face difficulties in securing water for drinking and irrigation purposes and predicted the drop (though rather slower than it is now) in the Aral Sea level. At present, after the collapse of the former Soviet Union, all the Central Asian states have their own development paths. During a short historical period under the conditions of independence they revived their national traditions and customs and now strive for better living conditions and for a juridical and democratic society. At the same time, they have been facing a lot of problems that need to be solved immediately. One of the problems is that each state in Central Asia pursues its own water use policy and holds its own interests in river water withdrawal thus reducing the water share that must be supplied to the Priaralie, first of all, and to downstream areas and deltas of the rivers Syr Darya and Amu Darya. After the collapse of the Union of Soviet Socialist Republic there has been no official body—at the interstate level—that deals with allocation and use of water resources in the rivers Syr Darya and Amu Darya. In this context, the following organizations were established: the Interstate Fund for Saving the Aral Sea (IFAS); the Interstate Commission for Water Coordination (ICWC) and its Scientific Information Center (SIC ICWC); and, two Basin Water Organizations (BVO "Syr Darya" and BVO "Amu Darya"). Owing to efforts made by IFAS and ICWC many difficult questions of interstate importance are being resolved effectively. However, the present activities of these organizations, particularly of BVO "Syr Darya" and BVO "Amu Darya", are very limited and that makes it impossible to establish full control over the use and allocation of water resources in two rivers.

Currently we lack an official executive agency—at the interstate level—that would ensure firm water supply, according to set limits, to the Aral Sea and the Amu Darya and Syr Darya river deltas. As a result, we have a tense situation in downstream areas. The causes are:

- Absence of unified center for managing water resources in the rivers and limited responsibilities of BVOs;
- Lack of proper measurement of water withdrawals; lack of access to information on day-to-day operation of relevant structures; and
- Unbalanced operation regime of large reservoirs and management of water resources in the lower reaches of these two rivers.

Moreover, subsection 2.1 of the BVO "Amu Darya" Regulations, which states "maintenance of firm water supply, in due time, to consumers according to ICWC-set limits of water withdrawal from interstate sources and of inflow to the Amu Darya river delta and the Aral Sea in annually planned amounts, as well as

establishment of day-to-day control over the maintenance of set limits and the operation regime of interstate reservoirs and monitoring of water quality," is not fulfilled.

The absence of coordination between operation regimes of Nurek reservoir and Tuyamuyun reservoir on the Amu Darya River has created recently a critical water situation in the lower reaches. Damage from the water shortage could be mitigated if an interstate agreement was reached in controlling the proper operation of these large reservoirs and water withdrawal limits were maintained.

Another problem is poor water use in all Central Asian countries. Water-saving measures are taken inadequately and inputs per unit crop production are unreasonable. Under such conditions agricultural output should be extended through the rise in yields per irrigated hectare rather than through the expansion of irrigated areas. Major runoff (80%) of the two rivers is formed in Tajikistan and Kyrgyzstan. In our opinion, this water is not a property of these two republics. People of the region have been using the water resources in these rivers for centuries. Water resources should be distributed according to irrigated areas, causing no harm to riparian states. It is known that during low water years mainly downstream areas suffer from water shortage.

First, it is necessary to make a range of resolutions in the field of environment and water management—at the national and regional levels—to alleviate environmental and socioeconomic crisis in the Central Asian region and Priaralie in particular:

1. Develop—on the basis of international analogue—a long-term coordinated strategy of Central Asian states on the provision of Priaralie with water.
2. Increase the role and extend the authorities of BVO "Amu Darya" with transfer of all relevant intake structures, large waterworks, and reservoirs to the BVO's responsibility so that it could ensure firm water supply to Priaralie. International experience in coordinated and rational use of shared water resources should be applied in this context.
3. It is necessary to revise radically the cropping patterns in the basin as a whole so as to reduce damage to backlands from water shortage.
4. Further extension of agricultural output through improved agricultural production technologies will promote considerable water saving in the basin as a whole. Moreover, this will increase water supply to river deltas and surrounding lakes and will recover fishery.
5. Limit—at the interstate level—investments for those states and zones that regularly break river water use rules.
6. During low water years limit water delivery from the Amu Darya and Syr Darya lower reaches.

Despite publicity and access to available information on environmental and the water-related situation in the region, there is some misrepresentation of the present situation in the region. These include the Aral Sea problem, environmental situation in some areas, and improper distribution of water and its pollution (Priaralie and Amu Darya and Syr Darya deltas) that formally are not made public in mass media.

In this context, nongovernment organizations (NGOs) must take the initiative in solving these issues and in raising public opinion. Currently almost all NGOs are in the process of development and still are not able to compete with public agencies. Many NGOs have no funds to cover their administrative costs and staff salaries and to undertake other necessary activities. The most important is that materials on acute problems are difficult to publish in legal mass media. Many officials think that NGOs impede public activities and create wrong public opinion. Only representatives of NGOs may point out the shortcomings that keep back social development and do not go beyond current laws and regulations of each state. NGOs should ensure publicity and raise public opinion thus benefiting the people.

The following should be done to develop activities of NGOs and increase their role in the solution of environmental and water management problems in Central Asia:

1. Include representatives of NGOs from all Central Asian republics in ICWC membership.
2. Ensure involvement of NGOs' experts during consideration and improvement of large-scale regional and interstate projects.
3. Ensure active involvement of NGOs in the solution of environmental and water management issues (design, construction, and operation) at national and regional levels.
4. Decide upon financing for publishing NGOs' materials and documents. NGOs may and should promote further economic development and better living standards of Central Asian nations.

NGOs may and should promote further economic development and better living standards of Central Asian nations.

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