CENTRAL ASIA: WATER FOR FOOD

A.A. Nazirov

Ministry of Land Reclamation and Water Resources of the Republic of Tajikistan

Dear Ladies and Gentlemen!

It is well-known that food production is one of the crucial elements of development and prosperity.

In this context, the first-priority objective of every sovereign state is to ensure national food security. As UN General Secretary underlined, “We need revolution in agriculture that would improve productivity per unit water – more yield per drop of water”.

Irrigated agriculture is the most productive agricultural sector. The productivity of an irrigated hectare is 3-8 times higher in arid zone compared to that in naturally humid land.

The key condition of high bio-productivity is two main components of agro-biocenosis – thermal and water resources. Under 50% of flow probability, the total water resources are estimated to be 105-115 km^3/year. It is about 2200 m^3/capita/year, that is three-fold of the worldwide figures: 700 m^3/capita/year, of which approximately 70% or 485 m^3/capita/year is used for irrigation. In Central Asia, under 85-90% of water used for irrigation, it is almost 1900 m^3/capita/year, which exceeds the world value 3,8 times.

Certainly, in general, regional aridity is above the mean world one; however, countries in Persian Gulf are characterized by extra-arid conditions but their specific indicators are lower than the mean world one.

Let us consider another one indicator – water volume in the Aral Sea. In 1960, it was 1064 km^3; 4,5 million ha were irrigated and 60 km^3 of flow was diverted from the two rivers supplying water to the Aral Sea.

Since 1966, when period of intensive irrigation construction was started in the region, additionally 2,5 million ha have been developed. The rest of about 60 km^3 of basin flow was taken for irrigation of this new area and this has led to the Aral Sea disaster. In addition, such large-scale diversion of water turned to be ineffective. However, it is a matter of specific analysis.

Before “large-scale” irrigation, less than 7...8 thousand m^3/year were used for irrigation of one hectare in Central Asian region. As irrigation area expanded, irrigation norms increased and, finally, reached 12...14 thousand m^3/ha. As to specific irrigation water use, and more precisely regarding ineffective water use, the Central Asian countries hold the first position all over the world. At the same time, our water professionals are

of very high international authority and created by them hydraulic structures and irrigation systems are often unique in the world practice.

Previously, the Aral Sea basin was an inland water body within an area of one state. All relevant problems in the basin were solved on centralized basis through various compensatory measures. Since formation of new independent states in the region, the basin had become shared by five and in the nearest future, probably, six states with their own priorities and water demands but, in general, with common problems. Just under such conditions, in 1993, five Central Asian states at their summit in Nukus have made a very vise decision – still follow the quotas that were set in Soviet time. To this end, the well-known regional institutions were established to ensure implementation of these decisions.

As we see food security in the region depends on the main resource of water, which use and management take new shapes. In general, in the region, food supply took a turn for the worse and led to changes in land use patterns and, consequently, in water use.

According to dietitians, human needs 2800 kcal, 100 g of protein, 100 g of fat, and 400 g of carbohydrate for normal nourishment. Actual food consumption was estimated to be 2615 kcal in 1985, 2240 kcal in 1990, and 528 kcal at present. Diet patterns are much worse. For example, the average resident consumed 31 kg of meet out of 68 kg of physiological norm in 1985, but this figure reduced to about 7 kg or 10% of the need in 2003. The same situation is observed regarding other foodstuffs, except bread. Certainly, these indicators relate to intra-republican production of basic food resources. Besides, the UN World Food Program has provided to the republic more than 400 thousand tons of foodstuff as humanitarian aid over the last 10 years of its operation.

Food shortage is partially compensated by foodstuff import, which increased from 18,7 to 70,0 million U.S. dollars or 3,7 times over this period and led to a new problem of food bio-security.

Given the demographic growth, higher population density (up to 500 person/km^2) and shortage of arable land, the selection of priority directions in agriculture and its specialization becomes particularly important. Current opinion that food situation may be improved through reduction of cotton production cannot lead to positive results since even complete reorientation of cotton-production system towards food production would not solve all the problems. Economic return on land would be several times less than in case of former agricultural specialization since cost parameters of food production are much lower than those of cotton production. This means that market exchange will provide ten times more food from a hectare of land under cotton than food production from the same area of irrigated arable land.

According to the UN's medium-term assessments, by 2025 the world population will reach 7,8 billion, i.e. 38% more than present population. By assuming that subsistence standards become improved in many

countries, IWMI estimates (IWMI, 2000) that in order to feed the population, 40% more food would be needed. To what degree irrigation needs to be improved? According to scientific estimations, irrigated areas need to be expanded by 29%, and due to increased productivity and more effective water use, agricultural withdrawals would be raised by 17%.

Under market relations, cost of water is very important. Researchers from Tajik Research Institute for Irrigation and Land Reclamation calculated the weighted-average costs to get additional (saved) 1000 m^3 of water by different ways**.**

The weighted-average costs to get additional 1000 m^3 of water, USD

#	Ways for getting additional water	Costs, USD
1	Saline water desalination	1000±250
2	Rehabilitation of irrigation and drainage systems	800±100
3	Spatial re-distribution	750±200
4	Waste water treatment	120±20
5	Reservoir regulation	70±20
6	Application of water-conservation technologies	3±2

The calculation results showed that the cheapest way was application of water-conservation irrigation technologies and cost only 3÷ 5 USD to get 1000 m^3 of water.

Therefore, under water shortage and the established water limits, we need to achieve rational irrigation use through the following: improvement of soil reclamation and water allowance zoning principles; development and implementation of scientifically-based irrigation regimes; identification of crop water consumption patterns; application of advanced water-efficient irrigation technologies; improvement of the state of lands; development and implementation of innovative irrigation technique and technologies and their optimization in order to increase yields, raise production per irrigated hectare, and input new irrigated areas in agricultural production.

National economy in Tajikistan uses annually 11,5÷12,8 km^3 or 18÷20,0% of flow formed in Tajikistan, while the rest of water flows to neighboring states such as Uzbekistan, Turkmenistan, and Kazakhstan.

Because of irregular distribution over the area, as well as of insufficient river flow regulation, out of available 720 thousand ha of irrigated land, 20% suffers from water shortage that could be compensated only through internal sources. About 300 thousand ha is irrigated by pumping stations.

Analysis showed that 92% of water is used in irrigated agriculture and generated 90% of crop production.

At present, in order to solve the national food security problem and to improve public welfare, besides intensive development method we need to apply extensive one, i.e. input new irrigated areas in agricultural production. Prospective areas suitable for irrigation are estimated to be 500-800 thousand ha. For irrigation of this area, water use needs to be increased again by 3…6 km^2. In general, the total prospective withdrawal for all economic sectors would be 18 km^3 or 28,1 % of river flow in Tajikistan. Such prospects could just aggravate critical conditions related to water shortage.

Tajikistan, located in flow formation zone of the largest in CA Amudarya river, plays an important role for sustainable development of agriculture and other economic sectors in Turkmenistan and Uzbekistan. Irrigated agriculture in Kazakhstan is linked with Kairakum reservoir located in the Syrdarya river. Water relations between Tajikistan and other CAR countries are based on before concluded agreements. However, those agreements establish only procedures of the interstate water allocation as existed in Soviet time and do not regulate economic relations as concerns use of water and hydropower resources in transboundary rivers.

In Soviet time, priority for new irrigated land development was given to the republics that had the largest cotton and rice production. Therefore, the largest water quantity was allocated to the republics located in Amudarya and Syrdarya downstream. As a result of such policy, Tajikistan is the least provided with irrigated area and water resources and has 0,116 ha/capita and 1843 m^3/capita, respectively.

Water use efficiency throughout the Aral Sea basin

#	Country	Specific water use per capita, m^3	Specific irrigated area per capita, ha	Specific water use per irrigated hectare, m^3	Water use per unit yield, m^3/t
1	Kazakhstan	1943	0,30	11350	1220
2	Kyrgyzstan	1371	0,14	10120	2410
3	Tajikistan	1843	0,11	13580	6170
4	Turkmenistan	4044	0,41	12370	2370
5	Uzbekistan	2596	0,19	12380	1350
	Total for the basin:	2524	0,20	11870	2320

Note: source: WUFMAS project data. The highest indicator of specific water use (6170) per unit yield is achieved in medium-stony soil (1st hydromodule district -) Sogd province of Tajikistan.

At present, due to lack of anti-filtration coating in conveyance and distribution system, of primitive furrow irrigation and inefficient farming, the mean farm irrigation efficiency is 0,42 or 58 % of water withdrawn from the irrigation source is lost in canals and irrigated fields. This leads to field subsidence, salinization and water-logging of downstream lands and to other negative effects.

Assessments and analysis of monitoring data have identified the following:

- Use of huge water quantities for irrigation for both the whole growing season and individual irrigation events;
- Irrigation depths vary within 2,0-2,5 thousand m^3/ha in farms;
- Irregular irrigation water use;
- Irrigation water losses through filtration achieve 40% and field outflow amounts to 32% of gross inflow to the field.
- Irrigation water use efficiency is very low and ranges from 0,4 to 0,6.
- Decrease of water productivity due to yield losses caused by various farming and organizational factors;

The main cause of such situation is poor discipline in water use. Long ago, labor-management relations in this area have collided with productive forces and prevented future development of the latter.

WUFMAS Project's data obtained by monitoring of crop yield formation factors in 220 control fields under representative Central Asian conditions can be shown as an example. According to those data, the annual irrigation water losses at the level of "field inlet-cotton rooting zone" average 51%, varying from 42...43% in Kazakhstan, Turkmenistan, and Uzbekistan to 67% in Kyrgyzstan and Tajikistan.

The scientifically-based and environmentally sound level of total water consumption in the region is estimated to be 80 km^3 a year. This is a limit established by the nature itself. In some or other way we should learn to keep within this limit. Experience of the countries that have similar natural and climatic conditions and obtain up to 4 t of raw cotton per hectare under specific water use not exceeding 5 thousand m^3/ha indicate to huge potential of water conservation.

Comparative analysis of irrigation water productivity data estimated on the basis of gross margin shows the following: water productivity is 0,06-0,16 US dollars per 1 m^3 in Central Asian countries, while it is 0,52 US dollars per 1 m^3 in Israel. Despite the fact that these data reflect local market conditions, most of all food market, they are quite significant.

From the above-mentioned, it follows that:

Implementation of water-conservation ideology as the basis for regional water strategy and all efforts related to future water development and management requires that great preparatory activities be undertaken. For every planning zone determined by river reach and its command irrigated area and, then, for the whole country within the basin area, the following indicators and factors should be determined, analyzed and estimated:

- potential land and water productivity – on the basis of available advanced experience, especially in low-water years;
- specific water consumption under minimum water use per unit production – by using common technical approaches;
- causes of yield shortage (related to reclamation and water management factors) and possibilities of overcoming it, with rating of measures undertaken;
- salt and water balances of a planning zone on the basis of previous data – probably, bringing their parameters to the values that ensure environmentally sustainable development of processes;
- possibility of utilizing waste and ground waters, as well as waters in all local sources that are not used currently;
- possibility of reducing organizational water losses at all chains of distribution system;
- non-productive water losses in all chains of irrigation system and, first of all, in irrigated field; the estimation will help to identify less capital-intensive water-conservation measures;
- reduction of return water discharge into rivers and lakes and improvement of water quality as a result of water-conservation measures.

Analysis of organizational water losses caused by mistakes of water allocation, specifically, due to poor information, is a particular task.

Regional and national experts should jointly identify such losses measured as billions cubic meters and elaborate a mechanism for their avoidance and prevention.

Accurate information should be prepared on the basis of the above-mentioned analyses and estimations for different social groups to convince decision makers, investment and water efforts planners, environmentalists, and water users of a need to follow steadily water-conservation principles by bringing water use rates to biological use level, of a profitability of such policy for every water consumer and for the society as a whole in economic, ecological, and social terms.

Because of international nature of the water-related problems, market relations of water consumer-riparian countries should be build on consideration of all principles laid by the international water law. With

reference to transboundary waterways, this means that any above-limit use should be compensated. Water saving is more profitable for consumer that transportation of outside water at higher price.

However, we need more radical solutions and one of the ways should be transfer to Integrated Water Resources Management (IWRM). The World Summit for Sustainable Development (WSSD) appealed to all the countries for development of IWRM strategies and effective water use by the end of 2005. To transfer to such complex system, five countries, having different and, at times, quite opposite interests, need a long way for not so much agreements as development of their national IWRM, with thorough calculations, economic analysis, and research that would gradually bring together positions through mutual concessions. Finally, this could lead to development of **regional** IWRM, with a single interstate center (commission) to deal with all water-management issues.

Regional view and joint efforts to solve the problems

The main points that need to be considered in the region are the following:

- Development of policy and strategy for water resources use and protection in national interests, with observance of international water law norms.
- Improvement of legislation in water and agricultural sectors; Bringing together national legislations near to regional one and development of integration process;
- Shifting interstate water project management to IWRM principles
- Establishment of Water User Associations and new forms of relations between water users and water managers on market basis;
- Transferring water project management to special institutions of different ownership categories;
- Rationalization of water use and protection management system's structure and functions;
- Establishment of a consortium and development of cooperation in production and supply of foodstuff, etc.
- Improvement of economic mechanism of water pricing;
- Elaboration of the interstate Program on development and application of water-conservation technologies in Central Asian countries, with specified dates and scopes;

- Attracting investments to development of new irrigated lands and improvement of their efficiency through application of new technologies.
- Rehabilitation of irrigation and collector-drainage systems, including the most vulnerable structures and pumping irrigation.
- Finishing construction of Ragun reservoir, with a volume of 13,5 km^3 at Vaksh river
- Construction of new reservoirs at Pyandj river with a volume of 35 m^3
- Cleaning of Nurek reservoir from siltation (annual siltation is 165 Mm^3)
- Development and application of a long-term program to prevent natural disasters in littoral zones, to provide systematic construction of bank-protection structures and to restore landscapes in mountain river catchments;
- Rehabilitation and development of high-quality drinking water supply to population; development of mountain fresh, mineral, table and medicinal water.
- Monitoring of water ecosystems (glacier studies and flow probability forecasting)
- Water allocation, which was adopted during the Soviet period, does not meet now regional and national interests. Therefore, new water allocation principles and mechanisms need to be developed and adopted at the interstate level. Besides, it is necessary to make provision for proportional compensations to prevent adverse water effects in flow formation zone.

Nowadays, water conservation is the only way to prevent soil from salinization, help the Aral Sea, save beauty and diversity of the nature in the form close to that left by our parents.

Thank you for attention!