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THE IMPACT OF GLOBAL CLIMATE CHANGE ON ENVIRONMENT (IN CAUSE OF WATER USE IN CENTRAL ASIA)

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ВЛИЯНИЕ ГЛОБАЛЬНОГО ИЗМЕНЕНИЯ КЛИМАТА НА ОКРУЖАЮЩУЮ СРЕДУ (НА ПРИМЕРЕ ВОДОПОЛЬЗОВАНИЯ В ЦЕНТРАЛЬНОЙ АЗИИ)

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Abstract

The problem of joint and efficient use water in Central Asia actually refers to one of the most important issues today. The solution to this problem demands not just development of new approaches to solving this problem, but also the development Extension Education programs for stakeholders and local communities.

Keywords: global climate change, water management, water resources, melting of glaciers, runoff of rivers, agricultural specialization.

Аннотация

Проблема совместного и эффективного использования водных ресурсов в Центральной Азии наиболее важная на сегодняшний день. Решение этой проблемы требует разработки не только новых подходов, но и программ заочного и вечернего обучения для заинтересованных сторон и местных общин.

Ключевые слова: глобальное изменение климата, управление водными ресурсами, водные ресурсы, таяние ледников, сток рек, сельскохозяйственная специализация.

Introduction

Central Asia in framework of a five countries: Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan are more than 4 million square kilometers. This is significantly larger than the territory of India and is almost a third of countries such as USA or China.

Natural Features

The natural feature of this region is the border area, consisting of mountains and deserts. Mountains, which occupy 30% of the total area of the region, are characterized by the presence of glaciers and snowfields. The Tian-Shan and Pamir mountain ranges are the most important in Central Asia. They provide much of the region's renewable water supply because (1) they are the sources of major rivers, and (2) the runoff from melting mountain snow provides water to feed ground springs. Desert landscapes are make up almost 70% of Central Asia. The water comes to such areas from melted snowfall in higher mountain ranges that feed ground springs, which can travel for hundreds of miles to water the oases. The dwindling of fresh water resources in many parts of the world will be an ever-increasing concern in the twenty-first century. Even now, problems of water supply in the western and southwestern United States, the Middle East, China, and Central Asia trouble politicians and planners worldwide. Solving the problem of water

management in the region as a whole will not only contribute to the development of agricultural production, but also the creators of the conditions for the safe development of Central Asia.

The main feature of the use of water in the region is agricultural specialization in cotton production imposed by the Soviet state. This is not only the transformation of the region into a zone specialization to grow industrial crops (cotton, tobacco, etc.), but also the construction of dams in the upper river gauges. By the 1960s, the diversion of river water for massive irrigated cotton plantations led to a drastic shrinking of the Aral Sea. For centuries, the sea and the two great rivers that fed into it, the Amu- Darya and the Syr-Darya, in modern times, the depletion of these bodies of water caused many areas to turn into desert. Another negative environmental consequence was that soil productivity was sharply reduced due to salinization. Changing this bleak situation will take a long time and require a lot of money. The reason that we offer and believe it necessary to develop and research regional networks, as explained by the complexity of natural processes and the relationship of nature and society at the present stage of human existence as well as the need to develop specific recommendations for creating a new system of agro-ecological zoning of the territory of Central Asia.

Cross-border nature of the geographic location of the major rivers of the Central Asia, the Syr-Darya and Amu-Darya creates several problems for their use. However, to a much greater extent, we believe that these problems are related both to the lack of modern data and research methods, for example, water resources, as well as the reluctance of co-operation in Central Asia for the benefit of the whole region. Addressing the joint use of water resources in Central Asia faces a number of circumstances. This is not merely the absence of an integrated, information data system on the rivers of the region, water resources management but also the inconsistency of the legislative framework on natural resources in the region. In our case we want to focus readers' attention on issues of systemic manifestations of the reflection of global climate change on the environment within the territory of Central Asia. Central Asia can be attributed to one of those regions. Another issue is the cross-border water sharing. The river runs through several countries and any policy in the upper stream countries would undoubtedly affect the communities in the downstream. Therefore, current water management lacks international or cross-border coordination.

On the issue of the use and distribution of water in Central Asia held a number of significant researches. Therefore, rather than absolute scarcity, improved governance and sectoral service delivery are among the key water management challenges in Central Asia. With the global climate change and its impact on the environment, such territories as Central Asia, with a border of mountains and desert landscapes, most rapidly "respond" to such changes. Therefore, the study of observed changes seems to be not only interesting but also important from a practical point of view to develop a system for monitoring and management of natural resources in the region.

Methods of the meteorological climate monitoring

Preliminary analysis of instrumental data for 100 years of meteorological climate monitoring showed that during the 20th century, annual average surface air temperature in Kyrgyzstan has increased steadily and by the year 2000 rose by 1.6 degrees or by 16% (Williams, Konovalov, 2005). Increase in global annual average temperature amounted to 0.6 degrees Celsius. At the same time, precipitation throughout the territory increased slightly, by only 23 mm, or 6% (Fig. 1). As you can see, the whole hundred year period of the last century was a pronounced process of sustained aridity (desertification) of the country climate, more than twice the world level. This warming has already caused a number of negative consequences for the ecology and economy of Kyrgyzstan.

At ten times increase in the number of natural disasters: floods, flash floods, landslides, flooding, landslides - causing enormous economic damage and claiming the lives of people. Under this state of affairs, surface air temperature of Kyrgyzstan in the 21st century, as in the past, will steadily increase and by the year 2050 the average annual temperature will rise by 1.3-1.7 degrees, and by the year 2100 by 2.5-3.0 degrees compared with the standards for the 1961-1990 period. The amount of precipitation will increase slightly, by 5%-7% and 10-15%, respectively (Williams,

Konovalov, 2008). That is, the process of aridity (desertification) in the republic, which was in the past century, will continue in the 21st century. This is the mildest scenario. In a worst case, temperature may rise by 4.4 degrees, and rainfall will decrease by 6%.

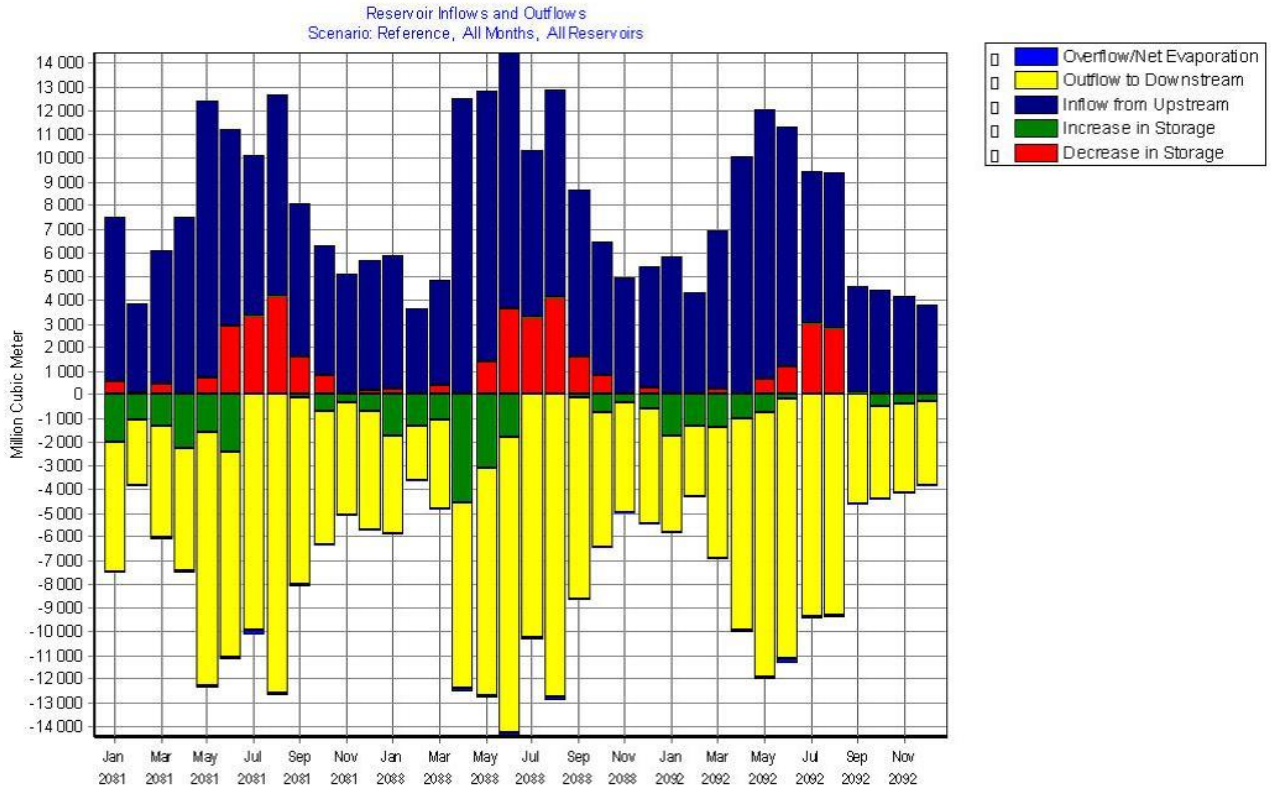

Fig 1. WEAP settings for the Business as Usual (Reference scenario): Syr-Darya reservoirs monthly operation scheme for normal (2081), wet (2088) and dry (2092) years 2070-99 A2 (4, 2003)

It is known that more than 90% of water resources in Central Asia are mainly used for irrigation of agricultural lands. The use of outdated, primitive methods of irrigation, results in irrecoverable loss of water. Thus, from 51.9 km^3/year of surface runoff, formed in Kyrgyzstan, the annual loss is at least 12 km^3/year of fresh water. Even larger deadweight losses of water occur in Uzbekistan and Kazakhstan –from 25% to 37% each. Failure to cooperate in the water and energy policy leads to an estimated loss of the countries in the region of almost U.S. $ 2 billion annually, reducing crop yields. Consider the main consequences of global warming for the entire Central Asia. First of all, it is necessary to ensure the population of the Central Asian region, a vital natural resource for its mountains - the drinking and irrigation water. According to the instrumental observations of scientists - glaciologists of the CIS and Pamir Alai, glaciers for the period from year 1957 to 2000, i.e. for 43 years, lost 25% of fresh water. The rate reduction is 0.6-0.8% by the area and 0.8%-1% by volume. Speed is not always the same. For example, in the year 1957 the rate of melting of the glacier Petrova doubled, compared with the previous period (Aizen etc, 2006).

Predicting of runoff of the rivers

The above findings are also confirmed by studies of foreign experts. A scientist from Oxford, Stephen Harrison, along with colleagues from Humboldt University, found that from the year 1955 to 2000 glaciers in the northern Tien-Shan mountains melted at a rate of 2 km^3/year, losing 90 km^3in 45years or nearly a two-year supply of surface runoff of all rivers of the republic. In the Pamir-Alai glaciers decreased by 1216 km^2, in the northern Tien Shan by 30% (Vilesov, 2001). In this century there will be further melting of snowfields and glaciers, and by the year 2025 their area will be reduced on an average by 30-40%. According to the forecast (Budyko, 1982), if the increase

in mean annual temperature in the year 2025 will amount to about 2degrees compared to the year1970 (today it is already 1.6 degrees), the size of the glaciers will decrease by 76% (southern slopes) and by 32 % (the north). Intensive melting of glaciers will naturally lead to an increase in water availability, which is fixed in recent years. During the period from the year 1973-2000 annual runoff increased by 6.3% compared with the previous period (from 48.9 to 51.9 km^3/year). In the next 20-30 years, according to some scientists a further increase in runoff by 10% (to 55.5 km^3) is predicted (Fig. 2).

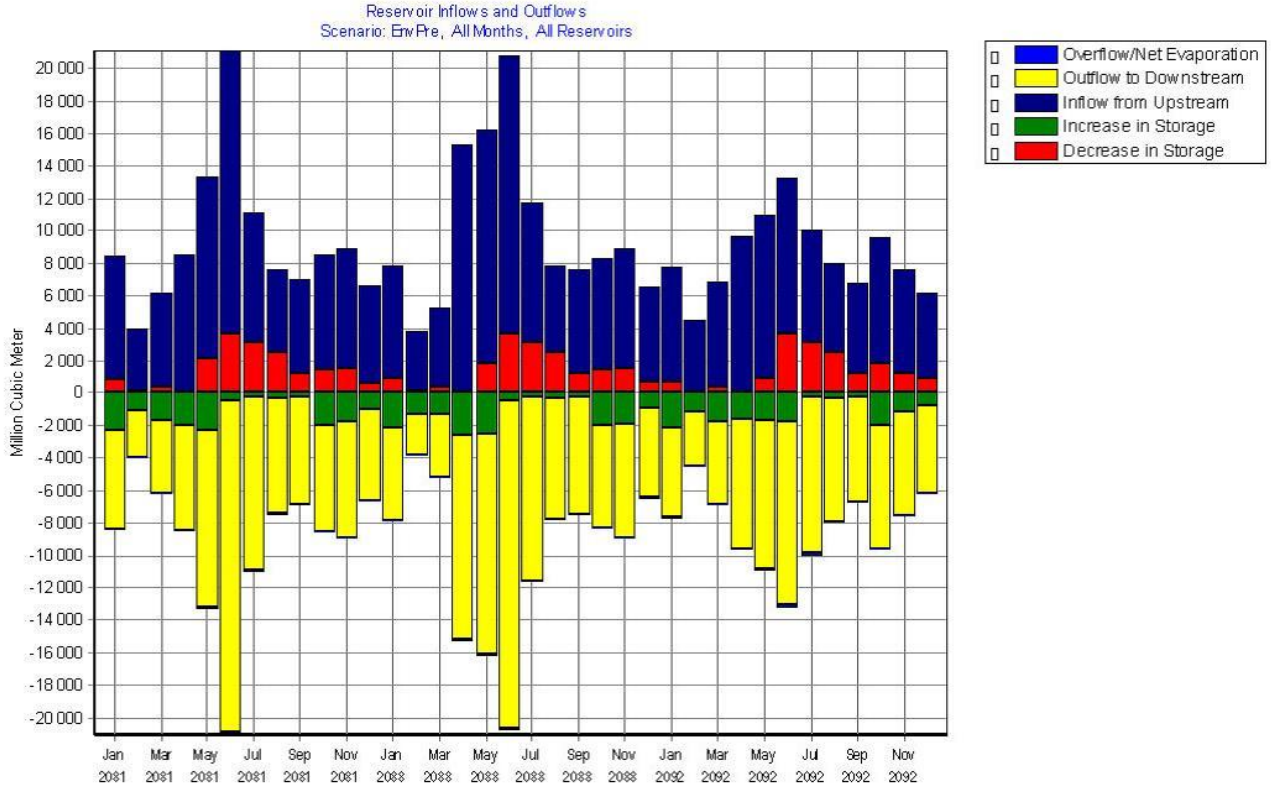

Fig. 2. WEAP settings for the Environmental Adaptation Strategy: Syr-Darya reservoirs monthly operation scheme for normal (2081), wet (2088) and dry (2092) years 2070-99 2070-99 A2 (4, 2003)

It would seem that there is nothing to worry about. However, optimists do not take into account two important circumstances. First, after the peak increase in water availability due to glacier melting, there will inevitably arise a recession as supplies of water in glaciers will begin to dry. Scientists predict by the year of 2030 runoff of rivers in Kyrgyzstan will be reduced by 25-35%, and if one does not take action today to protect and restore the remaining stock, by the year 2050 runoff will be reduced by another 30-40% to only 16-21 km3/year. Today the runoff amounts to 51.9 km3. In the region as a whole the total surface runoff by the year 2030 will reduce from the current 117 km3 per year to a minimum at least 47 km3 per year, i.e. by the year 2100 the glaciers of Kyrgyzstan and Tajikistan will only be in the photo archives (Aizen etc, 2006).

Meanwhile, the time for taking action in response to new threats of global scale and the challenges associated with global climate change, and which dramatically affect Central Asia, is steadily declining, with a view to the inertia of ecological systems. The problem of water supply in Central Asia will get worse even if the forecast for 20-30 years is a runoff increase. According to U.S. Census Bureau estimates and forecasts of the United Nations Fund for Population by the years 2020-2030 the population of Central Asia will grow at least twice, and will amount to more than 70 million people (UNFPA, 2005). Accordingly, the increase in water demand and an increase in runoff for this period will be only 10%, which naturally does not eliminate the problem. In the mostly irrigated agriculture in arid Central Asia – there is also the problem of food security. And that's just in the light of demographic indicators. If we take into account the optimistic program of

economic development: agriculture, industry, energy, mining industry, the demand for water will increase by another 1.5 to 2 times; in the total by 3-4 times. In addition, Afghanistan, as the subject of a Greater Central Asia, has already begun to develop non-criminal agriculture and began to produce its share of water from the Amu-Darya basin, which, naturally, creates a difficult situation with the use of water resources in Central Asia.

Conclusion

For scholars of different countries, including Central Asia, the problem of rational use of water resources in Central Asia, both scientific and socio-economic point of view does not exist, because most of the runoff in the region is formed mainly in the mountains of Kyrgyzstan and Tajikistan continue to spread to neighboring countries. This, among other things, is due to lack of mechanism for water management in our region. Naturally, in a planned economy and the overall economic development of a unified leadership in the Soviet Union, not any payment for the use of water could be considered. Therefore, today the problems of water use, to some extent, bear the burden of the past. It has been more than 20 years after the collapse of Soviet state. However, the Central Asian countries still adhere to past policies regulating the use of water resources in the region. For this reason, we believe that in addition to research estimates the current state of water resources is necessary to develop a variety of educational programs for the needs of local communities and water users in the region.

Existing Education Programs in Universities are expensive, so not everyone can take advantage of them. People need more affordable Programs of Environment Education. That's way we need developing Extension Programs for Central Asia – Regional Extension Water Outreach Education Programs. It should be a system called CAREN-Central Asian Regional Educational Network, which consists of two major packages of educational programs: Public Environmental Education Program for users of natural resources at the local level and Professional Environmental Education Programs for governments in the region: national and local levels. So, on the basis of the above characteristics of the state to regulate the issue of water use in Central Asia, there is a problem of developing a new system of water management in the region.

In this connection, the researchers of MSU and Central Asian countries propose to start a new cycle of studies to assess the consequences of global climate change on the environment in Central Asia and neighboring countries. This is above all, studies to establish CARIN - Central Asian Regional Information Network. The resulting network will form the basis for monitoring the "behavior" of the environment in Central Asia and adjacent territories, and for research to establish a system of water management in the region. CARIN system should contribute to the update, supplement and expand the existing database on the Environment in Central Asia. But CARIN can also provide research to create CARAN - Central Asian Regional Agricultural Network. Ultimately, the development of CARIN, CAREN and, CARAN ensures the creation of the regional system of natural processes for different needs, taking into account the impact of global climate change on the environment in Central Asia.

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