ЕКОЛОГІЧНІ ПРОБЛЕМИ ВОДНИХ РЕСУРСІВ

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UZBEKISTAN: ARAL SEA ECOLOGICAL DISASTER AND WATER RESOURCES MANAGEMENT ISSUES

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Central Asia is a region that is rich in the natural resources. However, water resources, especially surface water resources are limited. The region's two main rivers are Syr Darya and Amu Darya. Uzbekistan, the single biggest consumer of water and is located downstream of these rivers. The region's biggest ecological disaster is shrinking of the Aral Sea which is the result of mismanagement of the water resources.

Key words: water resources, ecology, Central Asian region, Aral Sea, disaster, rational water use, management, adaptation strategy.

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УЗБЕКИСТАН: ЕКОЛОГІЧНА КАТАСТРОФА В АРАЛЬСЬКОМУ МОРІ ТА УПРАВЛІННЯ ВОДНИМИ РЕСУРСАМИ

Центральна Азія є багатим регіоном з природними ресурсами. Однак водні ресурси, а саме поверхневі води, вельми обмежені. Дві головних і великі річки – Сирдар'я та Амудар'я. Узбекистан є єдиним та найбільшим споживачем води в регіоні і він розташований у нижній частині течії цих річок. Найбільшою екологічною катастрофою даного регіону є висихання Аральського моря, що стало результатом нераціонального управління водними ресурсами.

Ключові слова: водні ресурси, екологія, регіон Центральної Азії, Аральське море, катастрофа, раціональне використання води, управління, стратегія зменшення наслідків.

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УЗБЕКИСТАН: ЭКОЛОГИЧЕСКАЯ КАТАСТРОФА В АРАЛЬСКОМ МОРЕ И УПРАВЛЕНИЕ ВОДНЫМИ РЕСУРСАМИ

Центральная Азия является богатым регионом с природными ресурсами. Однако, водные ресурсы а именно поверхностные воды весьма ограничены. Две главные и крупнее реки – это Сырдарья и Амударья и Узбекистан является единственным и крупнейшим потребителем воды в регионе и он расположен в нижней части по течение этих рек. Крупнейшей экологической катастрофой данного региона является высыхание Аральского моря, что стало результатом нерационального управления водными ресурсами.

Ключевые слова: водные ресурсы, экология, регион Центральной Азии, Аральское море, катастрофа, рациональное использование воды, управление, стратегия уменьшение последствия.

The Republic of Uzbekistan is 447 km^2 and is located geographically at the northern boundary of the subtropical and temperate climate zones. To the north and west of Uzbekistan is Kazakhstan, west and south are Turkmenistan and Afghanistan, and east are Tajikistan and Kyrgyzstan. Uzbekistan is only one of two double landlocked countries in the world, making its access the ocean extremely difficult. Uzbekistan and other Central Asian countries including Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan and Afghanistan are struggling to come to terms with an ecological disaster affecting the Aral Sea. The crisis has been brought about by the mismanagement of water resources from the Aral's main tributaries, the Amudarya and the Sirdarya rivers. The primary source of quality drinking water in Uzbekistan and Central Asia is ground water, which accounts for between 85 an 90% of the general water budget. Agricultural irrigation systems have caused high pollutions levels in the region's (unevenly distributed) surface waters. Historically water flow the Aral Sea was 56 km^3 per year, which decreased to 47 km^3 between 1966 and 1970. Water flow plummeted to 2 km^3 between 1981 and 1983, and now stands at less than 1,8 km^3.

A key question is how to balance social and economic development with natural resource protection. Central Asian Republics utilize the same watersheds and share many water management issues in common. It is clear that the region's existing multination and regional water management and environmental protection project are insufficient by themselves to meet the scale of the problem. Further multinational agreements and joint-state/joint-agency programs will undoubtedly be required. Central Asian countries are suffering from regional climate change due to the destruction of the Aral Sea as well as global climate change, which will drastically alter the environment and have vast implications for future water resource availability. The two major rivers supplying water resources to Uzbekistan are being overused for irrigation purposes, which has led to the diminishment of the once large Aral Sea. Other factors affecting Uzbekistan's water resources are the desert-like climate for most of the country, low annual rainfall (7-12 inches), extremely hot summers, and the displacement of around seventy-percent of the population living in rural areas. Newer more modern strategies to conserve water and use water more efficiently as well as farm more sustainably must be enacted soon to adapt with the region's changing climate. These adaptation strategies include smarter irrigation practices, better usage of groundwater, and possible diversion of surface waters from Russian rivers and the Caspian Sea. Drip irrigation is feasible for Uzbekistan and is better suited for the region due to its diminishing water resources.

WATER RESOURCES MANAGEMENT

Uzbekistan is an arid country that relies on irrigated farming as a major source of its economy. With around 90% of water resources used in the republic originating from the mountains of nearby countries, water resource management is a crucial role in Uzbekistan's livelihood. The problem associated with such water intensive irrigation practices is the Aral Sea is shrinking, which leads to many more environmental, economic, and social problems. Uzbekistan as well as the other Central Asian countries all share the surface water of the Aral Sea basin as their means of water resources. The sources of water in the region come from river runoff (glaciers), ground water, and lakes.

The two rivers that fuel Central Asian countries water supply are the Amudarya and Syrdarya. The Amudarya's volume is 78.5 km^3/year and the Syrdarya's volume is 37.9 km^3/year. The annual volumes are then divided at an agreed upon ratio and each country in Central Asia can then use that amount; Uzbekistan receiving an average of 43-53 km^3 annually. These two rivers flow have been diverted from their natural pathway for the use of reservoirs and irrigation. Uzbekistan contributes a little less than 10 percent of total river runoff for the two large rivers, with the majority of the contribution coming from streams in the mountainous regions of the country, and little to none coming from the plains. Infiltration of water from rivers, canals, lakes, and irrigated areas into the ground as well as from precipitation contribute to the 95 deposits of groundwater in Uzbekistan .

Previously the fourth largest inland lake in the world, the Aral Sea has been subjected to years of inflow from the Amudarya and Syrdarya rivers being diverted and used for

irrigation. The original size of the Aral Sea prior to it drying up was an area of 66.1 km^2 and volume of 1064 km^3 . The loss of area and volume of the Aral Sea is caused by a decline of inflow and is causing increased salinity of the remaining water, sand and salt transfer to nearby areas, loss of fishing, loss of cargo transport, and a change in the local and regional microclimate that is effecting at least 35 million people. By 1994, the Aral's area was reduced to 31.7 thousand km^2 and salinity had risen to a level almost equal to world's oceans, 35 percent. Inflow into the Aral has changed from 1060-2090m^3 originally to between 50-500m^3 by the late 1980's.

To understand how dire water shortages is for Uzbekistan, it is important to understand the population distribution as well as the percentage of the population involved in agriculture. Around eighty percent of all population movements in the mid-nineties were from urban to more rural settings. Almost seventy percent of the population lives in rural areas of Uzbekistan and future population increases could be seeing even more people moving out of the cities. This large population group is supplying fifty percent of the work force in the agricultural sector, which supplies eighty percent of national demand for food. The other work force sectors are around twenty-five percent in industry and the remaining workers in service or other categories.

As it can be seen from the large portion of the population working the farms in Uzbekistan, agriculture is extremely important for national food demand, the economy, and for the workforce. Mostly all of the farming in this area cannot be accomplished without the assistance of irrigation, which is extremely water intensive in the hot, dry climate of Uzbekistan. Less than ten percent of the land used for farming is not irrigated; the irrigated portion going to grow mainly cotton, but also rice, potatoes, and other grains.

The current loss of the Aral Sea and the continued intensive use of water in Central Asia will eventually lead to water shortages throughout the region, but this problem coupled with climate change is extremely dangerous. Uzbekistan's need for a more sustainable usage of water resources is greatly increased with the largest natural threat, climate change. Not only is Central Asia already experiencing a changing microclimate, but also global climate change is going to intensify the changes. The current method of irrigation in Uzbekistan is called open or furrow irrigation and this is the traditional method used for hundreds of years. Water is diverted directly from a stream or water supply and is forced down the rows of crops through furrows by gravity. This method is cheap and does not require additional equipment. Furrow irrigation is basically free as long as you have a water supply, but drip irrigation requires piping throughout the entire plantation as well as a purification system to prevent saline contamination. With newer technologies being created everyday, small developing farmers may soon have the ability to create a piped irrigation infrastructure. Low cost trickle systems are much cheaper, reduce labor by one half, save water, doubled the amount of land that can be irrigated, and can be used in semi-hilly areas.

Groundwater usage in Uzbekistan is also a valid option for reclamation of water that infiltrated soils during open irrigation processes. Water tables near irrigated lands are increasing and this buildup of water is useable for town centers as well as rural areas. The problem with the usage of infiltrated groundwater is that it is contaminated with surface salts and it needs to be purified. Uzbekistan's current ground water pumping stations are from the previous decades and do not implore any electric extraction or purification (Ikramov, 2006). This is another infrastructure change that can be adapted along with trickle irrigation to be better sustainable at using the local water resources.

The most progressive, political, controversial, and difficult adaptations strategy to diminishing water resources and the loss of the Aral Sea is diverting waters from either Russian rivers and/or the Caspian Sea. This adaptation is unlike the others because it involves the cooperation of multiple countries as well as the decrease of water resources in another country to balance out the gains for the Aral Sea. The problem associated with sharing between countries of water resources is the fear that the country with the water will be adversely affected in the future. With the onset of global climate changes, countries are more reluctant to lose water resources to another country.

With the dissolution of the Soviet Union went the idea of supplying central Asia with water resources for agricultural processes with canals from the Ob and Volga rivers. A

canal could be constructed from the Volga River to the Aral Sea that would require no pumping stations due to the favorable elevation gradient (Ring, 2009). The logistics of this canal is that it would be 800 km long, 200 m wide, and 16 m deep at a cost of eight billion US dollars (Ring, 2009). Another canal from the Ob and Irtysh rivers would be of similar logistics, but would require pumping stations to reach the Aral Sea. These pumping stations would bring the cost up to 22 billion US dollars. Critics to these plans say that diversion from these rivers will affect other regions of the continent, which will cause even bigger problems. Also political issues arise between Russia and central Asian countries.

The Caspian Sea is another option for a diversion project. This project is still not even in planning stages, but is possible some time in the distant future. Water rights are still being established between the five countries surrounding the Caspian Sea and until they make compromises, Uzbekistan will not receive aid. Also if a project were being established, around seventeen pumping stations would be required to make up for the extreme gradient from the Caspian to the Aral Sea making this project more expensive and unlikely.

Water resources are going to be a limiting factor in the productivity and survival of Central Asian countries in the not too distant future. Global climate change compounded with regional climate change from the loss of the Aral Sea is instilling extreme environmental impacts on the region. In order for Uzbekistan and the other Central Asian countries to continue using water like they have been, adaptations must be made. Smarter irrigation practices and groundwater pumping are two feasible and intra-country solutions to heavy water usage. Also, the usage of water from the Ob- Irtysh Rivers in Russia via canal systems as well as diversions from the Caspian Sea are possible for the future.

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