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Problems of Drinking Water Supply for the Population of Kyrgyzstan and Solution Methods

YAOMING LI

Prof. Dr.
Research Centre for Ecology and Environment of Central Asia (Bishkek), Kyrgyzstan, Research Centre for Ecology and Environment of Central Asia, Chinese Academy of Sciences (Urumqi), China

ALAMANOV SALAMAT

Prof.
Research Centre for Ecology and Environment of Central Asia (Bishkek), Kyrgyzstan, Geology Institute of the National Academy of Sciences, Kyrgyzstan

SALAMAT ABDYZHAPAR

Dr.
Research Centre for Ecology and Environment of Central Asia (Bishkek), Kyrgyzstan, Geology Institute of the National Academy of Sciences, Kyrgyzstan

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kuycam@istinye.edu.tr

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briq@briqjournal.com
editor@briqjournal.com

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YAOMING LI

Prof. Dr.
Research Centre for Ecology and Environment of Central Asia (Bishkek), Kyrgyzstan, Research Centre for Ecology and Environment of Central Asia, Chinese Academy of Sciences (Urumqi), China

Yaoming Li is head of the Research Centre for Green Development of Silk Road at the Xinjiang Institute of Ecology and Geography in the Chinese Academy of Sciences. He also has a chair in the CAS Research Centre for Ecology and Environment of Central Asia (Bishkek). He has a PhD in Ecology from Russian State Hydrometeorological University. As an ecologist, he focuses on desert vegetation restoration in arid regions, ecological monitoring and water resource management. His research group has established eighteen standard field stations to observe ecosystems, meteorological and vorticity flux along the Altai Mountains, Tianshan Mountains, Pamirs, and the Iranian Plateau, covering all the types of ecosystems of arid areas in Central Asia. He also works on location, monitoring vegetation degradation and restoration of desert grassland in Central Asia. He has published more than twenty scientific articles and two books in the last five years.

E-mail: lym@ms.xjb.ac.cn
https://orcid.org/0000-0003-2948-4590

ALAMANOV SALAMAT

Prof.
Research Centre for Ecology and Environment of Central Asia (Bishkek), Kyrgyzstan, Geology Institute of the National Academy of Sciences, Kyrgyzstan

Alamanov Salamat is Professor Emeritus of the Institute of Ecology and Tourism KSU named I. Arabaev and professor of the Research Centre for Ecology and Environment of Central Asia (Bishkek). He was also Ambassador Extraordinary and Plenipotentiary of the Kyrgyz Republic. He has published over 120 scientific, educational, and methodical works on mountain hydrology, geography, and regulation of state borders. He works on the water resources problem of Kyrgyzstan.

E-mail: s.alamanov@mail.ru

SALAMAT ABDYZHAPAR UULU

Dr.
Research Centre for Ecology and Environment of Central Asia (Bishkek), Kyrgyzstan, Geology Institute of the National Academy of Sciences, Kyrgyzstan

Salamat Abdyzhapar uulu PhD, Physical Geography (CAS), is co-director of the Research Centre for Ecology and Environment of Central Asia (Bishkek), Geology Institute, National Academy of Sciences of Kyrgyzstan. His research is related to the impact of climate change on water resources and water quality. He has also published several SCI papers in international scientific journals.

E-mail: salamattalas18@gmail.com

ABSTRACT

Irrational water use, which is observed in all sectors of the water economy of Kyrgyzstan, leads to deterioration in the qualitative and quantitative characteristics of water resources in the country. Due to the ageing of existing centralized drinking water supply systems, rural residents use water from open sources, often directly from nearby rivers. A systematic examination of their qualitative composition has not been carried out yet. Poor drinking water quality increases the number of people with diseases related to low water quality. Studies of the quality of water resources in Kyrgyzstan and the installation of "Water Treatment Houses" supported by ANSO will help solve the issues of supplying the population with clean drinking water.

Keywords: Central Asia, Kyrgyzstan, water problem, water quality, water supply

Introduction

In recent decades, irrational water use in agriculture, hydropower, industry, and household consumption has led to a qualitative depletion of water resources (UNDP, 2006). The need to study the spatial and temporal features of the dynamics of the quality and quantity of water resources is gaining urgency.

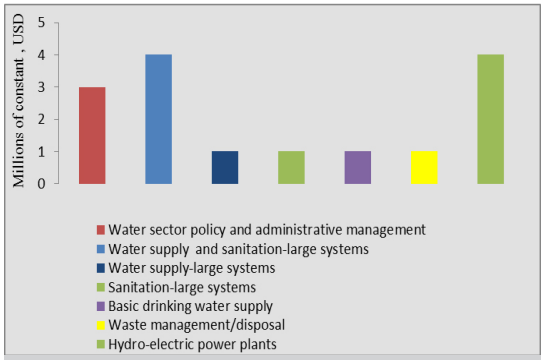
Water used for irrigation of agricultural fields and returning to riverbeds and other water bodies increases water mineralization (Rotiroti et al., 2019). The poor condition of canals, non-compliance with irrigation technology, and failing irrigation infrastructure of the country have led to a decrease in land quality and increased waterlogging, flooding, and salinization (O'Hara, 2000; Environmental Agency, 2015-2017). Although disbursements (2019) for development expenditures related to water supply and sanitation (USD million) in Kyrgyzstan are higher than the rest of the subsectors (Figure 1), cases of disease infections due to unclean drinking water continue (UN Water, 2020).

The main sources of water pollution are agricultural sectors, mining enterprises, landfill sites, and settlements located near rivers (Picture 1, 2). According to the National Report on the State of the Environment in the Kyrgyz Republic (2011-2014), due to limited access to drinking water and its poor quality, the incidence of intestinal infections, typhoid fever, and malaria has increased in the population.

According to the report of the Department of Drinking Water Supply and Sewerage (DDWSS, 2015-2018) and the State Agency for Architecture, Construction, and Housing and Communal Services, of the 3.2 million people in rural areas, 38.32% have access to a street pump, 21.58% have access to a water pump in their yard or the house, 25.51% drink water from ditches, rivers, and canals, and 6.93% from springs. The services of water carriers are 2.32% of the population. Individual private wells were drilled by 2.23%, and access to wells is established in 1.12% of the population. 0.91% of the population has to get water from a pump in the yard of their neigh-

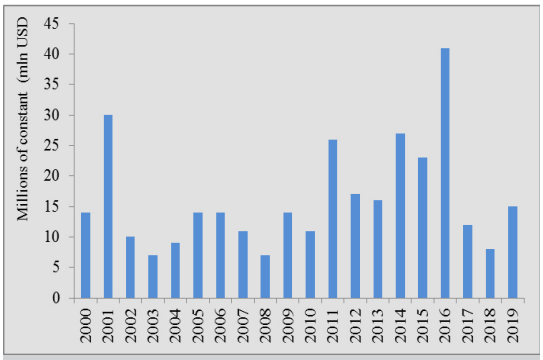
Figure 1. Amount of financial assistance received by Kyrgyzstan to develop water supply and sanitation (USD million), 2019.

(a) by subsectors



Source from UN website.

(a) by subsectors



Source from UN website.

bours. 0.02% of the population of Kyrgyzstan uses water from swamps.

The conditions of centralized wastewater disposal facilities remain problematic. In 267 villages, water pipelines were built before 1960, in 458 villages before 1980, and in 396 villages, there are no water pipelines. After the liquidation of collective and state farms, rural water supply networks were not repaired for more than 10 years, which led to an intensive deterioration of their technical condition and a complete shutdown of the functioning of water supply systems in most villages of the Republic. In remote cities and district centres, access to sewerage systems is reduced by 1.5-2% annually due to the degradation of existing infrastructure (DDWSS, 2015-2018).

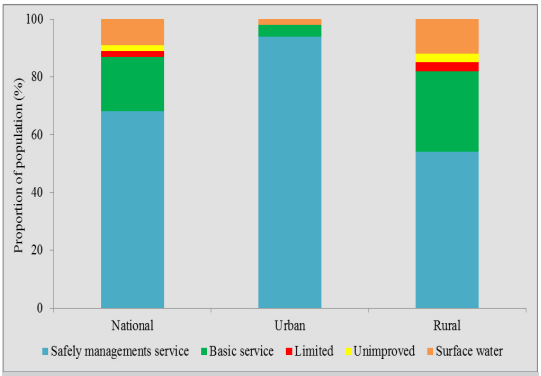
The proportion of the population using an improved drinking water source was 89% in 2017. The proportion of safely treated domestic wastewater flows in Kyrgyzstan was 18.9% in 2020. The proportion of the population using safely managed drinking water services for all areas (both urban and rural) was 68.2% and 93.5% for urban areas in 2017 (Figure 2) (UN Water, 2020). In rural areas, only 3% of residential and public buildings are connected to sewerage systems. These are schools and medical centres (DDWSS, 2015-2018).

The centralized water supply system in the Republic serves 84% of the population. More than 600 thousand people of the rural population, living in 514 villages (29.1% of the total number of villages), use water from unprotected open sources (Picture 3). Consequently, there is an increase in the incidence of enteral (A, E) hepatitis, which is mainly associated with the use of poor-quality drinking water.

Also, the availability of drinking water in residential areas located around the cities of Bishkek and Osh, where the percentage of water supply is 67.3% and 12%, is of particular concern. The incidence of hepatitis is especially high in Batken (4161 people per 100 thousand population, 2011) and Jalal-Abad oblasts (5400 people per 100 thousand population), where the incidence rate is almost 2 times higher than the national level. There is an increase in pollution of water bodies used by the population for drinking water supply

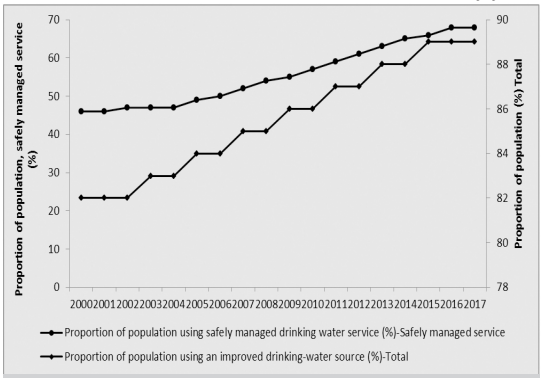
Figure 2. Proportion of population using drinking water services in Kyrgyzstan (2017).

(a) by service level and location



Source from UN website.

(b) by years



Source from UN website.

(DDWSS, 2015-2018; Report of the Ombudsman of KR 2015; National Statistical Committee, 2020). Thereby, to ensure rational water use within the river basin, it is important to perform an adequate assessment of the ecological state of water resources by assessing and predicting the quality of water used for drinking, households, irrigation, fishery, and recreational purposes.

Since the 1990s, the volume of work on monitoring the chemical composition of natural surface waters has sharply decreased, information has become practically inaccessible to scientific institutions, meaning that scientific research on assessing their quality has significantly decreased. The Agency for Hydrometeorology of the Ministry of Emergency Situations of the Kyrgyz Republic, which has become a private institution, monitors water quality only on the Chu River, determining 8 indicators: pH, the proportion of suspended substrates, the total hardness index, oxygen content, biological oxygen consumption, nitrogen, ammonium nitrogen, and nitrate nitrogen. These kinds of observations have not yet been carried out on other rivers of the country (Agency for Hydrometeorology, 2018).

The current trends of climate change, water scarcity, population growth, demographic changes, and urbanization can, and eventually will, create difficulties in providing clean water in the country (CAREC, 2012). According to forecasts of international institutions, by 2025, almost half of the world's population will be forced to live in areas with a shortage of clean water (UN Economic Commission for Europe, 2011).

According to the DDWSS, the most critical condition for supply clean water is noted in the Jalal-Abad region, where 148 villages currently lack drinking water. At the same time, there are 390 villages throughout Kyrgyzstan where there is no clean drinking water (DDWSS, 2015-2018).

The policy of the Government of the Kyrgyz Republic aims at providing clean drinking water to the population, primarily in acutely affected villages, until 2024. In Kyrgyzstan, only 65% of the rural population has access to

Picture 1. Draining the sump water in the Ak-Buura river, in the vicinity of Osh city. August 2017.

clean drinking water. In 653 villages, there is no water supply system at all, or it is outdated there since they were built in the last century (Strategy for the development of drinking water supply 2016; DDWSS 2015-2018).

To provide water supply requires 1394 water sources, of which 159 (11%) are surface sources. In the Republic, there are 1133 water pipelines. Of those, 348 (30.7%) do not meet the sanitary and hygienic standards, 153 (45%) do not comply with the sanitary protection zone, 188 (53%) of them do not function or lack disinfection installations, and 28 (8%) of them do not have the necessary complex of treatment facilities. Only 21% of the population of Kyrgyzstan is provided with a central sewerage system. In some cities, existing drainage systems require major repairs or renovation (Strategy for the development of drinking water supply, 2016).

The technical condition of water distribution networks remains unsatisfactory from year to year. This situation is the cause of both microbial and chemical pollution of tap water (Department of Disease Prevention and State Sanitary, 2017; ARIS, n.d.).

In rural areas, about 40% of the population is not provided with clean drinking water at the proper level. The state of the centralized wastewater disposal facilities remains especially problematic. Due to the degradation of the existing infrastructure in remote cities and regional centres, access to sewerage systems is reduced by 1.5-2% annually (Törnqvist et al.,

Picture 2. Stored coal on a terrace in the middle reaches of the Zhazy river, August 2017

2011; Bekturganov et al., 2016). In most villages, water supply networks were built during the Soviet period, but now they are almost completely unusable, which is why the quality of drinking water does not meet the required standards. This situation worsens every year.

Recently, the number of people employed in the water supply and wastewater treatment sector has dropped dramatically. This is due to the lack of interest on the part of new graduates to work in this sector of the economy, a lack of funds to recruit and retain qualified personnel, especially in the public sector, and the ageing labour force. Also, the water supply sector faces difficulties in attracting qualified personnel willing to live and work in rural areas, as well as the low prestige of working in the sewer sector in general (Reports of the Ombudsman KR, 2018).

Methods for Solution

Based on the above circumstances, the study of spatial and temporal patterns of water resource quality and the development based on its results using scientifically based recommendations for optimizing management and rational development, primarily for drinking water supply, is of central importance to the Kyrgyz Republic. Actual data on the chemical composition of water in specific natural water bodies obtained during implementation of the research project, "the study of the geographical features of the distribution of the quality of water resources of the Kyrgyz Republic to provide the population with drinking water" (running in 2016 with support of Chinese Academy of Sciences, the Research Centre for Ecology and Environment of Central Asia, and the Institute of Geology of the National Academy of Sciences of the Kyrgyz Republic), will provide an

opportunity to develop recommendations on measures to provide drinking water to the local communities of Kyrgyzstan (Alamanov, 2014).

International cooperation plays a major role in solving the problem of water supply and building capacity for further development. This project, led by the Xinjiang Institute of Ecology and Geography, CAS, and supported by ANSO, is helping to create a distributed technology system for safe drinking water and propose related industry standards and regulations. Applying such advanced technologies and products in related fields in Central Asian countries along the Silk Road Economic Belt benefits local communities and can improve people's quality of life. Such assistance is in line with implementing the United Nations Sustainable Development Goal (ANSO, 2020).

Installing a Water Purification House (WPH) As A Solution to the Problem

As a pilot project, a WPH (Water Purification House) was put into action as a system for clearing the water for drinking purposes in the village of Dostuk, Alamedin District, Chui Oblast, in the Kyrgyz Republic in August 2018.

Installation of water purification equipment cleans any contaminated and even brackish water. This device is ready to use, easy to install, and easy to operate. The combined filtration and adsorption system effectively removes all types of bacteria, sediment, heavy metal ions, and other harmful substances from the water and can also remove chloroform and fluorine that cannot be removed with conventional methods.

Such WPHs are advantageous to build in

Picture3. Open source of drinking water for residents of the village of Ana-Kyzyl (lower reaches of the river Zhazy river, Osh oblast), August 2018

hard-to-reach populated areas, such as those scattered or at differing elevations where it is not profitable to conduct a centralized water supply system. The installation of a water treatment system is well suited for a number of small villages in particular need. The system carries out the process of pumping, purifying, and supplying clean drinking water as a single process and can provide water to residents of a small settlement of up to 2700 people. In principle, the equipment can be connected both to a centralized water supply system and open and underground water sources.

This system is designed at the Chongqing Institute of Intelligent and Green Technologies and Xinjiang Institute of Ecology and Geography of the Chinese Academy of Sciences. Such systems are well suited for small settlements where the geographical location does not allow the building of a centralized drinking water system. The number of settlements proposed for installing equipment for the purification of drinking water is 212 villages.

Conclusions

The quality of drinking water has a direct impact on the quality of life for the population (Ma, Li, Abuduwaili et al., 2020a). The health status of people and the availability of clean agricultural products depends on the water consumed (Ma, Li, Abuduwaili et al., 2019). The deterioration of water quality and the poor state of the drinking water supply system in rural areas of the Kyrgyz Republic leads to an increase in the incidence of diseases of the population (Ma, Li, Abuduwaili et al., 2020b).

As a result of the implementation of the planned project, the sanitary and hygienic conditions of the rural water supply sector will improve, and the level of morbidity associated with the use of water that does not meet drinking water quality standards will decrease. The installation of water treatment equipment purifies any contaminated and even brackish water. Such installations are advantageous to install in hard-to-reach populated areas, such as those scattered or at differing elevations where it is not profitable to conduct a centralized water supply system. The installation of a water treatment system is well suited for many small villages in particular need. As a result, more than 250,000 people can get access to clean and safe drinking water. A radical solution to the problems of irrigation shortage and sufficient drinking water volume, which is due to the low quality and deterioration of the water supply network intended to deliver water to settlements, is extremely important and requires large capital investment.

A detailed study of the situation in the catchments of the rivers of Kyrgyzstan and expeditionary surveys of other catchments have shown that the process concerning an increasing number of river valleys is the deterioration of environmental conditions in their riverine part in response to the growing uncontrollable anthropogenic load from year to year.

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