There are 9 species of different plant species growing in the interband space. With an increase in the age of forest plantations in the interband space, an increase in the average plant height and the number of indicators of natural plant renewal is observed. In the interstitial spaces of forest crops of the black saxaul, a microclimate is created that improves the natural renewal of herbaceous plants, their growth and number are directly dependent on the distance from the forest belts: in the 5th zone, on average, up to 55-68 pieces (various types of herbs) were detected, followed by a decrease in their number by 15 m or more.

Four of the most common plant species were identified at the trial sites – black saxaul (Haloxylon aphyllum), leafy potash (Kalidium foliatum), salsola tragus (Salsola tragus) and Climacoptera (Climacoptera).

4 most common plant species were identified at the trial sites – black saxaul (Haloxylon aphyllum), leafy potash (Kalidium foliatum), weed pickle (Salsola tragus) and climacoptera (Climacoptera).

Comparison of quantitative indicators of plants in different space between strips indicates that they are significantly larger at 35 m, and at 60 m space between strips they decrease by 30-40%

Key words: black saxaul, interstitial space, microclimate, environment, survival, herbaceous vegetation, soil formation.

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FUNDAMENTALS OF WATER RESOURCES MANAGEMENT OF BALKASH-ALAKOL WATER BASIN

Abstract

The principles of water management were developed based on the analysis of the water management situation in Balkash – Alakol water district.

The analysis of modern degradation of ecological systems shows that this process is a direct result of timely forecast assessments and foresight of possible consequences of decisions taken at the stage of developing schemes for integrated use and protection of water resources for separate river basins of Kazakhstan.

In water-scarce river basins, the further development of water management and, accordingly, the development of economic sectors require matching the available water resources and demand for them. Thus, ideally, it is necessary to coordinate the possibility of taking water from the environment of a certain amount of natural, including water resources, with the self-recovering ability of the environment.

Due to anthropogenic activity and a sharp increase in water consumption in the upper reaches of Ile River, tense water management and ecological situation has already developed in the Balkash-Alakolskiy water basin, in which the unique Balkash lake can share the same fate as Aral Sea. The planned medium and long-term measures for development of irrigated agriculture in the territories of Zhetysu and Almaty regions result in additional excessive burden on natural environment in the region. Possible comprehensive measures are proposed to solve the strategic task of water (socio-ecological and economically optimal) management in Balkash-Alakol water basin, taking into account the preservation of Balkash Lake.

Key words: *water resources, water consumption, water management situation, integrated measures, efficient use, runoff, environmental flows.*

Introduction

The river flow of Balkash-Alakol water basin in the average dryness of year is 28.85 km^3, including 11.5 km^3 coming from the territory of the People's Republic of China. The Ile River is the main waterway of Balkash–Alakol depression, where about 80% of its flow is formed. The main flow-forming part of the basin of Ile river falls on the People's Republic of China, where the catchment area has a sufficiently developed hydrographic system. In the middle and lower part of the basin, large spaces are left without surface runoff.

Regulation of runoff and water intake in the river basin has aggravated the water management and environmental situation in the region: decrease in area of hayfields and tugai forests, biological diversity, sharp decrease in pasture productivity, animal husbandry is turning into a loss-making industry.

Sustainable socio-economic development of Kazakhstan is hindered by many existing problems in the water sector. One of the main factors is upset nature's balance between the available water resources and demands for them. Water is a key natural component in survival of mankind and preserving the integrity of ecosystems in the biosphere, while being one of the limiting factors in the development of society.

The President, K.J.Tokayev, speaking about strategic value of industrial crops, including sugar beet, instructed to increase the share of domestic sugar from 7% to 43% by 2026 [1,2]. Therefore it is planned to increase the area of irrigated land by 18 thousand hectares for sugar beet crops in the Aksu, Alakol and Sarkand areas of Zhetysu region.

On the other hand, the President instructed to take measures to preserve the unique Balkash Lake and provide the population of this region with high-quality drinking water [3].

Considering the above, as well as the basic principle of sustainable development of economic sectors in the river basin, i.e. establishing an optimal level of water resources use and creation of climate friendly condition in the environment [4,5,320p,6, 20p.], it should be noted that the problems of water management in the river basin and the preservation of ecological equilibrium in the environment are relevant.

Methods and materials

To establish the water availability of the region, methods of collecting initial water flow records at various steam gauges were used and statistically processed using moment method, maximum likelihood method, etc.

More than 400 steam gauges have been opened in Ile river basin on the territory of Kazakhstan at various times. Currently, there are 28 steam gauges in the basin. The duration of observations of the annual runoff ranges from several years to 98 years (Ile river). The bulk of the rivers of the Ile – Balkash region flow from the southeast to the northwest. More than 90% of rivers gravitate to the Balkash lake basin, the rest – to the basin of Balkash-Alakol group of lakes. The largest transboundary river flowing into the lake is the Ile river, with basin area of 140 thousand km^2, within Kazakhstan - 77.4 thousand km^2. The total length of the river is 1,439 km, on the territory of Kazakhstan – 815 km [7, 646 p.]. The monitoring network along the stem stream of the Ile river is available in the following river stations: Dubun s. - with a catchment area of 64 388 km^2 (formerly Kaiyergan area, with a catchment area of 60 800 km^2), 171 km (recent data -164 km) above the Kapchagai HPP, with a catchment area F=85400 km^2, 37 km below the camp Ile (Kapchagai area) with a catchment area of 111 000 km^2, Uchzharma s., with a catchment area of 129000 km^2.

Data of these steam gauges are available for various periods: Dubun s. has been operating since 2000 (as to Kaiyergan area, there were data up to 1960 for only 12 years), 171 km above Kapchagai HPP has been operating since 1956, 37 km below camp Ile (Kapchagai area) has been operating since 1910, the Uchzharma s. has been operating since 1937.

Results and discussion

Among the all countries of the Central Asian region, Kazakhstan is the abutment line for the majority of transboundary rivers (Syrdarya, Shu, Talas, Zhaiyk, Ile, Emel). Such situation with water management leaves its traces on the river ecosystem. Analysis of available water resources and volumes of water consumption by sectors of the economy in Kazakhstan showed that water intake increased with increase in development of society. Thus, until the 1990s, the volume of water intake increased intensively, and in subsequent periods, decreased (Figure 1). At the same time, irrigation remains the largest water consumer.

The Ile – Balkash water basin is one of the most humidified areas of the Republic of Kazakhstan. The developed river network, the average density of the river network in the mountainous part - 0.60 – 3.0 km/km ^{2}, in the plain - 0.30-0.50 km/km^2.

Mountain-type rivers, which have significant catchment basins and are the largest and most full-flowing, play the greatest role in formation of water resources in the region. Their sources lie at altitudes above 3000 m.

The main waterway of Balkhash Lake basin is Ile river; the most significant rivers include Karatal, Aksu, Lepsy, Ayaguz, Bakanas, etc.

Of the rivers flowing into the eastern part of the Balkhash lake, Karatal river is the largest river. It is the second largest river in the territory under consideration after Ile River.

The projected groundwater resources of the Balkhash-Alakol hydrographic basin are 17.4 km^3/year, including 7.7 km^3/year not related to surface runoff.

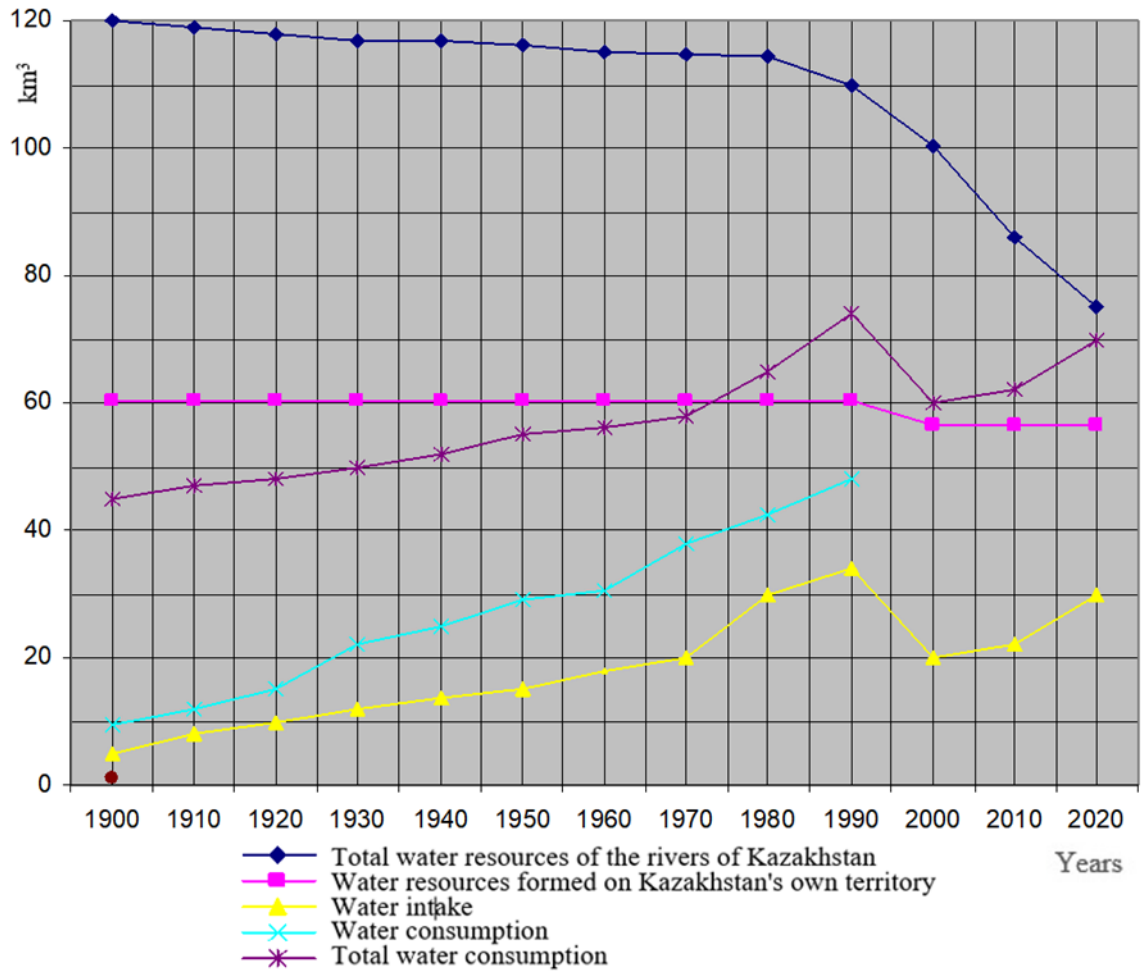

Figure 1 - Total water resources (curve 1), own water resources of the Republic of Kazakhstan (curve 2), water intakes from water sources (curve 3), water consumption of economic sectors (curve 4) and total water consumption taking into account the necessary environmental, fisheries and sanitary flashes (curve 5).

The water resources of Ile river in the average water content year - 17.7 km^3, and near the border with the PRC are 12624 million m^3, including 11390 million m^3 on the territory of the PRC. The losses for evaporation and filtration are equal to 1 km ^{3}, environmental flows along the Ile River is 11.8 km ^{3} of water per year. Then, the available flow in the river basin is only 4.9 km^3. Losses for evaporation and filtration and environmental flows for the basins of other rivers of Balkash lake, are equal to 0.1 and 2.8 km^3 of water per year respectively.

The analysis shows that if the average long-term runoff of the river in the station of Uchzharma s. before 1960 was 479 m^3/s, then in the period up to 1990 it was equal to 363 m^3/s. The greatest impact of anthropogenic activity was observed in 1971-1980 and 1981-1990, when the average long-term runoff in the station of Uchzharma s. was 344 and 363 m^3/s, respectively, which is 100 m^3/s less than the average long-term runoff for 1961-1970 [8, 579 p]. At the same time, the water resources of the Ile river entering the territory of the Republic of Kazakhstan from China decreased due to water intake for development of economic sectors, both in the PRC and in the territory of the Almaty region. Fig.1

As the graphs show, in the Kazakh part of the Ile – Balkhash basin, before 1990, water consumption increased from 1.8 to 6 km^3, by 2000 it decreased to 2251 million m^3, and by 2005 water consumption increased to 3 km^3 per year.

Water consumption in the territory of the People's Republic of China has also tended to increase and a further increase to 5 km^3 is expected in the near future. In this case, the inflow of water to the territory of Kazakhstan will be 13.2 compared to 14.7 km^3 in 2010, Table 1.

If we take into account the necessary inflow to Balkash Lake in the years of average water content - 9 km^3, and water losses in reservoirs - 2.3 km^3, the delta of the Ile river - 0.35 km^3 of water (the minimum value), then the allocated volume for water consumers will not exceed 2.5 km^3. Currently, irrigated agriculture in this region has no more than 2.5 km^3 of water in an average water content year. With an increase in water intake in China from 3.5 km^3 to 5.0 km^3, no more than 0.5 km3 of water per year will remain for irrigation.

Table 1. Possible taking of water for irrigation in the Ile river basin during the years of different water content and development of economic sectors for different periods, km ^{3} [8, 579 p].

No.	Components of the water balance	Water content of the year			
		P=25%	P=50%	P=75%	P=95%
1	**Calculation of the incoming part to the territory of the Republic of Kazakhstan**				
1.1	Water resources	20,29*	18.17	15.42	12.45
1.2	Taking of water on the territory of China	3.50	3.50	3.50	3.50
1.3	Inflow on the territory of the Republic of Kazakhstan	16.79	14.67	11.92	8.95
2	**Consumable part in the territory of the Republic of Kazakhstan**				
2.1	Water consumption for priority needs (PWS, IWS and AWS)	0.54	0.54	0.54	0.54
2.2	Water losses from reservoirs	2.30*	2.30	2.10	2.00
2.3	Water losses in the delta	0.35	0.35	0.35	0.35
2.4	Environmental flows to Lake Balkash	11.00	9.00	8.50	8.00

2.5	Total water consumption	14.19	12.19	11.49	10.89
2.6	Possible volumes of water allocated for the irrigation industry	2.60	2.48	0.44	0.00
3	**Calculation of the incoming flow on the territory of the Republic of Kazakhstan**				
3.1	Water resources	20,29*	18.17	15.42	12.45
3.2	Taking of water on the territory of China	5.00	5.00	5.00	5.00
3.3	Inflow on the territory of the Republic of Kazakhstan	15.29	13.17	10.42	7.45
4	**Consumable part in the territory of the Republic of Kazakhstan**				
4.1	Water consumption for priority needs (PWS, IWS and AWS)	1.10	1.10	1.10	1.10
4.2	Water losses from reservoirs	2.30*	2.30	2.10	2.00
4.3	Water losses in the delta	0.35	0.35	0.35	0.35
4.4	Environmental flows to Balkash Lake	11.00	9.00	8.50	8.00
4.5	Total water consumption	14.75	12.75	2.05	11.35
4.6	Possible volumes of water allocated for the irrigation industry	0.54	0.42	0.00	0.00

The water resources of the rivers and temporary streams of Balkash-Alakol water area are 27759 million m^3/year, including in the years of 50%, 75% and 95% availability - 26808, 22785, 17847 million m^3, respectively, Fig.2.

The reduction of water inflow into the lake is caused by the construction of the Kapchagai HPP, uncontrolled use of water resources of Karatal, Lepsy rivers etc. [10, 132 p.]. For example, the Ayaguz River carried its waters to the lake until the mid-1950s. The ill-considered policy of acclimatization of alien fish species in the 1950s and uncontrolled fishing led to a decline in the development of fish farms. Waterfowl farms are practically shutting down their activities. The hunting and fishing industry has become unprofitable with decrease in the volumes of wild fowl and fish, harvested plant raw materials.

The plant community is being modified. Meadow vegetation is partially transformed into steppe vegetation, and steppe vegetation, in turn, into desert vegetation. Perennial grasses are replaced by annuals. Weeds unsuitable for grazing appear. Due to a significant reduction in the area of hayfields, tugai forests, biological diversity has decreased. Excess use of soil feeding capacity resulted in decrease in number of sheep and goats by more than three times, and meat consumption per capita fell from 77 to 45 kg/year [11, 138 p.]. The pace of the onset of the sands is increasing, animal husbandry is turning into a loss-making industry.

From the hydrological regime of the rivers flowing into the lake. Balkash, and the water balance of the latter largely depends on the biodiversity and conditions of reproduction of valuable fish species [11,139p.]. The main element of the incoming part of the lake's water balance is the inflow of surface waters. The difficulty of determining it is that constant measurements of river flow during most years are made at posts located at a considerable distance from Lake Balkash. Water management balance of the lake. The Balkash for the period 1992-2005 is presented in Appendix B2. The analysis shows that the largest component of the incoming part of the HCB is surface runoff,

River runoff, total water consumption of economic sectors, water losses from reservoirs and the needs of natural complexes (including lakes. Balkash) in the absence and presence of anthropogenic impacts on water resources in the BA HCB for retrospective and prospective periods without taking into account global climate change shown in the figure 2.

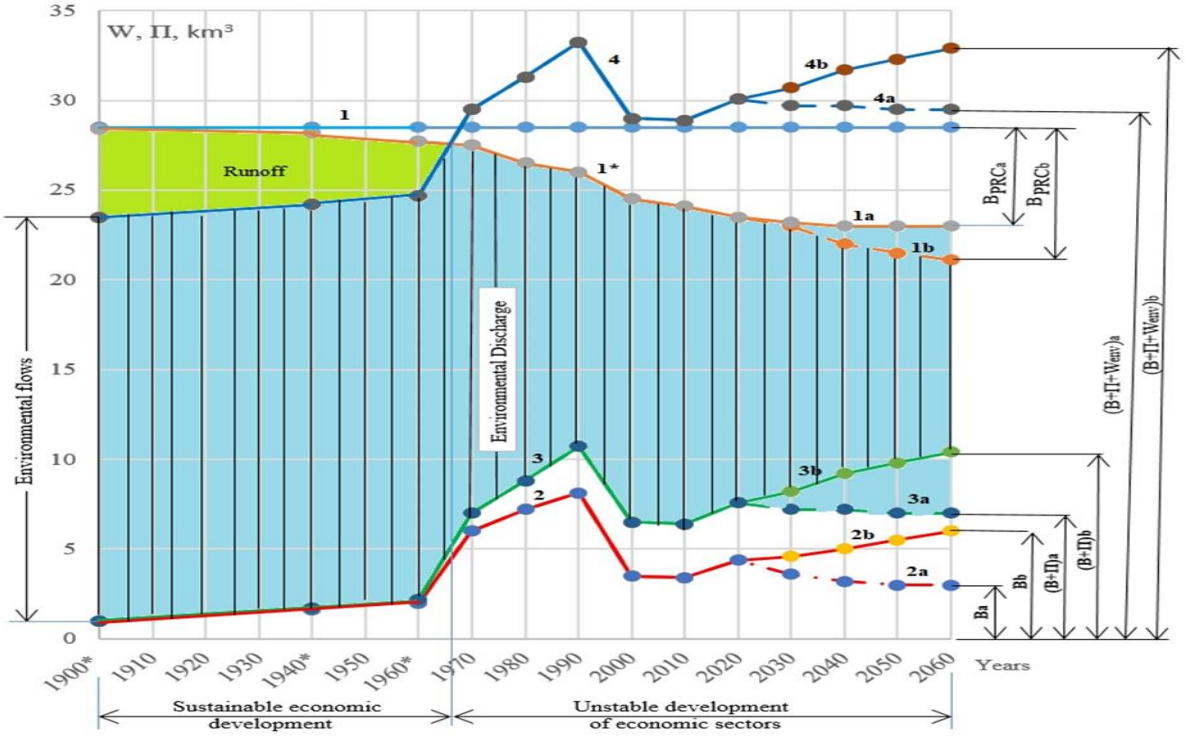

Figure 2. River runoff, total water consumption of economic sectors, water losses from reservoirs and the needs of natural complexes (including lake Balkash) in the absence and presence of anthropogenic impacts on water resources in the Balkash – Alakolskiy WMB for retrospective and prospective periods (all in the average annual calculation and without taking into account global climate changes)

№	Name	Designation	Retrospective period	Perspective period	
				Optimistic script	Pessimistic scenario
1	Average annual river flow BA WMB				
	For the natural period		Curve 1		
	River runoff as a result of anthropogenic impact on the territory of the People's Republic of China (Inflow to the territory of the Republic of Kazakhstan)		Curve 1*	Curve 1а	Curve 1б
2	Total water consumption of economic sectors in the Republic of Kazakhstan	В	Curve 2	Curve 2а	Curve 2б
3	Total water consumption of economic sectors, taking into account water losses from reservoirs in the territory of the Republic of Kazakhstan	В+П	Curve 3	Curve 3а	Curve 3б
4	The total water consumption of economic sectors, taking into account water losses from reservoirs and the needs of natural complexes and an internal reservoir	$В+П+W_{пр.охр}$	Curve 4	Curve 4а	Curve 4б

The water supply of the Kazakh part of the BA of the HCB decreases with the development of economic sectors both in the territory of the neighboring state of the People's Republic of China and in the territory of Kazakhstan. If in the 60s of the last century the average annual runoff of theIf the

silt was 27.5 km^3 (the total flow of the basin is 28.5 km^3), then at present it is estimated at only 23 km^3, then under the pessimistic scenario of development by 2040, the reduction is expected by another 1.0 km^3, and by 2060 it will be 20.5 km^3 Under the optimistic scenario up to 23 km^3 by 2040 and 2060 at. As a result, the inflow of water into the lake. Balkash will gradually decrease. So, if before 1955 the inflow of water into Lake Balkash was 23.5 km^3 or more, and this was characterized as a sustainable development of economic sectors, then in subsequent years (1990) the flow of water into the lake gradually decreased to 15.5 km^3. By 2010, the inflow increased to 17.5 km^3.

Under the pessimistic scenario, by 2040-2060, the volume of incoming water into the lake will decrease and amount to 12.5 km^3 and 11.0 km^3, respectively, and under the optimistic development scenario, an inflow of 15 km^3 is expected by 2040 and 16.5 km^3 by 2060. After 1955, a period of unstable development of economic sectors began in the BA VKHB, which led to a decrease in the water level in the lake. Balkash and to further complicate the water management and environmental situation in the region. According to the forecast, if the current situation regarding the use of water resources in the Balkhash – Alakol water management basin persists, the water level in the lake will also gradually decrease. At the same time, the mark of the level of Balkash will reach 338.5 m, which does not meet the requirement of the Decree of the Government of the Republic of Kazakhstan on the preservation of Lake Balkhash at 341.0 m.

In order to maintain this level, it is necessary that the total water consumption of economic sectors in the BA HCB does not exceed 6.0 km^3/year, taking into account water losses for evaporation,. If we take into account that changing climatic factors will lead to a reduction in the volume of water in rivers of Kazakhstan, then in the near future, the "Balkhash crisis" may come after the Aral Sea [8, 579 p].

The available water resources of the Balkash-Alakol water district are shown in Table 2.

Table 2. Available surface water resources of Balkash-Alakol water district, km ^{3} [9, 596 p.].

Average long-term runoff, total	Including							Runoff in low-water years (P=95%)			
	Mandatory consumption of runoff				Unregulated flood runoff	Total consumption	Available flow	Natural	Of these, available	Increase due to - regulation	Available taking into account - regulation
	Losses on evaporation and - filtration	Flows		Total							
		Environmental and health	Transport and health								
27.76	1.13	14.6	0	15.73	1.8	17.53	10.23	17.85	5.4	3.15	8.55

As a result of uncontrolled use of water in the upper reaches of the
Ile River, an unfavorable ecological situation may develop in the basin of Balkash Lake in the very near future, and the lake may share the same fate as Aral Sea [12]. To prevent such a situation, it is necessary:

- not to reduce the value of the ecologically permissible 11 km^3 per year inflow of water into the lake along the Ile River, which will keep the water level in the lake to the maximum permissible 341 m BS;

- the main sources of water supply under consideration have the status of transboundary rivers, which further aggravates the water management situation in the region. Therefore, planning for use and protection of water resources should be based on international cooperation and international water jurisdiction. In this regard, it is necessary to take real steps to conclude an agreement with the PRC for joint use of surface water resources of Ile river basin in accordance with international water law and adopted conventions. According to the latest data, there are already more than 13 reservoirs and 40 hydroelectric power plants in the Ile river basin on the territory of China [12, 23-34p].

Conclusions

Almaty and Zhetysu regions have high potential not only for the development of irrigated agriculture. The natural, climatic and terrain conditions of the area are very favorable for the development of tourism and sports. It is possible to develop pond fisheries on the basis of mountain streams of Ile and Dzungarian Alatau, they are also ideal sources for the construction of small and micro hydroelectric power plants.

It is necessary to take into account the peculiarities of Balkash Lake, which has fresh water in the western part, salty water in the eastern part. [13, p.565]. This uniqueness of the lake can be used for recreational purposes. The water area of Balkash Lake allows organizing water sports events of any rank. Conditions will be created for organization of training bases for all types of water sports. Solar and wind energy can be used to power recreational facilities and fish farms. [14, p.639–655]

2. A very unfavorable water management and environmental situation has already developed in Balkash-Alakol water basin. Maintaining the current trends in the development of economic sectors nullifies conditions for their sustainable development. Branches of the economy will develop only due to infringement of the interests of natural complexes, including due to an internal reservoir – Balkash lake. The planned medium and long–term measures for development of irrigated agriculture in the territories of Zhetysu and Almaty regions result in additional burden on the environment in the region, which can lead to catastrophic consequences - Balkash can share the same fate as Aral Sea.

3. Possible comprehensive measures are proposed to solve the strategic task of water (socio-ecological and economically optimal) management in Balkash-Alakolskiy water basin, taking into account the preservation of Balkash Lake.

When determining the technical and economic indicators of water management of the river basin, it is necessary to take into account not only the direct positive effect, but also the accompanying negative consequences (damage). The criterion for choosing the optimal water management of the river basin is to achieve the maximum effect from the development of economic sectors. As an alternative, it is proposed to consider the possibility of reducing the lake level by 0.5 m. At the same time, it is necessary to analyze various options for maintaining the water level in the lake and development of economic sectors in the basin when coordinating the water allocation issues with the PRC and choose the most profitable option for using water and land resources [15, p.248–256].

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БАЛҚАШ-АЛАКӨЛ СУ ШАРУАШЫЛЫҒЫ БАССЕЙНІНІҢ СУ РЕСУРСТАРЫН ҰТЫМДЫ ПАЙДАЛАНУ НЕГІЗДЕРІ

Аңдатпа

Балқаш-Алакөл су шаруашылығы ауданындағы су шаруашылығы жағдайын талдау негізінде су ресурстарын ұтымды пайдалану қағидаттары әзірленді. Экологиялық жүйелердің қазіргі заманғы деградациясын талдау бұл үдеріс Қазақстанның жекелеген өзен бассейндері үшін су ресурстарын кешенді пайдалану және қорғау схемаларын әзірлеу сатысында қабылданатын шешімдердің ықтимал салдарын уақтылы болжау мен болжаудың тікелей нәтижесі болып табылатынын көрсетеді. Су тапшылығы бар өзендер бассейндерінде су шаруашылығын одан әрі дамыту және тиісінше экономика салаларын дамыту қолма-қол Су ресурстарының мүмкіндіктерін оларға қажеттіліктермен келісуді талап етеді. Осылайша, ең дұрысы, қоршаған ортадан белгілі бір мөлшердегі суды алу мүмкіндігі туралы келісу қажет.

Антропогендік іс-әрекеттің және Іле өзенінің жоғарғы ағысындағы, Балқаш-Алакөл су шаруашылығы бассейніндегі суды пайдалану деңгейінің күрт өсуі нәтижесінде қазіргі уақытта қалыптасқан су шаруашылығы және экологиялық жағдай табиғаты ерекше Балқаш көлі Арал теңізінің тағдырын қайталауына әбден мүмкүн. Жетісу және Алматы облыстарының аумақтарында суармалы егіншілікті дамыту жөніндегі орта және ұзақ мерзімді кезеңдерге жоспарланған іс-шаралар өңірдегі табиғи ортаның жай-күйіне қосымша шамадан тыс жүктемелер салады. Балқаш көлінің сақталуын ескере отырып, Балқаш-Алакөл су шаруашылығы бассейнінде су ресурстарын ұтымды (әлеуметтік-экологиялық және экономикалық оңтайлы) пайдалану жөніндегі стратегиялық міндетті шешу бойынша ықтимал кешенді шаралар ұсынылды.

Кілт сөздер: Су ресурстары, су тұтыну, су шаруашылығы жағдайы, кешенді шаралар, ұтымды пайдалану, ағынды сулар, экологиялық ағындар.

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ОСНОВЫ РАЦИОНАЛЬНОГО ИСПОЛЬЗОВАНИЯ ВОДНЫХ РЕСУРСОВ БАЛКАШ-АЛАКОЛЬСКОГО ВОДОХОЗЯЙСТВЕННОГО БАССЕЙНА

Аннотация

На основе анализа водохозяйственной обстановки в Балкаш-Алакольском водохозяйственном районе разработаны принципы рационального использования водных ресурсов.

Анализ современной деградации экологических систем показывает, что этот процесс является непосредственным результатом своевременных прогнозных оценок и предвидения возможных последствий принимаемых решений в стадии разработки схем комплексного использования и охраны водных ресурсов для отдельных речных бассейнов Казахстана.

В дефицитных по воде бассейнах рек дальнейшее развитие водного хозяйства и соответственно развитие отраслей экономики, требуют согласования возможностей наличных водных ресурсов с потребностями на них. Таким образом, в идеале требуется согласование возможности отбора воды из окружающей среды определенного количества природных, в том числе и водных ресурсов, с самовосстанавливающей способностью окружающей среды.

В результате антропогенной деятельности и резкого подъема уровня использования воды верховьях реки Иле, в Балкаш-Алакольском водохозяйственном бассейне уже в настоящее время сложилась напряженная водохозяйственная и экологическая обстановка, в которой уникальное озеро Балкаш может повторить судьбу Аральского моря. Намечаемые на средне и долгосрочные периоды мероприятия по развитию орошаемого земледелия на территориях Жетысуйского и Алматинского областях накладывают дополнительные чрезмерные нагрузки на состояние природной окружающей среды в регионе. Предложены возможные комплексные меры по решению стратегической задачи по рациональному (социально-экологической и экономической оптимальному) использованию водных ресурсов в Балкаш-Алакольском водохозяйственном бассейне с учетом сохранения озера Балкаш.

Ключевые слова: водные ресурсы, водопотребление, водохозяйственная обстановка, комплексные меры, рациональное использование, сток, экологические стоки.

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ВЛИЯНИЕ РАЗЛИЧНЫХ СТИМУЛЯТОРОВ НА КАЛЛУСОГЕНЕЗ *JUGNALIS REGIA EFFIGIA*

Аннотация

Источниками фитопрепаратов являются лекарственные растения, которые ценятся во всем мире, и которые могут исчезнуть в эпоху изменения климата. Одним из таких источников является грецкий орех. Грецкий орех входит в род *Juglans* семейства *Juglandaceae*. Цель исследования состоит, в том, чтобы изучить действие различных концентрации стимуляторов роста на различные виды эксплант *Juglans regia effigia* с использованием технологии микроклонального размножения, где в качестве материнского растения брали взрослые