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JPRS L/9834

8 July 1981

Translation

TRANSLATIONS ON MAJOR USSR RIVER DIVERSION PROJECTS

Volume III



FOREIGN BROADCAST INFORMATION SERVICE

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VOLUME III

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PREFACE

This is the third of a four-volume special report. Most of the translations are reports or discussions on proposals for or ramifications of projects to divert part of the flow of certain major northward flowing river systems into areas of the southern USSR, especially Kazakhstan and Central Asia.

The collection of translations was prompted by a notable increase in the volume of material published about the feasibility of river diversion projects; most of this material was published just before and during the 26th CPSU Congress held in February 1981. The material selected is from a broad range of Soviet central and republic newspapers and journals, in the local languages of the Central Asian republics as well as in Russian.

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STATEMENTS BY POLITICAL LEADERS

CPSU CENTRAL COMMITTEE DRAFT DIRECTIONS FOR 1981-85

LD021304 Moscow Domestic Service in Russian 0000 GMT 2 Dec 80

[The CPSU Central Committee draft of the main directions for the economic and social development of the USSR for 1981-85 and for the period up to 1990]

[Excerpt] The further development of land improvement is to be provided; at the cost of state capital investments 3.4-3.6 million hectares of irrigated and 3.7-3.9 million hectares of drained lands are to be brought into use and some 26-28 million hectares of pastureland are to be reclaimed from desert, semi-desert and mountainous regions. An all-round improvement in the effectiveness of the use of irrigated and drained lands and a reduction in the time taken to achieve planned yields on these lands is to be attained; the technical level and quality of water-conservancy construction is to be raised; comprehensive work is to be carried out in land-improvement and recovery of agricultural land; measures are to be implemented to improve the meliorative condition of irrigated and drained lands; work is to be speeded up on the reconstruction of existing land-improvement systems and improvement in their supplies of water and in elimination of their salinity and high soil acidity.

Preparatory work is to commence on diverting part of the outflow of northern rivers to the Volga River basin, as well as continuing the scientific and design studies for the diversion of the waters of Siberian rivers to Central Asia and Kazakhstan.

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SPEECHES MADE AT 20TH UZBEK CP CONGRESS

Rashidov Report

LD171515 Tashkent PRAVDA VOSTOKA in Russian 4 Feb 81 pp 2-6

[Text of "Uzbek CP Central Committee Report to the 20th Uzbek CP Congress" delivered 3 February in Tashkent by Sh. R. Rashidov, candidate member of the CPSU Central Committee Politburo and first secretary of the Uzbek CP Central Committee]

[Excerpts] Formulation of an Uzbek SSR food program is currently in progress. It will make provision for the dynamic and balanced development of all sectors of agriculture, processing industry, transport, trade and procurements and also for the resolution of social questions of the development of the countryside.

The republic is faced with resolving complex tasks in the field of water resources and land reclamation during the 11th 5-Year Plan. Some R6.5 billion is being allocated for these purposes. It is planned to open up around 500,000 hectares of new land in all oblasts and the Karakalpak ASSR. The prime project will be to continue the opening up of the Karshi and Dzhizak steppes.

The Talimardzhanskoye, Tuyamuyunskoye, Gissarakskoye and Karultyubinskoye reservoirs will be commissioned. The capacities of the Arkhangaranskoye and Kattakurganskoye reservoirs will be increased, and construction of the Tupolangskoye, Sokhskoye and Shorkulskoye reservoirs will be started.

A high-powered production base has been created in the republic, and cadres have been trained to carry out these and other water resources projects. All this is making it possible to open up virgin lands on a broad front, to create new sovkhozes and to demand that agricultural and water resources workers achieve high output from irrigated lands.

The central task must be to improve land that has been irrigated for a long time and improve the operation of reclamation systems and the entire collection and drainage system. This work must be centralized and concentrated in the republic Ministry of Reclamation and Water Resources, including the operation of the network within farms.

Long-term forecasts for the coming 5-year period anticipate little water and an increase in the shortage of water resources. In these conditions paramount importance is attached to the task of comprehensively modernizing our fields, making economical and efficient use of water, pursuing a strict policy of water distribution and seeking additional sources. Precisely this task must determine the

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activeness and degree of responsibility of workers in the Ministries of Reclamation and Water Resources and Agriculture, the Glavsredazirsovkhozstroy, the State Committee for Water Resources Construction, scientific research and design planning organizations, party and soviet organs, kolkhoz and sovkhos leaders and specialists and all cadres entrusted with work in this most important sector of water resources construction.

The republic has enormous areas of fertile land for irrigation. Given the availability of water resources it is possible to open up over 8 million ha of new land and to obtain from it a great deal of additional cotton, grain and other agricultural produce. However, this potential can only be realized on the basis of diverting part of the flow of Siberian rivers to Central Asia. The Uzbek CP Central Committee is persistently raising the question of expediting the practical start of this work during this very 5-year plan.

Sadykov Speech

Tashkent PRAVDA VOSTOKA in Russian 5 Feb 81 p 4

[Speech by Uzbek SSR Academy of Sciences President A. S. Sadykov]

[Excerpts] Thanks to the constant concern of the Communist Party and the Soviet state for developing science in Uzbekistan, a powerful scientific-technical potential has been created here--about 200 scientific-research institutes and VUZ's in which 35,000 scientists work and teach.

The important role of science in technical progress and the large investments in its development pose the critical question of continuing to increase research effectiveness.

Increasing the water supply is of decisive importance to the national economic cotton complex and the entire republic economy. The question of diverting a portion of the flow of Siberian rivers to Central Asia and Kazakhstan is especially important under the conditions which have evolved. More than 100 scientific organizations are working on this problem.

It is appropriate to begin work on building a canal and irrigating the republic's enormous land reserve in the 11th Five-Year Plan. This will be a tremendous contribution to increasing cotton production and implementing the food program. Prompt water diversion will have a positive influence on reducing the negative consequences of the drying out of the Aral to a minimum and on developing the productive forces, economy and social life of the area near the Aral.

Khudaybergenov Speech

Tashkent PRAVDA VOSTOKA in Russian 5 Feb 81 p 4

[Speech by Khorezmskaya Obkom First Secretary M. Kh. Khudaybergenov]

[Excerpt] Last year, we held a meeting of the All-Union Coordination Council for Cotton Growing, at which questions associated with prospects for further developing this branch in the Khorezm Oasis were raised. Their resolution at this stage is inseparable from the upcoming start-up of the Tuyamuyunskiy hydrosystem. It is

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necessary that the USSR Ministry of Reclamation and Water Management and the republic Ministry of Reclamation and Water Management take the steps necessary to accelerate reconstruction of interrepublic mainline canals which have long since exhausted their throughput capacity and intraoblast irrigation systems, as well as the drainage-collector network.

Speaking of the water problem, which is becoming increasingly critical with each passing year, we must not fail to mention the vitally important necessity of diverting a portion of the flow from Siberian rivers to Central Asia and Kazakhstan, as is outlined in the CPSU Central Committee draft.

Khudayberdyev Report

Tashkent PRAVDA VOSTOKA in Russian 5 Feb 81 pp 5-6

[Report by Uzbek SSR Council of Ministers Chairman N. D. Khudayberdyev]

[Excerpt] Uzbekistan has available to it very rich experience in planning and building modern hydraulic engineering structures, in the multipurpose utilization of virgin lands. In conjunction with the profoundly assiduous attitude our peasantry has towards water and land, this has transformed republic irrigation and land reclamation into a benchmark for many countries.

Nonetheless, the increasing water resources deficit advances questions of efficient water use to the fore. Along with expanding work on the comprehensive renovation of irrigation systems, lining canals and using groundwater intelligently, with completing construction of a number of large, medium-sized and small reservoirs, we need to expand the struggle to conserve water everywhere. Improving the operation service, mechanizing surface irrigation, developing trickle and in-soil irrigation, closed and vertical drainage, and the intelligent expenditure of water for leaching--this is the arsenal of means which must be brought into play. Only such a genuinely state-oriented attitude towards saving water can enable us to retain the tempo established in developing agriculture until additional water resources can be brought into the region.

In the course of discussion of the CPSU Central Committee draft, the republic community has quite properly proposed that the diversion of a portion of the flow of Siberian rivers to Kazakhstan and Central Asia be accelerated. This call has sounded with special force at our congress as well. The Union ministries of agriculture, reclamation and water management and the USSR Gosstroy have expressed similar opinions. The technical and economic substantiation has already been worked out. The start of preparatory work on carrying out this ambitious water-management construction in the 11th Five-Year Plan will doubtless be an important stage in the continuing steep ascent of irrigation farming in the republics of Central Asia and Kazakhstan and in solving the Aral Sea problem.

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Dzhurabekov Speech

Tashkent PRAVDA VOSTOKA in Russian 6 Feb 81 p 3

[Speech by Minister of Reclamation and Water Management I. Kh. Dzhurabekov]

[Excerpts] Water management workers are making a contribution to the struggle to obtain guaranteed high harvests of cotton and other agricultural output. Our task is to provide, promptly and in full measure, irrigation water for more than three million hectares of plowed, irrigated fields.

Much work has been done to master the virgin lands. New virgin-land rayons--Elikkalinskiy, Parkentskiy, Kumkurganskiy and others--have been created in recent years alone. Lands in the Ishtykhanskiy, Urtachul'skiy, Malikchul'skiy and other tracts have provided an increasingly substantial return.

River flow is being regulated to increase the water supply. We are completing construction of the Andizhan Reservoir, and the Amudar'ya has been spanned by a section of the Tuyamuyunskiy hydrosystem. New canals, run-off collectors and other facilities have been put into operation. Much work has been done on renovating large hydrosystems and water carriers.

Machine irrigation has been developed intensively. About 4,000 km of canals was lined with concrete during the five-year period to increase the efficiency of the irrigation systems and reduce water losses due to filtration.

In connection with the continuous increase in the amount of land being irrigated in the republic, the operation of reclamation systems is taking on increasing importance. Operators running many canals, reservoirs and systems are fighting actively for good yields, ensuring a prompt water supply to agricultural land.

In view of the fact that the Syrdar'ya flow is completely regulated and the resources of the Amudar'ya will be completely exhausted by 1985, the ministry is taking steps to make fuller use of existing water resources. Work is underway on the comprehensive restructuring of long-irrigated land, on which more than 14,000 km of the drainage-collector network has been built. Irrigation charts have been consolidated for 360,000 ha. An increasingly large proportion of the irrigated land is being drained.

In spite of the successes achieved, we are well aware that the current level of reclamation cannot be considered adequate to carry out the assignments of the 11th Five-Year Plan. We are therefore making an analysis to reveal bottlenecks in the activity of water management organizations, to outline ways of overcoming them and to reveal reserves.

Crop yield growth is currently being retarded on individual farms of Central Fergana, the Golodnaya and Surkhan-Sherebadskaya steppes and other areas of Uzbekistan due to poorly reclaimed land. We are obligated to resolve the task of increasing yields on these lands.

In view of weather conditions, steps are being taken to overcome the lack of water, we are building more pump stations to supply water to systems with a water shortage, more water storage facilities are being provided and more canals are being lined with concrete.

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Much work is being done to prepare irrigation systems for the growing season. In February, we will finish flushing irrigation, and in March all water management systems will be ready to supply water to the fields.

In the current five-year plan, we will finish building the Tuyamuyunskiy hydro-system on the Amudar'ya the Gissarakskiy and a number of other reservoirs, canals and collectors. We plan to begin building Sokhskiy reservoir in Ferganskaya Oblast and Tupolangskiy reservoir in Surkhandar'inskaya Oblast. In Fergana Valley, the assault on the adyry [foothills] continues, with construction of high-pressure pump stations, and work on converting the open collector-drainage network to a closed network will be accelerated in Khorezmskaya Oblast.

The collectives of water management organizations warmly support the CPSU Central Committee draft for the 26th Party Congress. We hope the plan for diverting a portion of the flow of Siberian rivers to Central Asia will soon be carried out. [applause]

Azimov Speech

Tashkent PRAVDA VOSTOKA in Russian 6 Feb 81 p 4

[Speech by Uzbek SSR Union of Writers Board First Secretary S. A. Azimov]

[Excerpt] It was proposed at an open meeting of Uzbekistan writer-communists that one point in the CPSU Central Committee draft section be reworded as follows, if it is considered appropriate to do so: "Accelerate scientific, planning and practical work on diverting a portion of the flow of Siberian rivers to Central Asia and Kazakhstan in the 11th Five-Year Plan in order to ensure an opportunity to carry out Kazakhstan whose utilization will be possible only if this project is carried out." It seems to us that this change is of fundamental political and economic importance.

The potential opportunities and natural resources of Central Asia for further developing the country's productive forces are truly colossal. That is why, with concern for the good of all the peoples of the country, we think resolution of this question is just as necessary and unavoidable as was the Leninist party program for mastering the virgin and long-fallow lands in its time.

One other question, that of the drop in the level of the Aral Sea. This can negatively affect the environment and the natural potential of the Aral area. We should obviously anticipate the construction of water-storage facilities in the Aral Sea basin.

Karimov Speech

Tashkent PRAVDA VOSTOKA in Russian 6 Feb 81 p 4

[Speech by Bukharskaya Obkom First Secretary A. Karimov]

[Excerpt] Under our conditions, irrigation and reclamation are the pivotal problems of agricultural production. Renovation of the Amu-Bukhara Machine Canal, building new pump stations and increasing the capacity of existing ones, building Shorkul'skiy and Tudakul'skiy reservoirs, lining more than 350 km of canals,

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developing the drainage network--all this has enabled us to significantly increase the water supply to the fields, to master virgin lands. However, these steps have still not ensured the use of all existing opportunities. The oblast could increase its sown area and its corresponding production and procurement of cotton, grain, meat, milk, vegetables and fruit several-fold. Cardinal resolution of the problem will depend on the fastest possible implementation of the plan for diverting a portion of the flow of Siberian rivers to Central Asia and Kazakhstan. We warmly support the proposal expressed in the Accountability Report that this work be expanded without delay and that it be done at a high rate.

Akhmedov Speech

Tashkent PRAVDA VOSTOKA in Russian 6 Feb 81 pp 5-6

[Speech by Uzbek SSR Council of Ministers Deputy Chairman and Gosplan Chairman K. A. Akhmedov]

[Excerpt] One of the primary tasks at the present stage is to increase national well-being, and foremost to resolve the food program. The republic has every condition necessary to carry it out. Along with further developing cotton growing, resolution of this problem is inseparably linked to accelerating in every way possible practical work on diverting water from Siberian rivers to Central Asia.

Khamrayev Speech

Tashkent PRAVDA VOSTOKA in Russian 6 Feb 81 p 6

[Speech by 'Sredazirsovkhovstroy' Main Administration Chief N. R. Khamrayev]

[Excerpt] Work will be continued on further increasing the potential of territorial agroindustrial complexes of the Golodnaya, Karshinskaya and Dzhizakskaya steppes and other tracts in Uzbekistan, in the fraternal republics of Tadzhikistan and Kirghizia, and in Ivanovskaya Oblast in the Russian Federation.

In 1985, our virgin lands will be producing cotton at a level of 1.2 million tons per year, along with nearly half a million tons of rice, and the production of stockraising output and other foodstuffs will have nearly doubled.

Virgin land residents are satisfied with the enormous amount of persistent work being done by party organs in connection with resolution of questions of diverting a portion of the flow of Siberian rivers to Central Asia and Kazakhstan. Everything is being done in the name of the further flowering of our homeland, growth in the well-being of our people, in the name of peace on our planet.

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SECRET

COMMENTS MADE IN SPEECH BY N. D. KHUDAYBERDYEV AT PARTY CONGRESS

Tashkent PARTIYNAYA ZHIZN' in Russian No 2, Feb 81 pp 54-71

[Article: "On the CC CPSU Report to the 26th Party Congress 'Basic Directions of the Economic and Social Development of the USSR for the Years 1981-1985 and the Period to 1990'; A Report by Comrade N. D. Khudayberdyev, chairman of the Council of Ministers of the Uzbek SSR"]

[Excerpt] Nonetheless the growing shortage of water resources raises questions of efficient water utilization. In addition to expansion of work for comprehensive reconstruction of work for irrigation systems, lining of canals and efficient utilization of underground waters and the completion of the construction of a number of locks, medium-sized and small water reservoirs, it is necessary everywhere to struggle for economy of water. Improvement of the operational service, mechanization of surface irrigation, the development of drop and intrasoil irrigation and closed and vertical drainage, and intelligent expenditure of water for leaching--such is the arsenal of means which should be put into operation. Only such a truly State attitude toward economizing on water will make it possible for us to maintain the rapid rates of development of agriculture until additional water resources are brought into the region.

During the course of the consideration of the draft of the CPSU Central Committee, the population of the republic quite correctly made a suggestion about accelerating the diversion of part of the water from Siberian rivers into Kazakhstan in Central Asia. This had special force in our congress as well. A similar opinion was expressed by the union ministries of agriculture, land reclamation and water management as well as the USSR Gosstroy. The technical and economic substantiation has already been developed. There is no doubt that the preparatory work begun under the Eleventh Five-Year Plan for carrying out this immense amount of water management construction will be an important stage in the subsequent sharp upsurge in irrigation farming in the republics of Central Asia and Kazakhstan and in the resolution of the Aral Sea problem.

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REPORT ON UZBEK CP CONGRESS

Moscow PRAVDA in Russian 6 Feb 81 p 2

[Article by V. Boldin, N. Gladkov and Yu. Mukimov, PRAVDA special correspondents, Tashkent: "To New Heights: From the Twentieth Congress of the Communist Party of Uzbekistan"]

[Excerpt] There are also other considerable reserves. It is possible to develop more than 8 million hectares of land within the republic. But realization of this task, it was stated in the report and the speeches of K. Kamalov, first secretary of the Karakalpakskiy party obkom, A. Karimov, first secretary of the Bukharskih party obkom and A. Sadykov, president of the republic's Academy of Sciences, is connected with reversal of part of the flow of Siberian rivers into Central Asia. As a result of developing the new land, it is possible to expand the zone of guaranteed harvest yields.

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UZBEK PARTY CONGRESS REPORT MENTIONS IRRIGATION, WATER DIVERSION

Moscow SEL'SKAYA ZHIZN' in Russian 6 Feb 81 p 2

[Article by M. Zamyatin and A. Uzilevskiy]

[Excerpt] The congress laid special emphasis on the importance of raising the return from the enormous amount of capital invested into development of new lands and construction of irrigation and land improvement facilities. Uzbek SSR Minister of Land Reclamation and Water Resources I. Dzhurabekov dwelled on this in detail in his speech. About 500,000 hectares of new irrigated land were brought into use in the republic in the 10th Five-Year Plan. In the new five-year plan, development of the Karshinskaya and Dzhizakskaya steppes and virgin lands in other regions will continue on a broad front. There are plans to introduce half a million hectares of farm land into agricultural turnover and create new sovkhozes.

Many speakers brought up the problems of water availability and effective use of irrigation water. They suggested that the draft Basic Directions should reflect the need for making preparations, as early as in the current five-year plan, for diverting part of the flow of Siberian rivers into Central Asia and Kazakhstan, inasmuch as the local water resources of these regions will be unable to support further expansion of agricultural production by as early as 1985.

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ECONOMIC ASSESSMENTS

RIVER DIVERSION SCHEME PART OF WATER MANAGEMENT CONSTRUCTION

Tashkent EKONOMIKA I ZHIZN' in Russian No 4, Apr 80 pp 13-14

[Article: "Capital Investments in Water Management Construction in Uzbek SSR"]

[Excerpt] "The future of our agriculture lies in the extensive development of land reclamation." These words of Leonid Il'ich Brezhnev pass through the minds and hearts of the workers of sunny Uzbekistan. We began with Lenin's decree, with the first soviet labor rubles that were invested in irrigation and, sparing no efforts, laid new canals and irrigation systems. Along this path we passed from squeaking Chigirs to powerful pumping stations, from primitive irrigation canals to man-made rivers and seas and unprecedented hydrotechnical structures.

Now we have even more large-scale programs. They were earmarked by the 25th CPSU Congress which set the task of conducting scientific research and the necessary planning work for diverting part of the flow of Siberian rivers into Central Asia.

As a result of the implementation of the party's plans more and more millions of hectares of desert land will be returned to life. The water supply for arable land will be increased, the volume of production of agricultural products will increase, villages, cities and powerful industrial giants will grow up and more blue arterials will appear.

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ACADEMICIANS PREFER DEVELOPMENT OF SIBERIA'S AGRICULTURE TO IMPORTATION OF FOOD

Moscow SOVETSKAYA ROSSIYA in Russian 5 Dec 80 pp 1-2

[Article by B. Boyev, director of the Siberian Scientific-Research Institute of Agricultural Economics and corresponding member of the All-Union Academy of Agricultural Sciences, and Yu. Novoselov, deputy chairman of the Presidium of the Siberian Department of the All-Union Academy of Agricultural Sciences and candidate of economic sciences, Novosibirsk: "A Systems, Scientific Approach--To Intensively Develop the Food Base of Siberia"]

[Excerpts] Never previously has Siberian industry developed so rapidly as in recent years.

The long years of experience in development of these regions shows that the successful development here of productive forces requires a cardinal solution of the question of provision of living conditions--first of all, sound nutrition. For this reason, the problem of establishment of a food base for Siberian and northern regional production complexes constitutes one of the most important and high-priority problems.

Unfortunately, it is still being solved badly, which unfortunately affects industrial production.

Under the extreme conditions of the Siberian North, agriculture is being developed with difficulty. Lack of experience in carrying out agriculture and shortages of labor resources also have their effect. Consequently, the population residing here is supplied primarily through the importation of food products from regions that are frequently many thousands of kilometers away.

But while it may have been possible to accept this somehow formerly, the large-scale development of new territories does not allow for dependence on this. The food problem has to be solved radically and fundamentally. The creation of a food complex requires a systems approach. This means that it is necessary to take into account the development of the food base and expenditures on its formation at all stages of organization of large industrial enterprises in the Siberian North. And this must be done under the conditions of elaboration of a technical-economic basis. Such a procedure has to be done through directives. The fact is that here in the Siberian North there are no reserves with which to provide the population with food without extra capital investments. Outlays on the creation of a food base comprise quite an appreciable part of expenditures connected with development of the wealth of the North. Therefore a situation cannot be considered normal where the working

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out of plans dealing with the development of natural resources is carried out with careful consideration being given to the needs of industrial installations under construction with respect to equipment, electric power, water, and manpower while questions of provision of food products for the growing population are kept outside the framework of the plans and estimates. We are convinced that the food base must be an obligatory composite part of all plans and the construction of agricultural installations has to be financed and provided with good material resources on the basis of a unified system and program of erection of industrial enterprises.

The orientation of a certain portion of managers cannot withstand criticism in regard to uncontrolled importation of food products to the North. Such an approach leads to frequent irregularities in supplying the population, large losses of produce, its reduced quality and nonproductive expenditures. Thus, for example, during the present five-year plan deliveries of potatoes come to the city of Surgut in Tyumenskaya Oblast from Chuvashskaya ASSR and Omskaya and Tomskaya Oblasts. In this connection product losses have comprised 18-24 percent. Cabbage has been shipped to Bratsk and Ust'-Ilimsk from the Uzbek and Tajik Republics. Less than half of the total volume of procured products reaching the consumer was of standard quality. In 1979, the builders of the Western Section of the Baykal-Amur Mainline were supplied with potatoes from Krasnoyarskiy and Altayskiy Krays, Buryatskaya ASSR and Uzbek SSR and with meat products from the North Caucasus, Abakan, Buryatiya and Omskaya Oblast. Because of big distances and numerous transshipment points, tremendous losses of vegetables occur and costs of transporting products exceed their production costs.

Because of a lack of guaranteed transportation it is simply impossible to deliver to many regions of the North and the BAM such agricultural products as whole milk, eggs, vegetables produced on sheltered ground. There is absolutely no possibility of bringing in these products from the southern rayons of Chitinskaya Oblast to the future Udokanskiy industrial center. Milk can be supplied to the Baykal-Amur Mainline zone from Buryatskaya ASSR only by means of a difficult roundabout way through Irkutskaya Oblast. It is unrealistic to speak of the question of bringing food products to the central part of the Baykal-Amur Mainline from Yakutiya, where surpluses will not be found for a long time because of the tempestuous development of industry. What then should the solution be?

As shown by the many years of experience of development of the country's northern regions, sections of land are to be found even in the most unfavorable soil and climatic conditions which could be used to one degree or another for agricultural purposes, including pasture maintenance of animals. Such lands are to be found most often among the floodlands of rivers and mountain hollows. Thus, for example, the construction zone of the Baykal-Amur Mainline includes among the available land almost one million hectares of which about 140,000 hectares could be put to use with relatively small outlays in the immediate years ahead. Of these, about 80,000 hectares are suitable for tillage. More than a million hectares of floodlands suitable for fodder production are to be found along the lower reaches of the Ob' River. In Yakutskaya ASSR, the floodlands of the Amga, Lena, Vilyuy and Olekma rivers have about 160,000 hectares that could be developed for cultivation. The reclamation land of the Nizhnyy Yenisey consists of more than 250,000 hectares, the main part of which is concentrated in Turukhanskiy Rayon. Land suitable for agricultural use also exists in other northern latitudes of Siberia and the Far East.

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Expeditionary studies and stationary experiments conducted in the last five years have shown that it would be possible to produce on these lands 11-18 tons of potatoes, 13-15 tons of vegetables and 17-26 tons of green mass of annual grasses per hectare. The hothouse yield of potatoes per square meter is 28-32 kilograms. On the fields of the Kureyskiy Support Point of the Scientific-Research Institute of Agriculture of the Far North located on the latitude of the Arctic Circle, scientists are producing 200-250 quintals of potatoes per hectare, 300-400 quintals of cabbage. Of course, yield would be somewhat lower under production conditions. But the "fault" does not lie so much in the severe climate as in the different organizational and economic mix-ups.

The fact that it is possible to successfully develop agricultural production in the northern regions of Siberia and in the Baykal-Amur Zone is borne out by the operational experience of the sovkhoses, kolkhozes and auxiliary farms of enterprises created here. For example, Podymakhinskiy Sovkhoz of Ust'-Kutskiy Rayon in Irkutskaya Oblast achieved a significant growth in the productivity of cows. Iskra Kolkhoz of Kazachinsk-Lenskiy Rayon is successfully developing production.

The accumulated experience of complex economic development in the new regions of industrial development provides a basis for the conclusion: maintenance of the population's needs for food products should be carried out through organization of production of not particularly transportable and quickly perishable products in the immediate vicinity of their places of consumption, as well as through intensification of agriculture in contiguous regions with more favorable natural and economic conditions for the production of meat, dairy products, potatoes and fodder for animal husbandry. But vegetables, fruits, grapes and melon crops that favor heat should be brought in from the more distant regions of the country. Moreover, the importance of sources of production of food products for individual regions of new construction varies. Thus, for example, while the need for potatoes and vegetables produced on open ground, milk and even meat can be completely satisfied in the Eastern Section of the Baykal-Amur Mainline through the organization of production close to the places of their consumption, in the area of the line abutting on South Yakutiya, where more than 200,000 people will be living in the near future, most food products will have to be brought in the foreseeable period from other, distant regions. Therefore it is necessary to consider not opposition but the rational combination of different variants of guaranteed maintenance of the population with needed food products involving minimum expenditures.

It would appear that it would be necessary to concentrate first and foremost in the immediate vicinity of industrial centers of the North the production of whole milk and sour-milk products, dietary eggs and vegetables grown on sheltered ground and in part potatoes and vegetables of local assortment grown on open ground. Rear bases ought to become basic suppliers of other products--food and forage grain, meat, butter, cheese, dry milk and partly potatoes and vegetables.

In the Basic Directions of Economic and Social Development of the USSR, it is emphasized that it is necessary to expand production of meat, milk, potatoes, vegetables and fruits on the subsidiary farms of enterprises and organizations. This task can be solved in Siberia, in the Far East and in the northern regions. It is only necessary to think over carefully what assistance should be provided today as well as tomorrow. In the immediate years ahead it would be possible to greatly increase crop

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production by improving the structure of sowing areas. This would require the elaboration, approval and implementation of concrete measures relating to intensification of the sector at each farm. Such measures have been developed by the RSFSR Ministry of Agriculture for sovkhozes of the Baykal-Amur Mainline zone, but, unfortunately, their implementation is being held back. The preparation of concrete measures should involve in addition to planning and agricultural organs scientific institutions of the Siberian Department of the All-Union Academy of Agricultural Sciences [VASKhNIL], the Siberian Department of the USSR Academy of Sciences and other agencies. It is essential to include in the complex groups soil scientists, land-tenure regulators, land-improvement specialists, livestock specialists and economists. In a word, those specialists should be included who would be able to prepare complex proposals in a qualified manner. This is how proposals were prepared in a short time for developing agriculture in the Barguzinskaya Basin of Buryatskaya ASSR.

Taking into account the weak knowledge of the regions of the Siberian North and their complex natural conditions, the great capital intensiveness of construction of facilities, it is necessary to elaborate and implement all measures on a strict scientific foundation, that is, all planning work must be preceded by exhaustive study, scientific expertise and active participation by scientists in the working out of proposals and decisions.

Unfortunately, one has the impression that certain operational personnel and planning organs, when turning to scientists, are only conforming to the mode, so as to be able to say should the need arise that "that is how the scientists advised." Scientists, however, prepare recommendations not for the purpose of being praised but for the purpose of jointly finding a correct solution. We have many examples where research carried out by order of operational organs and officially approved by directorate organs, has been slow in being introduced into production. Such was the case with proposals for the development of agriculture in Barguzinskaya Basin. In most of the regions of the Baykal-Amur Mainline zone, the USSR Ministry of Land Reclamation and Water Resources and the RSFSR Ministry of Land Reclamation and Water Resources have for all practical purposes not begun the development of land, although proposals from the Siberian Department of the All-Union Academy of Agricultural Sciences and planning organizations exist. The material-technical base of the farms of the Baykal-Amur Mainline Zone (Angarskiy, Zolotinka, Zarya sovkhozes and others) are being poorly strengthened. For many years, wide-scale introduction of film hothouses with two-layer covering, which have well proved themselves in Yakutiya, has been held back. The Ministry of Timber and Wood Processing Industry and industrial ministries, developing the mineral resources of the North, shoo off agrarian scientists and do not display the necessary interest in establishing and developing subsidiary farms in the Baykal-Amur Mainline zone. Scientific-research institutes often have great difficulty in "making headway" with their developments. This attests not only to stubbornness of the servitors of science but also to the conservativeness of certain departments. The documents published on the 26th CPSU Congress and the decisions of the October (1980) Plenum of the CPSU Central Committee direct us to large-scale creative work and call us to make untiring searches, daring experiments and purposeful and effective work. This is demanded in particular by the problems of the food base of the new eastern and northern regions.

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CSO: 1800/371

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AGRONOMIST URGES TIGHTER CONTROL OF IRRIGATION WATER IN CENTRAL ASIA

Moscow PRAVDA in Russian 8 Dec 80 p 3

[Article by Uzbek SSR Distinguished Agronomist K. Kurochkin: "The Harvest Will Compensate"]

[Text] The ability to utilize irrigation water is a measure of the cultural level of farming. This is especially valid in application to cotton-growing regions, where only artificial irrigation can compensate for the long hot summer and inadequate precipitation.

The methods of economical water consumption and reservoir construction were known in Central Asia in deep antiquity.

Today, irrigated farming has become the foundation of all agricultural production in this sunny land. Rains provide about 2 or 3 percent of the water of the rivers in this area. The two main arteries--the Amudar'ya and Syrdar'ya--get the rest of their water from snow and glaciers. This means that everything depends on the quantity of snowfall. According to figures of the Uzbek SSR's hydrometeorological service, 10 of the last 20 years were low-water years. Concurrently the gross harvests of the republic's main agricultural crop--cotton--are growing constantly, and the size of the yields is rising. This year for example the republic will harvest 6.2 million tons of "white gold". These successes are the product of the selfless labor of the farmers, and the constant concern of the party and government for introducing full mechanization and developing irrigation and land reclamation.

Major measures foreseeing a further rise in the effectiveness of irrigated crops are outlined in the CPSU Central Committee's draft report to the 26th CPSU Congress. The technical level and quality of hydraulic engineering construction will grow dramatically, which will doubtlessly help the republic's cotton-growers to increase their production of the valuable industrial crop.

There are already 16 large reservoirs storing water in the Uzbek SSR. The water travels a total of 150,000 kilometers in canals and irrigation channels. The irrigation system management service, which has modern equipment at its disposal, is working in full correspondence with this truly gigantic scale.

The age-old Deccani dream of watering the steppes and deserts and transforming them into flourishing oases is coming true. Just in the 10th Five-Year Plan alone the Uzbek SSR reclaimed hundreds of thousands of hectares of new land. Land improvement

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measures were implemented over an enormous area, and the kolkhozes and sovkhoses on old arable land received extra rations of life-giving moisture.

And still, there is not enough water. Nature failed to account for the scope of the invasion of the vast lifeless spaces. It is no accident that the draft Basic Directions foresee continuing the scientific research and planning in support of diverting the waters of Siberian waters to Central Asia and Kazakhstan. And although it will not be long before this is done, the problem of irrigating the cotton fields must be solved for the moment through internal reserves.

Today, the approach many farmers take to the problem is rather simple: Give me more water, and I will guarantee a high yield. They act according to the principle that cereal cannot be spoiled with too much butter. But is this so in fact? No, it turns out. It was precisely in the low-water years that some farms achieved their highest cotton yields. As an example Andizhanskaya Oblast harvested an average of 32 quintals of raw cotton per hectare, while when water was abundant, the figure was 27 quintals. About the same relationship was revealed in a number of rayons of Surkhandar'inskaya and Samarkandskaya oblasts.

It would seem that everyone has long been aware that excessive irrigation carries the danger of swamping, salinization, compaction, and cooling of the soil, and removal of up to 50 percent of the nutrients into the drainage network. This has been a known fact, but somehow no one seemed very concerned about the consequences. The main thing was to have water. Its reserves were significantly increased. But the growth in yields was not at all proportional to the water supply. On the other hand the water table began to rise noticeably in some places, and the condition of the land began to worsen.

But now the approach has changed abruptly. Researchers at experimental stations have established that depending on the soil conditions and climate, about 170 cubic meters of water would be enough to obtain 1 quintal of cotton, and that if the water table is near the surface, even less would be required. In fact, however, we find that consumption is 1.5-2 times higher than the scientifically substantiated norms.

What is the solution? We need to begin keeping records of water consumption. We need to monitor its consumption not only as far as the boundaries of the kolkhozes and sovkhoses, as is presently being done by the republic's Ministry of Land Reclamation and Water Resources. Inside the farms, after all, water is distributed among the farming teams "by guesstimate", without water measuring devices.

Add droplet to droplet, and you have a sea. So goes the Eastern proverb. We could easily persuade ourselves of the truth of this proverb with simple arithmetic. For example, what could possibly be the consequence of exceeding the irrigation norm by 200 "or so" cubic meters per hectare of cotton? A drop in the bucket. But on the scale of the republic as a whole, calculated for three instances of irrigation, the losses would be more than a billion cubic meters, which is enough to fill an entire reservoir.

This is why, I believe, Section Five of the draft CPSU Central Committee report, in the place where measures to improve the condition of the irrigated land are

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discussed, the following phrase should be added: "Establish strict surveillance over consumption of water for irrigation." I would like to add that it would not be difficult to outfit irrigation networks with water measuring devices and with flow control instruments, and the benefit would be tremendous. By standardizing irrigation practices, we would raise the responsibility of farm executives and farming teams, and help exclude drying out or excessive moistening of fields. The return per irrigated hectare would increase.

We should also make broader use of another important reserve--introducing the most progressive methods of irrigation, employing flexible hoses and syphons, automatic water dispensing systems, and buried pipelines. I think that we cannot get by in this area without a competent, careful approach on the part of farmers, and without the creative efforts of scientists.

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CSO: 1824/177

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DIVERSION OF NORTHERN WATERS INTO VOLGA

Moscow IZVESTIYA in Russian 28 Dec 80 p 2

[Article by G. Voropayev, chairman of the scientific council of the USSR Academy of Sciences and the USSR State Committee for Science and Technology on problems of the Caspian, corresponding member of the USSR Academy of Sciences: "The Volga Will Be Full"]

[Text] The draft of the CPSU Central Committee for the 26th Party Congress, "Main Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period up to 1990," includes the following line: "to begin to conduct preliminary work for diverting part of the flow of northern rivers into the Volga River basin." What is concealed behind this line? At the present time there are about 90 million people living on the territory of the Volga Basin and the basins of the Don and the rivers of the Northern Caucasus as well as the interfluvium of the Volga and Ural, which are connected to the Volga in terms of water management. Almost one-fourth of the union-wide industrial and agricultural output is produced here. The mouths of the Volga and Ural and the region of the northern Caspian produce more than 90 percent of the world catches of fish of the sturgeon family. The water resources of the Volga Basin provide for the operation of hydroelectric power stations with a total capacity of more than 10 million kilowatts. The potential resources of this region are exceptionally great, and therefore further intensive development of its productive forces is planned.

This region has great prospects and a great future.

The development of productive forces has always involved an increase in water consumption. During the course of our century the intake of fresh water from river systems and underground sources for the needs of the national economy has increased 6-7-fold and the tendency is such that by the end of the century it will significantly increase even more. And this is related to the intervention in the natural conditions of the river systems and bodies of water as well as underground water resources. Water reservoirs are being created which eliminate the flooding of rivers. The influx of fresh water into the mouths is decreasing. Discharges of used water into river systems and other bodies of water are increasing. This, in turn, changes the hydrological, hydrochemical and hydrobiological conditions of the water environment and of the adjacent territories. In practice one almost never succeeds in simultaneously providing for equal and highly effective conditions for all industries that consume water. Frequently as a result of water management

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measures, fishing and agriculture as well as the natural environment as a whole suffer.

Scientific and technical progress makes it possible to reduce proportional expenditures of water per unit of output produced. But even taking this factor into account, an increase in the consumption of water is inevitable both in this region and in others. At the present time about 20 cubic kilometers of water are taken from the Volga alone and they will not be returned. By the end of the century this volume can increase. But it is not permissible to take more and more water from the Volga. This would disturb the water balance of the northern Caspian.

As a result of a long series of years with little precipitation and the removal of water from the rivers of the Caspian Sea basin, the fresh water influx into it is constantly decreasing. As a result, the water level in the sea is becoming constantly lower and in recent years has reached a level that is 28.5-29 meters lower than that of the world ocean. If the level drops even one meter lower, all the shallows of the northern Caspian which produce many fish will be lost. At the present time these shallows are constantly being freshened by the water from the Volga and the Ural, they warm well, they are rich in biogens and they are the basis of the high productivity of fishing in the Caspian region. A further drop in the level of water will lead to a loss of the shallows, they will be dried out, and this will have a negative effect on all other branches of the economy which are related in one way or another to the presently existing coastal zone of the Caspian Sea.

Taking this into account and also the increased need for water of all the southern regions of the Russian Federation, the 25th CPSU Congress entered in its documents: to conduct comprehensive scientific research and, on the basis of this, to begin to develop plans for diverting part of the water of northern rivers into the Volga River basin. At the present time the technical and economic substantiation for solving this problem has been developed. The plan envisions a complex of hydro-technical installations (water reservoirs, pumping stations, canals, hydroelectric power stations and so forth) that provide for putting 19-20 cubic kilometers of water from northern rivers into the Volga Basin each year.

The facilities of the first stage, which involve an overall volume of about 6 cubic kilometers, include installations for taking in about 2 cubic kilometers of water from the Lacha, Vozhe and Kubenskoye lakes and up to 4 cubic kilometers from the rivers of the Upper Sukhona, and this water will be transferred through the Sheksna River into the Rybinskoye water reservoir. It is also intended to remove approximately 3.5 cubic kilometers of water from Lake Onega, which will also be transferred through the Sheksna into the Rybinskoye water reservoir, and 9-10 cubic kilometers from the Pechora River, which will be transferred through the Kama into the Volga.

Technically these structures are fairly simple and their construction will not require large volumes of work, large capital investments or long time period for construction. The greatest complexity of diverting the water consists in evaluating the ecological consequences. Scientific organizations of the country have conducted a fairly broad complex of research. A task was set: to predict the development of natural processes in connection with the change of the water

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conditions of the river systems and territories, to reveal possible negative aspects and to earmark measures which would eliminate these negative consequences or compensate for them.

Considerable investigatory forces have been concentrated on carrying out this task.

Research has established that the removal of fresh water in the earmarked volumes will not cause large-scale changes in the climate either of the territories involved directly or of those bordering on them. The changes will be local. They can be predicted and therefore measures can be developed promptly to eliminate the unfavorable effects on the environment.

Of course it is impossible to avoid completely certain negative consequences. But on the whole, weighing all "pros" and "cons," one can expect that the implementation of this measure will produce a great economic advantage.

What specifically will the diversion of part of the flow of northern rivers into the Volga River basin produce? If one is to single out the main thing, one can say the following.

In the first place this will make it possible to keep the productivity of fishing in the northern Caspian on a high level and to increase it subsequently. In recent years 270,000 quintals of fish of the sturgeon family have been caught here--record catches which were unknown in this region in the past. In the second place, in the Volga Basin and, primarily, in the regions adjacent to it conditions will be created for more successful development of irrigation farming. The increases in irrigated land will exceed 4 million hectares. And, finally, in the third place, the augmentation of water resources of the Volga will prevent immense harm to the national economy which would actually threaten us if these rivers were not diverted.

In view of what has been said, it seems expedient to somewhat strengthen the wording in the draft of the CPSU Central Committee for the 26th Party Congress pertaining to this issue and to enter it in the following redaction:

"To complete technical planning and begin construction of facilities of the first stage of the first section of the diversion of part of the flow from northern rivers into the Volga River basin."

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CSO: 1824/191

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ACADEMICIAN ADVOCATES RIVER REVERSAL PLAN

Moscow EKONOMICHESKAYA GAZETA in Russian No 5, Jan 81 p 7

[Article by S. Ziyadullaev, chairman of the Council for Study of the Productive Forces of the Uzbek SSR Academy of Sciences and member of the Uzbek SSR Academy of Sciences: "Need for More Irrigation in Central Asia"]

[Text] Uzbekistan, the other republics of Central Asia, and Kazakhstan have tremendous resources for further extensive development of the productive forces of the USSR, including agriculture.

The basis of agricultural production in Central Asia and Southern Kazakhstan is irrigation. At the present time the irrigated land in the region amounts to 7.8 million hectares, of which 3.4 million hectares are in Uzbekistan.

A characteristic feature of this region, particularly in the last 10-15 years, is tremendous expansion of hydroeconomic construction and intensive development of new irrigated lands. This is naturally accompanied by rapid increase in the use of water resources. It is enough to note that in Uzbekistan alone during the Tenth Five-Year Plan about 500 thousand hectares of irrigated land were put into use, which has made it possible to systematically increase the production of valuable agricultural crops--cotton, hemp, and grains (particularly rice and corn), vegetables, melons, fruits, grapes, and livestock products.

Further growth of agricultural production and of the associated branches of industry requires radical solution of the problem of increasing the water supply for the long-irrigated lands and for systematic development of the new irrigated lands.

In the future up to 25 million hectares of land may be irrigated and developed in the region, of which the most effective for immediate development are considered to be about 14 million hectares, including up to 8 million hectares in Uzbekistan alone. But the water resources are not adequate for transforming this possibility into reality. The specialists of the scientific-research and planning institutes have estimated that if we maintain the present rate of development of the new irrigated lands the water resources of the two primary water arteries of the region--the Syrdar'ya and the Amudar'ya Rivers--they will be exhausted in the very near future. A radical approach to the resolution of this problem is the

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redirection of part of the flow of the Siberian rivers into Central Asia and Kazakhstan. The resolutions of the 25th CPSU Congress indicated the need for carrying out scientific studies and the implementation on this basis of planning studies of this problem.

Under the direction of the USSR Academy of Sciences and the USSR State Committee on Science and Engineering more than a hundred of the country's scientific-research and planning institutes are carrying out these studies. As a result the general planning agency--Soyuzgiprovdokhoz [All-Union State Planning, Surveying and Scientific Research Institute of Water Management Construction] of the USSR Ministry of Land Reclamation and Water Resources has completed preparation of the technical and economic justification (TEO) for the river reversal plan. The TEO examines the questions dealt with in sufficient depth and from many aspects and sufficiently links the most crucial aspects of the problem of the first stage of the operations with their further development.

In July 1980 the TEO in its final form was presented for review by State experts of USSR Gosplan. However the review council has not yet issued its findings, and this is in turn holding up preparation of the technical plan and beginning of the preparatory work.

The forecast for the development of the productive forces of the Central Asian economic region and of Southern Kazakhstan shows that the shortage of water resources in the near future may have a negative influence on effective utilization of the region's natural and manpower resources. Diversion of part of the flow of the Siberian rivers is a necessary condition for successful performance of the tasks associated with development of the branches of the national economy which are outlined by the long-term prospects of the economic and social development of the republics of Central Asia and Kazakhstan.

It is important to accomplish the diversion in the shortest possible time, before the local water resources have been exhausted. Delay in the schedule for diverting the flow of the Siberian rivers may create a difficult economic situation in the Central Asian republics.

Prior to the arrival of the Siberian water we must obviously maximize the mobilization of all the internal reserves toward more effective use of water resources. The primary directions and a system of organizational, economic, and production and technical measures for the most complete, rational, and economic utilization of the existing local water resources have already been defined.

Most important in the system of planned measures are accelerated construction of large and small water reservoirs for seasonal and perennial regulation of river flow and reconstruction of the existing irrigation systems. The most complex part of these operations is the complete reconstruction of land usage and water utilization within the economy. The overall cost of the operations associated with reconstruction of the systems is estimated to be about 8-8.5 thousand rubles per hectare. Considerable time and large capital investments will be required for these measures.

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The entire system of measures listed above is already being put into operation. But calculations show that the guaranteed additional flow which will be obtained as a result of construction of water reservoirs, and also the savings of water as a result of reconstruction of the old systems, will be completely utilized in an increase in the ability to supply water of the existing irrigated land.

Thus, the increasing water resource deficit cannot be completely compensated by utilization of the internal reserves. Therefore the work on construction of the canal and reconstruction of the irrigation systems must be carried out simultaneously.

We should also point out the not unimportant fact of deterioration of the existing water resources. According to the predictions of the scientific institutes the mineral salt content in the irrigation water of the lower reaches of the Amudar'ya and Syrdar'ya will increase. The danger of intense salinization, reduction of the fertility, and withdrawal of irrigated lands from the agricultural cycle will increase. This danger will intensify as a result of the lack of fresh water for flushing of the land, which can be obtained in large volume only through use of the flow of the Siberian rivers. Even today in many regions of the Syrdar'ya and Amudar'ya basin because of the severe shortage and deterioration of the quality of the water resources it is more and more often necessary to take measures to terminate irrigation and dry out fields which have already been planted in rice, corn, vegetables, fruits, and alfalfa in order to supply water to the cotton fields.

In view of the increasing shortage of water resources, expansion of the irrigated lands through utilization of the local resources will be sharply curtailed in the near future. To this we should add that according to the available predictions the population of the Central Asian republics will nearly double in the next 20 years, and the demand for foodstuffs with account for the needs of the other regions of the country will increase still more.

The influence of the shortage of water resources is not limited to agriculture alone but also extends to the associated branches of the agro-industrial complex, which involves nearly half the workers occupied in the social production of the republic.

The fate of the Aral Sea also is a worrisome question. The intense development of the new irrigated areas is accompanied by increasing demand for the water resources of the Amudar'ya and Syrdar'ya and reduction of water inflow to the Aral Sea, the level of which has dropped by seven meters during the last 15 years and continues to fall. The negative consequences of this are felt in the Kara-Kalpaks ASSR and the Khorezmskaya Oblast of Uzbekistan, the Tashauzskaya Oblast of Turkmenia, and Southern Kazakhstan.

The scientific 'institutes' predictions of the influence the lowering of the level of the Aral Sea will have on the environment deserve particular attention. To prevent negative consequences of the drying up of the Aral Sea protective and compensating measures to ensure minimal limiting dimensions of the water surface area and level of the Aral Sea should be developed in time, under the guidance of the USSR Ministry of Land Reclamation and Water Resources.

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As is seen from the above analysis, timely diversion of part of the flow of Siberian rivers into our region is becoming of paramount importance for further extensive development of the productive forces and successful realization of the food program of the country.

Therefore we are introducing a proposal in Section V of the draft Basic Guidelines, where territorial redistribution of water resources is discussed. This proposal is as follows: "To complete the scientific and planning studies on the diversion of the waters of Siberian rivers into Central Asia and Kazakhstan, and in the Eleventh Five-Year Plan to begin preparatory work for the initial stages of the diversion."

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CSO: 1829/166

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POTENTIAL BENEFITS OF RIVER REVERSAL: DEVELOPMENT OF KARSHINSKAYA STEPPE

Tashkent KOMMUNIST UZBEKISTANA in Russian No 1, Jan 81 pp 44-48

[Excerpt from article by Corresponding Member of the Uzbek SSR Academy of Sciences K. Bedrintsev and Candidate of Economic Sciences P. Kalyakin: "Formation and Development of the Kashkadar'inskiy Territorial Production Complex"]

[Excerpt] The foregoing indicates the need to carry out more thoroughgoing development of the Karshinskaya steppe as soon as possible by implementing a systematic overall program to develop it as a territorial production complex (TPK). The scientific bases for a program of this type has been developed by the Uzbek SSR Academy of Sciences Council for the Study of Productive Forces and the republic Gosplan in conjunction with a number of scientific research and development organizations. Let us review the most important aspects of these bases.

Land and Water Resources

The Kashkadar'ya and the Amudar'ya are the principal sources of irrigation in Kashkadar'inskaya Oblast. Over the past 15-20 years, the water supply here has been increased considerably through construction of the Karshinskiy main canal and a number of reservoirs, and through measures taken to reduce water loss from seepage. As a result, the amount of irrigated land in the oblast increased to 355,000 hectares by 1980.

According to data from the Uzbek SSR Ministry of Water Management and Glavsredazir-sovkhovstroy [Main Administration for Central Asian Sovkhoz Irrigation System Construction], in the future only 690,000 hectares of the overall area suitable for irrigation in Kashkadar'inskaya Oblast--1 million 430,000 hectares including 960,000 hectares in the Karshinskaya steppe--can be irrigated, even with more complete utilization of the water resources of the Kashkadar'ya basin and the delivery of water to the Karshinskaya steppe from the Amudar'ya in the amounts established by the Plan for Comprehensive Utilization of Water Resources of the Aral Sea Basin, developed in 1973 by the Sredazgiprovodkhopok Institute [Central Asian State Institute for the Planning of Irrigation Structures and Rural Electric Power Plants]. The remaining area could be irrigated following diversion of part of the flow of Siberian rivers to Central Asia. An important and pressing problem in the development of irrigation facilities is the provision of equipment for the main Kyzylayakskiy water supply center on the Amudar'ya. Lack of this equipment is delaying development of the Karshinskiy land and postponing it to a later date.

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UZBEK WRITERS UNION ADVOCATES RIVER DIVERSION

Union's First Secretary Comments

Tashkent OZBEKISTAN MADANIYATI in Uzbek 9 Jan 81 pp 1-2

[Article by Sarvar Azimov, Uzbek Union of Writers first secretary: "Writers' Readiness--to the People and the Party"]

[Excerpt] The report of the CPSU Central Committee to the 26th Party Congress serves as a basis for drawing up the state plan in the 11th Five-Year Plan. Nationwide discussion of the report encouraged feelings of patriotism and there is no doubt that in the process it reinvigorated the political activity of the popular masses and the elevation of labor.

As a result of the Leninist national policy of the Communist Party and the Soviet government Uzbekistan has achieved great victories in his historical development and in the construction of a developed socialist society. Uzbekistan's workers esteem most highly a document which was signed by Vladimir Il'ich Lenin and which is of unparalleled importance. This is the Reclamation Decree of Mirzachul'.

Our intense times put forward completely new and complicated tasks. In our opinion the time has come for diverting part of the water of the great Siberian rivers to Central Asia and Kazakhstan. According to estimates of specialists the work to be done will justify itself in a short time with the fruits of Soviet Asia's soil, and a considerable share will be added to solving the problem of supply the whole Soviet population with food.

In the CPSU Central Committee's draft (Section V, Development of the Agroindustrial Complex) this task is described as follows: "The preparatory work for diverting part of the water of the northern rivers into the Volga basin should be initiated; and the scientific and planning work of diverting the waters of those Siberian rivers into Central Asia and Kazakhstan should be continued."

In consideration of the immense importance in the economic development of the Soviet Union which involves the transformation to productive soil of the unreclaimed land of the eternal Central Asian region and Kazakhstan, and of expediting the practical solution to the above-mentioned problem, we have edited the CPSU Central Committee draft as follows: "Having considered the feasibility of realizing the plan to irrigate these lands in order to provide the potential for carrying out in a planned manner the work preparatory to developing the virgin lands of Central Asia and Kazakhstan, scientific, planning and practical work

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should be expedited during the 11th Five-Year Plan, with the aim of diverting part of the water of the Siberian rivers to Central Asia and Kazakhstan."

In the section "Protection of the Environment" of the CPSU Central Committee draft the necessity of accelerating the construction of facilities for storing the waters of the Black Sea, Azov Sea, Baltic Sea and Caspian Sea basins has been accurately depicted. The appearance of disturbing conditions in the Aral Sea basin has attracted attention, and in our own view it is appropriate to include the Aral Sea in the draft, on the list, after the Black Sea, Azov Sea, Baltic Sea and Caspian Sea.

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CSO: 1810/069

Uzbek Report on Meeting

Tashkent OZBEKISTAN MADANIYATI in Uzbek 9 Jan 81 p 1

[Commentary under the heading "In Honor of the 26th CPSU Congress--New Goals of Victory: The Means of Putting Artistic Words Into Action"]

[Excerpts] Uzbekistan's Peoples Poet Turob Tola, secretary of the main party organization of the Uzbek Union of Writers, convened the open party meeting. First Secretary of the Uzbek Union of Writers board of directors, Sarvar Azimov, reported "Concerning the CPSU Central Committee's Report to the 26th Party Congress on 'The Basic Directions of the USSR's Economic and Social Development for the Period 1981-1985 and Up to the Year 1990' and the Tasks of Uzbekistan's Writers."

Discussion of the report was begun by Uzbekistan People's Writer Nazir Safarov: "Proceeding from the necessity of considering our country eternal and our people prosperous I would wish for the diversion to Uzbekistan of part of the water of the rivers of Siberia, especially the Irtysh, Yenisey and Ob' rivers.

"In my works I have often addressed the question of water, which is the source of life, and have written of the Chorroq Dam. I have also depicted the beginning of construction of the Uzbekistan-Irtysh canal.

"In the report the necessity of protecting the water of various sea basins has been especially affirmed. I, too, fully support the suggestion, as it was expressed in the address, about the necessity of placing the Aral Sea in the list of those seas." - [Thus spoke] writer Birmushin, chief editor of the journal SHARQ YULDUZL.

Section director Mikhail Grebenyuk of the journal ZVEZDA VOSTOKA said, "Works by Uzbekistan's writers and journalistic articles of various types which are published regularly in the pages of our journal discuss every sort of topic. The main topics of writing we will publish in the future are the efforts being made by Uzbekistan's workers to reclaim unworkable land, the courage of our unselfish people who are spreading life-giving water to the barren waste and the construction by industrial factory workers.

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"For several years now ZVEZDA VOSTOKA has posted correspondents in Dzhizakskaya Oblast. The life of the herdsmen, completely devoted to bravery and steadfastness, is always a center of attention in our journal. We know very well what vital importance a single drop of water has in those places. The reclamation of new lands requires the creation of completely new sources of life-giving water. For this reason maintenance of the Aral Sea basin is of ultimate importance. Our collective, observing the wishes of a large number of our journal's readers, proposes inclusion in the report on Basic Directions of a sentence about continuing to look after the Aral Sea."

Laziz Qayumov, editor of the newspaper OZBEKISTAN MADANIYATI said this: "The meaning of the great changes that have taken place in our lives is, in my opinion, uniquely embodied in the fact of the more than six million tons of our 'white gold' which were amassed in last year's harvest. The riddle of water, beyond the caprice of climate, stands athwart the working struggle which goes on in order to deliver such harvests to the homeland. As a result of decisive and immediate measures undertaken by the party and our government the difficulties will be avoided in good time. The appearance of urgent and pressing problems of supplying the stability of steadily increasing cotton production is natural, and diverting some of the water of Siberia's rivers to serve the Aral Sea basin has become one of the problems confronting our life.

"In our day feelings of homeland are not confined to narrow geographic boundaries. The matter of the riddle of water which confronts our nation was discussed by the active members of the oblast party-economy in Tyumen' at the last meeting of the USSR Union of Writers. It was noted not only in connection with scientific and theoretical problems, but spiritual and moral problems as well. It is necessary for the writer to understand the essence of such problems and to contribute his own share to their solution.

"By its size and scale, and from the point of view of the great tasks which it has set out concretely, the CPSU Central Committee report to the 26th Party Congress is a great document of our time. I completely agree that those suggestions which have been proposed in our meeting should be noted in that document.

"The Draft Basic Directions is an important program for our continuous creative activity."

"At the present time the man of every sphere," said Shamid Alidin [name unclear], chief editor of the journal YYLDYZ, "is a conscious worker who understands very well the basic essence of the work assigned to him.

"Truly the Draft Basic Directions is a great document aimed at economic and social development and expansion of people's prosperity for many years. We writers must profoundly exhibit in our works the essence of such great demands and provide for their implementation in line with our heroes.

"Some important suggestions have been mentioned here about editing certain places in the report. Certainly the diversion to Kazakhstan and Central Asia of part of Siberia's rivers and maintenance of the Aral Sea basin are extremely vital matters. I am in full agreement and support those suggestions."

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Turob Tola, secretary of the Uzbek Union of Writers main party organization, summarized the matter.

Based on debate and discussion of the subject, the open party meeting of the Uzbek Union of Writers accepted an appropriate resolution "Concerning the CPSU Central Committee's Report to the 26th Party Congress on 'Main Directions of the USSR's Economic and Social Development for the Period 1981-1985 and Estimated Up to the Year 1990' and the Tasks of Uzbekistan's Writers."

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CSO: 1810/069

PRAVDA VOSTOKA Report

Tashkent PRAVDA VOSTOKA in Russian 14 Jan 81 p 2

[Article by P. Borisov: "To Reflect Worthily the Labor of Our Contemporary; From the Party meeting of the Uzbek Union of Writers Union"; passages printed in italics enclosed in slantlines]

[Excerpts] A most important document which specified the activity of the Communist Party in further resolution of the far-reaching tasks of Communist construction, the draft of the CPSU Central Committee for the Twenty-sixth Party Congress, was discussed in an open party meeting of the republic's writers.

Sarvar Azimov, first secretary of the managing board of the republic's Writers' Union presented the report "The CPSU Central Committee Draft for the Twenty-sixth Congress of the Communist Party of the Soviet Union 'Basic Directions for the Economic and Social Development of the USSR for the Years 1981-1985 and for the Period to 1990' and the Tasks of Uzbekistan's Writers."

He told of the active, genuinely nation-wide discussion of questions of our economic and social policies, prospects and the ways to develop the national economy of our Motherland.

The speaker, having noted the considerable attention which the CPSU Central Committee project devotes to all aspects of the development of our country during the coming decade, dwelt in particular on the section devoted to the development of the agroindustrial complex, particularly on the following formulation: /"...to begin preparatory work on the diversion of part of the flow of northern rivers into the Volga river basin, as well as to continue scientific and planning studies on diversion of the flow of Siberian rivers into Central Asia and Kazakhstan."/

It is proposed that this formulation be written in the following version:

/"To accelerate the scientific, design and practical operations on diversion of part of the flow of Siberian rivers into Central Asia and Kazakhstan during the Eleventh Five-Year Plan, so as to make possible the execution, according to plan, of the preparatory measures for the development of new lands in Central Asia and Kazakhstan."/

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Another proposal was also introduced. An unfavorable situation has developed in the Aral Sea basin. Therefore, in the section "Environmental Protection," where the necessity for accelerating construction of water storage facilities in the Black, Azov, Baltic and Caspian Sea basins is properly and providently noted, /the Aral Sea should be inserted into the list of seas after the Azov Sea./

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CSO: 1829/178

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IMAMALIYEV ON RIVER REVERSAL IN CONNECTION WITH AGRICULTURE

Tashkent PRAVDA VOSTOKA in Russian 16 Jan 81 p 2

[Article by A. Imamaliyev, director of the All-Union Scientific Research Institute for Cotton Growing, academician of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] in the column "Discussion of the CPSU Central Committee Plan": "Problems of Irrigated Farming"]

[Text] "To achieve a comprehensive increase in the efficiency of irrigated and dry land usage and a reduction in the time required for producing the planned yield on these lands."
(from the CPSU Central Committee Draft for the 26th Party Congress)

In past years our republic's workers have achieved great success in intensifying agricultural production, increasing the yield and improving the quality of cotton and other crops. More than 6 million tons of cotton were harvested for the first time in 1980. The average yield of this crop was 31.7 quintals per hectare country-wide and 33.2 quintals per hectare in Uzbekistan.

As a scientific and specialist working in the cotton growing field I would like to present my own thoughts on some very important problems in irrigated farming. As the CPSU Central Committee Draft indicated, our party is paying unusual attention to the problem of developing and reclaiming land. In Uzbekistan alone nearly half a million hectares of new land are put into crop rotation during each five-year plan. Unfortunately, the water resources of Central Asia restrict further development of new land and scientists calculate that these resources will be almost completely exhausted after 1985. Meanwhile, if there were water sources for the territory of Central Asia and Kazakhstan, some tens of millions of hectares of land could be developed and produce a guaranteed harvest of cotton, grain, vegetables, cucurbits, potatoes, fruit and grapes. Along with this several harvests of grain and fodder could be produced in a single season, thereby solving the problem of providing a food supply for livestock.

But the work on diverting part of the northern and Siberian river flow to Central Asia and Kazakhstan is proceeding slowly. There has been a lot of controversy about it. Studies by scientists world-wide and in our country have demonstrated the groundlessness of any doubts whatever about the project. A record harvest of

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cotton and other crops has been made possible through the active modification of nature by the Soviet people in developing and reclaiming new land, constructing large reservoirs and irrigation systems and adopting new technology for soil cultivation, chemical fertilization, mechanization and so on. It should be remembered that the Central Asian and Kazakhstan region is very suitable for intensive farming. Capital investments for the development of irrigation are repaid quite rapidly here. For this reason, we believe that work on diverting part of the northern and Siberian river flow to Central Asia and Kazakhstan should be accelerated.

Increasing the soil fertility is the main problem facing agricultural science. "Land is a priceless natural resource," comrade L. I. Brezhnev has said. "And we must preserve it and increase its productivity." At present we are using mineral fertilizers to produce more than half of the harvests of farm crops. Mineral fertilization along with crop rotation increases the yield even more effectively. The many years of experience of SoyuzNIKHI [All-Union Scientific Institute of Cotton Growing] show that cultivation of cotton plants without employing mineral fertilizers and crop rotation yields 12-14 quintals of cotton per hectare. Mineral fertilizer application increases the yield to 34-36 quintals. And, finally, mineral fertilizers used in conjunction with crop rotation yield 43-46 quintals per hectare. The enormous value of organic and mineral fertilizers in preserving and augmenting soil fertility is apparent from this. Unfortunately, the necessary attention is not always paid to applying them correctly.

At the All-Union Agronomy Conference, it was emphasized that a lowering of the soil's organic content, especially the humus content, is being observed in almost all areas of our country as indeed throughout the world. The soil's humus content is the primary criterion of its fertility. According to the calculations of our scientists, the humus content in cotton growing zones has dropped to 33 percent over the last 5-10 years although the yield is being kept at a high level, mainly through the application of mineral fertilizers. However, the quality of the harvest seems to have deteriorated. This is certainly understandable; mineral fertilizers, even the most complex, contain only a few useful elements such as nitrogen, phosphorus, potassium and sometimes zinc and copper. But the largest possible combination of elements, several dozen, is needed for normal plant growth and development. Plants under cultivation take almost all of the elements they need from the soil, leading to a reduction in its fertility. Crop rotation, the basis of intensive farming in all areas of our country, is the main source of enrichment for the soil's fertile layer. A uniform system of crop rotation has been developed for the cotton growing zone of the country, which increases soil fertility and yield and sharply reduces the morbidity of cotton from wilt and its vulnerability to insect pests. Alfalfa cultivated either in pure form or mixed with corn, sorghum, sudan grass or other grains plays the predominant role in cotton rotation. Over a three year period, a stand of alfalfa leaves as much as 600 or more kilograms of biological nitrogen and up to 25 tons of organic residue in each hectare, improves the physico-chemical composition of the soil, promotes the propagation of useful microorganisms in the soil and sharply increases the effectiveness of mineral fertilizers, preventing their leaching from the fertile layer. The problem lies in the adoption of scientifically-based crop rotation schedules throughout the republic's agriculture in the near future.

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Scientific bases for obtaining high-quality and uniform harvests of agricultural crops depend on efficient use of solar energy and water with minimal damage to the plants from pests, diseases and weeds in addition to soil fertility.

Water plays a special role under the conditions in Central Asia. Building modern canals and ditch systems has sharply reduced water loss along the route from the source to the plant. Much is being done to make maximum use of water in the fields. But, unfortunately, much remains to be done to increase its efficient use. Above all, it is necessary to implement a capital plan for the fields. This will bring about uniform irrigation, efficient utilization of soil fertility, the production of steady, uniform and full-quality growth of cotton seedlings, the bases for obtaining a high-quality and early harvest. In addition, the appropriate equipment and technology are required for successful solution of these problems.

In the irrigated farming zones of our country great success has been achieved in producing and increasing the yield of many crops. Among the leading countries of the world we are producing the largest harvests of cotton, rice, corn, alfalfa, fruit and grapes. The challenge lies in ensuring the further progress of agriculture. But the active assistance of science is required for this, especially in breeding, seed growing, working out a scientific basis for developing and reclaiming new lands, efficient use of water resources, automation and mechanization of production, chemical fertilization, plant protection and farm economy and management. It will be necessary to accelerate the adoption of scientific advances in farming and to strengthen the bond of science with production. To do this we must proceed more boldly toward developing scientific production and scientific training associations. Everything possible is being done in our country to improve the life of the Soviet people. The scientists of Uzbekistan are striving to make a worthy contribution toward implementing the agrarian policy of our party.

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CSO: 1829/149

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ENVIRONMENTAL CONCERNS, WATER CONSERVATION, AND RIVER DIVERSION

Moscow TRUD in Russian 17 Jan 81 p 2

[Article by B. Laskorin, academician, chairman of the All-Union Council of Scientific-Technical Societies for Environmental Protection: "Priceless Water"]

[Text] Water is life. Meanwhile, in a number of regions surface water is so contaminated that in the immediate future it will not be able to serve as a source for potable water supply. This is why the time has come to devote greater attention to subsurface water. To use it as potable water there is a requirement for serious work and, consequently, for considerable capital investments which should be envisioned in good time in the plans for the development of the country's national economy. But there is also a second side to this problem. Until recently, we underestimated the pernicious nature of the consequences from the contamination of subsurface water and did not attach the proper significance to its protection against harmful run-off.

In the performance of mining work, drilling, construction, and the operation of mines and quarries it is necessary to envision measures to purify and use subsurface water which is obtained at the same time and to prevent the contamination of aquifers. All plans for geological technology, especially when working out methods for the underground leaching of various minerals, should be created in such a way that the contamination of subsurface water is completely prevented. The disposal of run-off containing harmful, toxic compounds or increased saline composition into underground aquifers is impermissible just as in surface sources.

However, a favorable technical and economic impact of closed water circulation may be obtained only in the case where the problems of local water purification, utilization of valuable components which are contained in it, and the maintenance of a constant saline composition of the circulating water will be solved. For these purposes, even now various distillation units--evaporative and membrane--are being used successfully. /In the plan of the CPSU Central Committee, it is desirable to envision recommendations for the more complete development, introduction, and elaboration of highly effective desalinization methods/ [in boldface].

In this connection, several words should be said about plans to divert part of the flow of the northern rivers to the southern regions of the country. In the draft "Basic Directions," it is planned to begin the conduct of preparatory work to divert part of the flow of northern rivers to the basin of the Volga River.

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It is believed that for the present these recommendations are premature. In the opinion of many specialists, now there are still no sufficiently convincing scientific-technical, technical-economic, and other data for the unambiguous solution of this problem and, therefore, it would be more correct to limit ourselves to more modest tasks for the next few years: /to accelerate the elaboration of the scientific feasibility and expediency of the partial diversion of the flow of northern rivers to the south/ [in boldface].

It should also be kept in mind that the transfer of river flow from northern regions to southern ones will not completely solve the problem of improving the qualities of surface water.

One more consideration. Of the total volume of the water consumed by industry, almost 45 to 50 percent is expended on cooling heat-exchange processes. Meanwhile, a number of enterprises of the petrochemical, chemical, and other branches have been using air cooling successfully for several years, as a result of which specific water consumption is being reduced several fold. /In the 11th Five-Year Plan, the wider introduction of air cooling methods should be envisioned and the production of the necessary equipment should be planned for this/ [in boldface]. A significant savings may be obtained when implementing measures to reduce the specific consumption of water in agriculture, in irrigation.

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CSO: 1824/190

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INTERVIEW WITH GEOGRAPHER V. S. PREOBRAZHENSKIY

Moscow SOVETSKAYA ROSSIYA in Russian 18 Jan 81 p 4

[Interview with Vladimir Sergeyevich Preobrazhenskiy, doctor of science, deputy director of the Institute of Geography, by S. Stepunina: "Without Abandoning Romance"]

[Excerpts] Our desire to "set off into the distance," to take a trip--and not just one!--through our native Russian expanses led us to a snowy corner beyond the Moscow river with the wonderful name Staromonetnyy. Here in the snow in a humble private dwelling is the academic Institute of Geography which can be classed as a staff of travelers. And Vladimir Sergeyevich Preobrazhenskiy, doctor of sciences and deputy director of the institute, is one of the generals of the staff of geography. Preobrazhenskiy says in his typical energetic manner, which is almost comical, turning to a guest: "Comrade chief," so our analogy with a staff can be applied here without objection.

[Answer] The essence of these new requirements on geography was formulated by the first of the soviet geographer-academics, Innokentiy Petrovich Gerasimov, the director of our institute. He earmarked ways of transforming it from a science that was mainly descriptive and informational into a science that is experimental and transformational. "I have in mind," wrote academician Gerasimov "problems of constructive transformation of nature." Constructive geography is a child of the '60's, one of the youngest sciences of modernity. I do not wish to offend traditional romanticism. We geographers are always nomads in spirit. It is difficult for us without a "field." But to improve natural conditions according to the previously earmarked scheme--construction--this dry phrase sounds extremely elevated to us. We modern geographers see in it the romance of truly scientific activity, search and discovery.

[Question] Everyone understands traditional geographical discovery, be it the discovery of Columbus, the Laptev brothers or Vil'kitskiy. Can the young constructive geography really speak about its discoveries or just about accomplishments?

[Answer] Undoubtedly. Here before us is a newspaper which has published the party document "Basic Directions for the Economic and Social Development of the USSR During 1981-1985 and the Period up to 1990." This, in addition to everything else, is a great scientific work, the fruit of the efforts of many scientists and various sciences. Look at the marks from the colored pen which I had in my hand when I

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read the document. All these are notes that not only pertain to us directly, but in many cases they are points based on data from modern geography. Frequently they are the fruits of our many years of work.

I shall begin with the point dearest to my heart: "To complete planning work for the Udokan copper deposit . . ." L. I. Mukhina's and my expedition was one of the first to arrive at Udokan immediately after the geologists who discovered the deposit. That traditional geographic discovery of glaciers which we discussed earlier was accompanied by a comprehensive study of the relief, climate and so forth, which was to confirm for the planners the possibility and ways of assimilating the riches of Udokan. Our science's constructive role was manifested even more clearly in another point of the document: "To begin to conduct preparatory work for diverting part of the flow of northern rivers into the Volga River basin . . ." This immense transformation was deeply studied in terms of the possible consequences. For instance there was the critical question: will the forests not begin to dry out if part of the water is diverted? And we answered a number of equally difficult questions before giving the "go ahead." Notice that the problem of diverting Siberian rivers into Central Asia and Kazakhstan was formulated in the document in a different way--to continue scientific developments This is no accident, for science has still not weighed everything related to the creation of the new natural design.

Some people might find it strange, but we are also directly involved in the wording in the document of such a task as improving the organization of people's recreation. Social geography is now devoting a very great deal of attention to this. There has also appeared another area--recreational geography. A whole complex of issues arose, for example, regarding such a region as the Caucasian Mineral Waters, which seemed to assimilated. New Narzan springs were opened near Kislovodsk, and the engineering task of delivering the water over 40 kilometers was solved in a unique way. But what are the results of this? Increased numbers of people engaging in recreation involves increased services and growth of the city, and this is a minus, for it goes against the requirements of the health resort. A new natural economic design which is substantiated by science must take into account everything, right down to the place for grazing sheep, for this, in turn, affects the quantity of Narzan water. If the land is trampled down by livestock, rain water can not penetrate as well, and the underground mineral streams require this natural supplement . . .

[Question] In one of your speeches, Vladimir Sergeyevich, you designated a special cohort of advocates of geography. What did you mean by advocates of geography?

[Answer] A clear example of this glorious cohort is Professor D. L. Armand, the author of an excellent book entitled "For Us and Our Grandchildren," one of the first Soviet publications in the area of environmental protection. If we have now achieved a certain amount of success in the formation of public opinion regarding a thrifty attitude toward nature and responsibility for it, this did not take place without the participation of advocates of geography. Glory and honor to them! And good luck in the future!

They are closely interwoven today--the fate of people for whose happiness all of our immense plans are intended, and the fate of nature, which, in turn, has such an

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influence on the health and well being of the people . . . And today geography, by solving its new constructive problems, simply can not consider these most complex systems of modernity separately; nature, economy and the population. Geography integrates and unites them and thus enters on the main path of human progress. Therefore should one really be surprised about our prediction of the forthcoming "century of geography"?

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ADVANTAGES OF DIVERTING NORTHERN WATERS TO THE SOUTH

Moscow IZVESTIYA in Russian 25 Jan 81 p 2

[Article by Yu. Zhdanov, chairman of the Northern Caucasus Scientific Center of the High School, corresponding member of the USSR Academy of Sciences, I. Vorovich, director of the Scientific Research Institute of Mechanics and Applied Mathematics, corresponding member of the USSR Academy of Sciences, P. Serdyuk, director, and O. Koren'kov, deputy director of the Yuzhgiprovodkhoz Institute (Rostov-on-Don): "From the Volga to the Don"]

[Text] The draft of the Basic Directions devotes considerable attention to the distribution, regulation and efficient utilization of fresh water resources. This problem is becoming especially crucial on the southern slope of the European territory of the country, where more than half the population and only 9 percent of the river flow are concentrated.

This is why all kinds of support should be given to the proposal of corresponding member of the USSR Academy of Sciences, G. V. Voropayev (IZVESTIYA, no 304 for 1980) to accelerate the implementation of the first part of the diversion of part of the flow of northern rivers into the Volga. It seems to us that in order to solve the problem completely it is necessary to take additional measures immediately, particularly the diversion of the river flow from the Volga into the Don, subsequently moving the water all the way to the interfluvium of the Don and the Kuban' (Krasnodarskiy and Stavropol'skiy krais) in order to satisfy the crucial needs of water management in the Azov Sea basin.

The Azov Sea has exceptional conditions which provide (with the observance of a complex of ecological conditions, including maintenance of a certain level of mineralization of the water) for the reproduction of more than 40 kilograms of valuable kinds of fish per hectare of surface or up to 150,000 kinds of delicacies a year. At the present time the balance of natural fresh water resources in the Azov Sea basin is extremely strained, which is beginning to exert a retarding influence on the development of the region's production forces--industry (atomic energy, chemistry, ore enriching and other labor-intensive kinds of production), agriculture (irrigation, which covers 1.6 million hectares) and fishing. Since to cover the shortage of the river flow in the Azov Sea by bringing highly mineralized Black Sea water through the Kerch Strait causes ecological damage, the data that have been cited confirm quite clearly that: the region that most needs outside fresh water resources in the south of the country's European territory is primarily the Azov Sea basin.

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The Soyuzgiprovodkhoz Institute imeni Ye. Ye. Alekseyevskiy and the USSR Ministry of Land Reclamation and Water Management in 1977 drew up the "Technical-Economic Substantiation for the First Part of the Diversion of Some of the Flow of the Volga into the Don," which is being considered by the state expert commission of the USSR Gosplan. A system of hydrotechnical installations was developed and the cost of the construction was calculated; the volume of water to be diverted into the basin of the Azov Sea was established at 6 cubic kilograms per year; the ecological need and the economic effectiveness were determined; and the effects of this on the water balance of the Caspian Sea were also considered.

The technical and economic substantiation of the first part of the diversion of some of the water from northern rivers into the basin of the Volga River also envisions the transfer of part of the additional water resources of the Volga into the adjacent Ural and Don river basins. Therefore since the problem of diverting the flow of northern rivers has been included in the category of urgent tasks of the Eleventh Five-Year Plan, the discussion about concrete sources of compensating the Caspian for the river flow that is diverted from the Volga into the Don loses its practical significance. The availability of such compensation within the Caspian Sea basin (damming the Kara-Bogaz-Gol) justifies raising the question of accelerating the implementation of the first part of the diversion of water from the Volga to the Don because of the fact that the Azov Sea region is the basin with the greatest shortage of fresh water resources.

According to predictions of scientists and specialists, in order to provide for planned socio-economic development of such an important region on the scale of the country as the Azov Sea basin is, the construction of the complex of structures on the route of the first section of the diversion of some of the river flow from the Volga into the Don should be completed no later than the Eleventh Five-Year Plan. Prompt (before 1990) implementation of the plan for transferring 6 cubic kilometers of river water from the Volga into the Don will provide for functioning of the water management complex in the Azov Sea basin which is normal in the socio-economic and ecological aspects, and the time period for recouping capital investments will not exceed 5-8 years.

As a result of the additional water resources and the complex of measures in the Don and Kuban' basins, more than a million hectares of irrigated land will be put into operation, mainly in the arid zone of the steppe chernozem plains of the Don-Kuban' interfluve--one of the most fruitful and arid regions of the country. The ecological system of the Azov Sea will be restored to a condition that is close to the natural balance. It will be possible to develop the basin's river system using its potential resources.

Taking into account what has been said, it seems expedient to refine the formulation of the fifth section of the draft of the Main Directions, replacing the paragraph beginning: "To begin to conduct preparatory work for diverting part of the flow of northern rivers into the Volga River basin . . ." with the following text:

"To develop a long-term program for the optimization of water resources of the country's European territory, to complete technical planning and to begin to construct facilities for the first part of the diversion of some of the flow of northern rivers into the Volga River basin and--at rapid rates--from the Volga into the Azov Sea basin."

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GEOLOGISTS URGE CONSIDERATION OF EFFECT ON ARAL SEA, OTHER RESULTS

Tashkent PRAVDA VOSTOKA in Russian 27 Jan 81 p 3

[Article by P. Chistyakov, deputy director, UzSSR Academy of Sciences Institute of Geology and Geophysics, candidate of geological-mineralogical sciences, UzSSR meritorious geologist, and I. Rubanov, candidate of geological-mineralogical sciences: "Resolve The Problem Comprehensively--Various Aspects Regarding The Diversion of Siberian Rivers"]

[Text] Many scientists, irrigation specialists, land reclamation specialists, and agricultural specialists in Central Asia and Kazakhstan have already firmly recognized: in a short time, the waters of Siberia will arrive in their region. The necessity for constructing a great canal arose some time ago. It has been and will continue to be reflected in many party and state documents, and has now been included in the CPSU Central Committee draft of the 26th Party Congress. There is no doubt that these outlines will be translated into actual construction.

As a result, it would appear that it is necessary to be morally prepared today to receive the Siberian waters. The most important factor is to study and learn the most rational way to utilize this valuable moisture. Considerable experience in such work has been amassed in this region, but the reserves here are still vast.

Will we always be capable of organizing intelligent approaches to water use?

Over the course of the past 15 years, through leakage of discharge and drainage waters the vast Sarykamyshskoye Lake has formed in the Kyzylkum, the depth of which in places reaches 40 meters. Flood and return waters also flooded a number of other major depressions, Arnasay, Dengizkul', and Aydar. Unproductive losses of water continue, while the Aral is growing more shallow.

For 10 years now, the Syrdar'ya does not carry its waters to the sea. Its entire mouth area discharge is detained in the area of the delta by a dam. A vast lake-marshland area has formed here, intensive evaporation taking place from its surface. Is it efficient to detain the water before the mouth, depriving the Aral itself of additional feed water?

Or to take the experience of operating the Karakum Canal? It is not just a case that the structure collects almost one-third of the waters of the Amudar'ya. It is much worse that a considerable amount of the water goes for nought--it is lost to evaporation and filtration, not only in the canal itself, but in numerous shallow

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overflow lakes along its channel route. Inasmuch as the shallow reservoirs heat to a greater extent, evaporation from their surfaces is more intensive.

Losses of water due to filtration are extremely great.

The latter fact gives cause for serious concern: would it not be more economical to face the river bed from Siberia to Central Asia with concrete? Of course, this would require considerable investment. But after all, is it cheaper to endure the water losses? Perhaps it is necessary to direct the efforts of the scientists toward development of a new technology for facing the channel, particularly in areas with friable soil? It is a fact, for example, that currently barkhan (isolated sand dunes) sand is used for the production of silicate bricks. Is it impossible to find a method of facing and sweating the sand directly on the slopes of the channel (for example, with the use of a laser device)? The glass-like layer so formed, water-resistant, might save many millions of cubic meters of water from filtration, and deliver them, figuratively speaking, "not having spilled", to the consumer. At the same time, possible salinization of water might be avoided.

A number of other aspects of the project to divert the Siberian waters warrant closer attention. In our view, insufficient study has been made of geological-lithological characteristics of the passage zones for the main channels. No seismic studies are being conducted at all. These studies, after all, are of primary significance. A lack of information regarding soil composition may result of information regarding tectonics and seismicity can lead even to the disabling of certain of its sectors in the event of a strong earth tremor. It is our conviction that it is necessary to mount serious research in the areas cited.

We should like to emphasize that the problem of diverting the Siberian river waters to Central Asia and Kazakhstan must be resolved comprehensively in conjunction with the Aral Sea problem. An assiduous, conservation-oriented use of the natural river flows of our region will reduce the government-wide expenditures for developing its industrial uses, and to minimize the undesirable consequences of water shortages, and will, to a considerable extent, improve the condition of the ever-shallowing Aral.

In discussing the CPSU CC draft for the 26th Party Congress, a number of the country's scientists have already proposed in PRAVDA VOSTOKA specific measures to accelerate preparation work, and scientific and planning for the diversion of Siberian rivers to Central Asia and Kazakhstan.

Joining them, we also propose in Section IX of "Protection of Nature" of the CPSU CC draft, that after the words "to continue the work to protect nature and rationally utilize unique natural complexes, primarily Baykal", to add: "and also the Aral Sea".

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CSO: 1829/167

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NEEDS FOR RIVER REVERSAL PROJECT SET OUT

Moscow SEL'SKAYA ZHIZN' in Russian 27 Jan 81 p 2

[Article by V. Dukhovnyy, director of the Central Asian Scientific Research Institute of Irrigation, S. Ziyadullayev, academician, UzSSR Academy of Sciences, A. Imamaliyev, director of the All-union Scientific Research Institute of Cotton Growing, Academician of VASKhNIL and S. Kamalov, Chairman of the Karakalpak branch of the Uzbekistan Academy of Sciences and academician of the UzSSR Academy of Sciences, Tashkent: "A Question of Great Significance"; italicized text in slant-lines]

[Text] The need for providing efficient and economical use of natural, material and labor resources as the decisive and most effective means for increasing the country's national wealth is emphasized by the Draft Basic Directions. The Central Asian republics, in which there are extremely favorable natural conditions and a large work force, have such resources at their disposal.

The Amudar'ya, Syrdar'ya and other rivers helped Soviet man to transform the Central Asian region radically, having expanded the irrigated area here to 6.2 million hectares. Now 95 percent of the gross cotton harvest is accounted for by the Central Asian republics. Thousands of kilometers of lined canals, hundreds of reservoirs and thousands of hydraulic structures help the industrious 'dekhkan' [farmer] to grow the "white gold."

The last decade has been noted for the particular scope of new land irrigation. In Uzbekistan and neighboring republics, large agroindustrial complexes have grown up. The Golodnaya Steppe, completely transformed, built up and now the birthplace of a complex method for developing virgin land using irrigation, is typical in this regard. In what was once a lifeless desert, there are now 12 administrative rayons of 3 oblasts of Uzbekistan and Tadikistan, nearly 200,000 people live here, new cities and settlements have sprung up and major transport routes have been laid. Nearly 80 sovkhoses, dozens of modern industrial enterprises and the Syrdar'inskaya GRES [State Regional Electric Power Plant], all of this has received life due to the arrival of the life-giving moisture. Expenditures for irrigation and new housing tracts are being repaid during the development process under the conditions in the region.

The constantly growing demand for increasing the production of irrigated fields requires the maximum use of water resources. Thus, due to regulation of the

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Syrdar'ya and use of reusable waters, 45 cubic kilometers of water are used here when there is an average annual streamflow of 35.6 cubic kilometers. At first, it seems improbable that the waters of the Syrdar'ya are used repeatedly during the course of a single growth cycle, but this is actually the case. In the Fergana Valley and the Dal'verzhinskaya and Golodnaya Steppes, the flow of the Syrdar'ya and the Naryn, granting life to hundreds of thousands of hectares of tilth, is returned to its course by a system of lateral and main drains. It is returned, but it is more highly mineralized! This mineralization will progress, reducing the effectiveness of agricultural production, as a function of the further growth in the scarcity of water resources and the increase in the number of times the water is reused.

Something else alarms the specialists. Our soils have the capability of accumulating salts in so-called blind pores. As long as they are not filled, the soils do not react so intensively to the concentration of a saline solution. But given protracted exposure to salts, the yield begins to diminish. Certain land areas in the river lowlands are now covered with salty outcroppings and are losing their fertility. The situation with the Aral Sea turns out to be quite complex. The level of the Aral drops annually, and forecasts show that toward the end of the Eleventh Five-Year Plan, the capabilities for further development of irrigation will be exhausted in Uzbekistan and the other Central Asian republics.

By our efforts of recent years we have succeeded in increasing somewhat the efficiency of irrigation systems and equipping a portion of the irrigation with anti-seepage linings. Because of improved draining methods (vertical and sub-surface drainage) water requirements for flushing [promyvnoye vodopotrebleniye] have been reduced by a factor of 2 on 890,000 hectares. Production of flexible irrigation pipes has been set up in Uzbekistan, and their annual output has exceeded 2,000 kilometers. This permits costs for irrigation water to be reduced by about 10 percent. Experimental drip and sub-surface irrigation systems which are more economical are being built.

There is no doubt that improvement of water usage is an important problem, a matter for all who are associated with irrigation. The task of developing overall renovation of old irrigated land even further, persistently introducing automation of the systems and improving the technology for watering and irrigation norms lies ahead of us. But estimates show that the indicated measures can reduce the scarcity of water only for a short time. The most important solution to the problem is diversion of part of the flow of Siberian rivers. We think that /it is advisable to set off the question of the need for joining the water resources of Siberia with the natural and labor resources of Central Asia as a separate paragraph in the Basic Directions./

Scientific and planning and survey organizations are already occupied with preparatory work. The experience in large-scale water management construction of many years, in the Central Asian republics and other regions of the country, confirms the reality of the planned goal. If the efforts of the Russian, Uzbek and Kazakh irrigators are joined and those bases which are already at the disposal of Glavsredazirsovkhosstroy, Glavrossovkhosstroy and the Uzbekistan Minvodkhoz [Ministry of Water Resources] are partially utilized, much may be accomplished by the end of the next five-year plan.

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The effectiveness of diverting part of the flow of Siberian rivers seems beyond doubt to us. An additional 8 million hectares of virgin land could be brought under irrigation in Uzbekistan alone by virtue of this program. Of this amount, 4 million (hectares) would be used for corn production and 1 million would be planted in rice. The country could receive an additional 40-45 million tons of grain annually. Expanding the present cotton land by developing 2 million new hectares would provide an increase of 6 million tons in the gross cotton harvest. The production of vegetables, potatoes, melons, fruits and grapes would also increase significantly.

Diverting part of the flow of Siberian rivers in Central Asia and Kazakhstan will permit us to solve the problem of food supply to the rapidly growing population of the region and sharply increase delivery into the All-Union store of grain, cotton, vegetables, fruits and livestock breeding production.

/We propose to reflect this important question in the Basic Directions, having formulated it as follows: "Begin preparatory work on diversion of part of the flow of Siberian rivers to Central Asia and Kazakhstan."/

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CSO: 1829/180

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ACADEMICIAN CITES NEED FOR RIVER DIVERSION

Tashkent SOVET OZBEKISTANI in Uzbek 14 Feb 81 p 2

[Excerpt of interview with Professor E. Akramov, Original Title Unavailable]

[Excerpt] Question: We perceive clearly in the present state of the UzSSR the results of V.I. Lenin's instructions concerning improvement of irrigation in Turkestan and the success of the activities of the Central Committee of the Uzbekistan Communist Party, the headquarters of Uzbek communism, in this area. In view of the fact that the UzSSR is the primary cotton-producing base of the Soviet Union, what additions should be made to the Draft Basic Directions [of the 11th Five-Year Plan].

Professor E. Akramov: Measures for the further increase of yields from land reclamation agriculture and the capital invested in it are foreseen in the draft. This will be of special importance for the irrigated agriculture zone, the Central Asian republics in particular. Some 400-465 thousand hectares must be provided water and new lands irrigated during the years 1981-1985 in Uzbekistan. Work of this magnitude will require a great capital investment. To achieve this we are thinking in terms of additional capital outlay to reconstruct the irrigation system, raise levels of water supply and speed up the pace of improvement of land reclamation activities.

It is well known that scientific and planning efforts to turn a portion of the waters of the Siberian rivers to Central Asia and Kazakhstan, in accordance with resolutions of the XXV Party Congress, have begun on a broad front. To be sure, it is very urgent that we obtain, as soon as possible, part of the waters of the Siberian rivers in order to develop further the production forces of the region of the Aral basin and further raise the material prosperity and cultural levels of the population of the region while rationally exploiting existing lands and other natural resources there. For this reason it would be appropriate, in paying attention to the urgency of preparatory construction work in Central Asia and Kazakhstan during the 11th Five-Year Plan, to add the following statement to the appropriate paragraph of section five of the draft: **/Let the preparatory work for diverting part of the water of the Siberian rivers into the Aral basin, Central Asia and Kazakhstan begin./** [in boldface]

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SCIENTIFIC AND TECHNICAL ANALYSES

REPORT ON CONFERENCE ON WATER PLANNING, DISTRIBUTION FOR WESTERN SIBERIA

Moscow VODNYYE RESURSY in Russian No 5, 1980 pp 201-203

[Report by S. M. Kudryavtseva from Oct 79 Novosibirsk conference on water planning and distribution for Western Siberia: "Conference on the Problems and Prospects for Water Planning in Western Siberia"]

[Text] On 17-19 October 1979 in Novosibirsk there was a conference of the section "The Complex Utilization and Conservation of Water Resources" of the Scientific Council of the USSR State Committee on Science and Technology. The meeting was organized jointly with the RSFSR Ministry of Water Resources and the Novosibirsk oblast administration of NTOSKh [Scientific and Technical Society of Agriculture] for the section dealing with the subject, "Problems and Prospects in Water Planning for Western Siberia."

Participating in the work of the conference were over 100 specialists from the institutes of the USSR Academy of Sciences, its Siberian department and the academies of science of several union republics, from republic ministries of reclamation and hydraulic engineering as well as from educational institutions and other departments.

At the meeting, which was opened by Sh. Ch. Chokin (KazNIIIE [Kazakh Scientific Research Institute of Power Engineering]), over 10 reports regarding the aforementioned topic were presented. The speech of N. S. Cherepakhin (RSFSR Ministry of Water Resources) emphasized the necessity to expand agricultural and industrial production in Western Siberia as well as in Central Asia on the basis of balancing the water resources of both regions and of creating a scientifically-based solution to the problem of water supply.

A. K. Kiyatkin (Soyuzgiprovodkhoz [All-Union State Planning, Surveying and Scientific Research Institute of Water Management Construction]) spoke about the future development of hydroeconomic construction in the Ob'-Irtysh basin and about the preliminary water management balance of this region. He noted that the final goal of water-management calculations that are being made for the Ob'-Irtysh basin is to discover surpluses and shortages of water in various parts of the basin, as well as the selection and evaluation of technical measures that will guarantee this region's national economy the needed volume of water resources with a scientifically-based regime for regulating them.

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The basis for determining the essential reclamation areas was established as the guaranteed supply of foodstuffs for the population and the creation of state reserves of commodity grain.

It should be noted that in the speech of A. K. Kiyatkin the current picture as well as the future of water management in the Ob'-Irtysk basin were evaluated quite optimistically. At the same time, many participants in the conference noted that the problems of the first stage of the diversion of part of the flow of the Ob' to the southern areas of the central region and of water planning for Western Siberia remain very complex and require thorough additional study.

A. A. Tynybayev (Ministry of Water Resources of the Kazakh SSR) devoted his speech to the future development of hydromeliorative and water-management construction and to the hydroeconomic balance of the Irtysk within the Kazakh SSR. As the speaker noted, satisfactory conditions for watering agricultural crops in the Irtysk area of Kazakhstan occur only once every 3 years. In the republic, irrigated farming in the Irtysk basin has been unsatisfactorily developed in general. At the present time the actual irrigated fund comprises less than 20 percent of the irrigated area (at a total irrigation capability of basin rivers taking into account the regulation of their current). Many irrigation systems, especially in the regions of traditional irrigation (Vostochno-Kazakhstanskaya, Semipalatinskaya Oblasts), are still in unsatisfactory condition.

The total potential irrigation fund is considered to equal 20 million hectares under conditions in which water resources are replenished from other basins. Existing water resources of this territory will enable us to increase the area that is regularly irrigated to 1.5 million hectares and that that is estuary-irrigated to 400,000 hectares by the end of the century. The speaker noted that according to the plan studies of the Kazgiprovodkhoz Institute, in the Irtysk basin it is planned to develop irrigation by means of local surface current formed by all of the tributaries of the Irtysk and the rivers of the inland-drainage zone, of the current of the Irtysk itself (including by curtailing releases onto the flood plain) and of ground and sewage waters. With the diversion of Siberian waters irrigated farming can be developed in Severo-Kazakhstanskaya, Kokchetavskaya and Kustanayskaya Oblasts, which have practically no water resources of their own.

Yu. N. Ivanov and V. I. Filonenko (Zapsibgiprovodkhoz [Western Siberian Planning Institute of Hydraulic Engineering] and Leningrad Planning Institute of Hydraulic Engineering) came to the conclusion that the only dependable source of water for the Barabinskaya Lowlands and the Kulundinskaya Steppe is the Ob' River. However, balance accounts presented by the authors (with a consideration of future water consumption) show that in connection with the introduction into operation of large irrigated areas in Altayskiy Kray and with the possible diversion of the flow from the Karasuk River into the Ob' basin, seasonal deficits of water resources may appear, which attests to the necessity of regulating the flow of the Ob'. In the opinion of the speakers, in order to avoid such deficits, in the basin of the upper Ob' it is essential to create additional regulating capacities. The utilization of regulated local streamflow and ground waters for irrigation is a priority goal here.

O. P. Novitskiy (Gidroroybproyekt [State Institute for the Planning of Hydraulic Engineering, Fishery-Improvement and Pond Structures], USSR Ministry of Fish Economy), discussed the prospects for the fish economy in the Ob'-Irtysk basin in the case of diversion and non-diversion of the streamflow. The fish economy of the

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Ob'-Irtys' basin will develop under conditions of a severe deficit of water resources. In the opinion of the speaker, the removal of even 25 cubic kilometers from the Ob' will worsen spawning conditions for semi-migratory fish in the river's floodlands. In realizing the indicated intra-basin water management measures the fish catch can drop in river reservoirs, according to the speaker, and the Ob' can lose its importance as a fish economy. In the region of the fish industry can be developed only if water is allowed to flood the floodlands in the spring.

N. I. Lyubochaninov (Giprorrechtrans [Planning Institute for River Transport], RSFSR Ministry of the River Fleet) discussed the development of water transport in the Ob'-Irtys' basin. He noted the expected tripling in freight shipments by the end of the century. As the speaker showed, navigation conditions will deteriorate if water is removed, especially during years with little precipitation, if compensatory measures will require an increase in capital investments. The speech did not examine the development of water transportation without streamflow diversion.

K. G. Pevzner (Kazgidproyekt [Kazakh Planning, Surveying and Scientific Research Institute on Hydraulic Engineering], USSR Ministry of Energy) examined the prospects for the development of hydraulic power engineering in the central region, having turned the attention of the audience to the low utilization of hydraulic energy potential at the present time. Nevertheless, the conclusions that were drawn about the development of this most important branch of the national economy were made without a consideration of the need for hydraulic power engineering resources required to divert streamflow into the southern part of the country.

It should be noted that the problem of territorial redistribution of water resources encompasses a large number of questions that were illuminated in the speech of V. N. Saks (Siberian Department of the USSR Academy of Sciences). It is difficult to predict the social-economic development of the region and to develop a methodology and scientific prognosis of the effect of diverting river flow on physical-geographical processes in the hydrosphere, lithosphere and atmosphere. Despite the complexity of the technical systems being planned now for diverting streamflow, their realization is fully possible at the present stage of development of science and technology. For this reason it is necessary to complete further research as quickly as possible to provide a scientific basis not only for the first stage, but for subsequent stages of diverting the water resources of Siberia as well.

L. K. Malik (Institute of Geography of the USSR Academy of Sciences) discussed a number of problems related to the future of water planning in Western Siberia and to the redistribution of water resources. One of the most important constructive problems that is being worked on by the specialists of the Institute of Geography of the USSR Academy of Sciences and in other institutions, as noted in the speech, is the study of the transformation and economic utilization of swamps and bogs in Western Siberia.

The speech of I. A. Gerardi (Soyuzvodproyekt [All-Union Association on Water Management Planning]) was devoted to the necessity of realizing the first stage of the diversion as soon as possible.

In speaking about the likely changes in the water balance of the central region as a result of the interzonal redistribution of the flow of Siberian rivers,

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V. S. Mezentsev (Omsk Agricultural Institute) drew the conclusion that in general the water balance in the arid zone would not undergo essential alterations.

A. G. Aganbegyan (Institute of Economics of the Siberian Department of the USSR Academy of Sciences) emphasized the necessity of more intensively utilizing the internal reserves of Central Asia (for example, the reconstruction of irrigation systems, the transition to regulated irrigation, etc.) which would permit us, in the opinion of the speaker, to solve some of the problems of supplying water to Central Asia already today instead of waiting for the redistribution of the flow of Siberian rivers.

Some speakers gave special attention to the necessity of preserving Chany Lake, a large fish economy reservoir in Western Siberia. Thus, V. I. Lap (Novosibirskaya Oblast Production Administration of Reclamation and Water Resources) spoke about the fact that the special characteristics of climate in Western Siberia resulted in a sharp decrease in the surface area and depth of lakes during drought periods and the death of fish living in them. The problem of preserving the lake can be fully solved only by diverting some of the flow from the Ob' basin into it. As the speaker noted, the problem of Chany Lake must be solved within a complex of work to regulate the water resources of the region.

At the end of the session there was a lively discussion during which many participants emphasized the following factors:

- the insufficient information from planning organizations on solving problems related to the diversion of streamflow;
- the absence of uniform accounts for determining the volume of water resources required by Central Asia;
- the inadequacy of studies that would enable us to evaluate water losses in areas where streamflow has been diverted;
- the absence of a clear hydroeconomic balance for the future.

A number of speakers noted that special attention should be given to studying the qualitative composition of diverted waters. The necessity of providing additional volumes of water to the industrial Urals was pointed out.

In concluding the discussion, B. G. Shtepa (USSR Ministry of Water Resources) emphasized that measures on utilizing internal resources cannot be juxtaposed to the problem of diversion of flow. The goal of providing water supplies to the central region can be realized only in complex terms, with a consideration of the needs of various branches of the national economies of Western Siberia, Central Asia and the Urals.

As the complex Western Siberian territorial natural complex becomes more developed, the water management problems of the Ob'-Irtysh basin will become more urgent and sometimes contradictory. Some aspects of these problems are topics of heated discussion among scientists. From this point of view the meeting in Novosibirsk was still another useful step in the development of further research and planning work in the area of water management of the central region.

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ACADEMICIANS CITE IRRIGATION DATA, FAVOR RIVER DIVERSION

Tashkent PRAVDA VOSTOKA in Russian 6 Jul 80 p 3

[Article by A. Sadykov, president, Uzbek SSR Academy of Sciences, Uzbek SSR Academy of Sciences academician; S. Ryzhov, vice president, Uzbek Academy of Sciences, Uzbek SSR Academy of Sciences academician; and K. Lapkin, academician-secretary, Department of Philosophical, Economic, and Juridical Sciences, Uzbek SSR Academy of Sciences, Uzbek SSR Academy of Sciences academician: "The Region Needs Water"]

[Text] Land reserves suitable for irrigation total approximately 50 million hectares in the Central Asia republics, including approximately 17 million hectares in Uzbekistan. Of this total area, 8 million hectares are irrigated (3.3 million hectares in Uzbekistan).

Lowland and piedmont areas of the Central Asian Region are known for their fertile nature; material and labor expenditures invested in them are quickly recouped. The high yield of these lands is determined by their specific properties--the presence of free carbonates, both calcium and magnesium, without which irrigated soils, for example, chernozems, lose rather rapidly both humus and structure, and are more difficult to work. The soils in the Central Asian Republics, with long-term irrigation, not only do not lose, but conversely, increase fertility through a certain augmentation of humus, phosphoric acid, and micro-biological activity.

It is known that the biomass of vegetation and micro-organisms established for the various geographical zones is determined by the ratio of heat and moisture, or the so-called bioclimatic potential. Under irrigation conditions, when water is provided in accordance with plant requirements, the bioclimatic potential is dependent upon temperature conditions only, consequently growth of the vegetative mass overall is determined by solar energy resources, which are, in the soil-climate zone of the republics of Central Asia, rather great.

Everything listed above, and also the duration of the growing season bear witness to the opportunities to further increase the vegetative mass, and the expediency of developing irrigational cultivation in the southern regions with their higher yields for all types of agricultural produce.

However, the assimilation of new lands in the region is being delayed by shortages of water for irrigation. According to the "Project For the Comprehensive Use of Water Resources in the Aral Sea Basin", compiled by the "Sredazgiprovodkhlpok" Institute, the area of possible irrigation in the Syrdar'ya and Amudar'ya Basins

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with their streamflow with full use of those waters might reach 8.9 million hectares, of which 4.5 to 4.6 million are in the Uzbek SSR. With the rates of land irrigation outlined, water resources would be exhausted in the Syrdar'ya Basin by 1985, and by 1990 in the Amudar'ya Basin.

The opinion exists that the large reserves of water resources might be obtained inside the region by increasing the efficiency of the irrigational network's operation and establishing the requisite reclamation regimen. Unfortunately, neither numerous analyses nor experiments bear those optimistic proposals out: even with a comprehensive, full-fledged remodeling of the existing irrigational systems and raising efficiency from .55 to .79, savings of water would amount to approximately 6.5 cubic kilometers, obviously insufficient for the earmarked growth of cultivated lands and agricultural production even for the near-term. Meanwhile, during short water years now, mineralized ground water are widely used for irrigation, waters which do not provide for high yield, and reduce the quality of fiber and the oil content of the cotton seeds.

In recent years, the flow of water into the Aral Sea has catastrophically rapidly reduced, its level has sharply dropped, hundreds of thousands of salinated and sandy lands have been drained on the periphery of the sea and in the lower courses of the Amudar'ya and Syrdar'ya, and are undergoing rapid aridization and dispersal by wind. The scale of the harmful consequence of this phenomenon is difficult to predict.

It must also be noted that now, due to the insufficiency of free irrigated lands in the cotton regions, correct crop rotations are not being implemented, and optimum ratios of areas planted in cotton to areas planted in fodder and grain crops are not being achieved. Naturally, this impedes the development of other agricultural sectors.

Some suggest that certain drought-resistant varieties of cotton could be introduced; those varieties with reduced water requirements would supposedly not reduce the yield. The essence of drought-resistance is that the plants and varieties possessing this property reduce the yield to a lesser degree when there is a shortage of water, while at the same time respond very well with a normal level of water supply. It can be said that it is still not known how to reduce the expenditure of water for transpiration of plants with a simultaneous increase in yield. The fact is, that plant transpiration is a physiological act linked with assimilation of carbon dioxide, i.e., with the basic life process of the plants. The higher the soil fertility, the higher the yield, and the lower the proportion of water expenditure for transpiration, although the total expenditure of water per field area unit increases with a growth in yield.

We will explain by citing an example.

Let us assume that the yield from a hectare was increased from 20 to 40 quintals, i.e., doubled. The transpiration coefficient here will drop to one and one-half times former level. In other words, the total expenditure of water to establish a higher yield level from a unit of area nevertheless will increase, although disproportionately to the growth in yield.

Theoretical research and numerous field experiments by SoyuzNIKHI [All-Union Scientific Research Institute of Cotton Growing] and other scientific institutions

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have demonstrated that cotton, grain, and industrial crops, irrespective of variety, must be irrigated at the same soil moisture level, approximately 65-75 percent of the field saturation level. If soil moisture prior to irrigation is less than 65 percent, this will result in acute retardation of growth in the plants and in reduced yield. Increasing the moisture level to 75-80 percent increases the growth of the vegetative mass, lengthens the vegetation, and lowers the yield of the productive segment. The earlier maturing varieties of all crops require fewer irrigations, but nevertheless, they must be irrigated at the same optimum moisture level--70 percent of soil saturation.

The entire irrigated territory of Central Asia has been divided into soil-climatic okrugs and hydromodulus regions [rayons], for which irrigation regimens have been developed for the agricultural crops grown there, with allowances for soil properties, temperature, and hydrogeological factors.

The region possesses vast capabilities for increasing the production of agricultural output. To do this, we emphasize once more, water is required. The Central Asian Republics will not be completely supplied by their own limited resources. The sole realistic solution is seen to be the diversion of a part of the flow of Siberian rivers discharge to the region.

The diversion will also have tremendous significance in the resolution of socio-economic problems in the development of the region--providing full employment for a rapidly growing population, improving the level of material welfare, a further increasing of the role of agriculture as well as the food base, of the balanced nature of all sectors of the cotton complex, and the increased contribution of the Central Asian Republics to the establishment of a material-technical base for communism.

Considering the extraordinary importance and tremendous significance of an all-out acceleration in the resolution of problems related to the diversion of Siberian rivers for the future economic and social development of Central Asia and Kazakhstan, and increasing their contributions in the solving of the country's national economic tasks, it is obligatory that a centralized management organ be created which will be the operational administration for this large-scale operation.

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STEADY DESICCATION OF ARAL SEA PORTENDS FUTURE WATER PROBLEMS

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 26 Sep 80 p 4

[Article by O. Tlenbekov, head of the laboratory of the Kazakh Scientific Research Institute of the USSR State Committee for Hydrometeorology and Environmental Control, candidate of geographical sciences: "Aral: Today and Tomorrow"]

[Text] The Aral Sea is one of the largest internal reservoirs of the world. It has been famous for its wealth since ancient times. Hundreds of thousands of centners of highly valuable commercial fish have been caught here, sturgeon, barbel, Aspius aspius and pike perch. The Aral also played a significant role as a shipping reservoir on which national economic cargo was extensively shipped between Kazakhstan and Uzbekistan.

In recent years attention to the Aral Sea has grown sharply. It has become the subject of study of scientific and planning institutions. Many printed publications treat it. Such intensified interest and pronounced concern for the future of the Aral stem from the fact that in the last 10-15 years considerable changes have taken place in its hydrological regime that are due to the intensive drop in its level and the desiccation of shallow sections.

The largest rivers in Central Asia, the Amudar'ya and the Syrdar'ya are replenishers of the Aral Sea. Due to the extensive development of irrigated farming and the construction of a number of reservoirs in their basins in recent years, the total volume of river flow entering the sea has significantly diminished.

The drastic reduction in flow of the Syrdar'ya River is aggravated even more by the fact that downstream several places are now covered with thick filled earth dams, and the water is directed into delta lakes that have fishing value. Thus, starting in 1974, the Syrdar'ya did not have a constant surface flow into the Aral Sea. The Amudar'ya flow was diminished by almost 75 percent. Consequently, starting in 1960 the Aral level began to drop, and by now has declined by almost 7 meters. The area of the sea has been curtailed by 15,000 square kilometers. The water salinity has significantly risen.

The changes in the hydrological pattern of the sea and in the river downstreams resulted in a sharp drop in the reproduction of fish reserves. Whereas in 1963 480,000 centners of fish were caught, in 1978-1979 only 40-50,000 centners. The muskrat industry practically stopped.

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The forecasts are not comforting. The process of decline in the sea level and reduction in its area will continue. According to preliminary estimates of the Aral water balance, its level will drop by the year 2000 by almost 19 meters. The sea area will be 25,000 square kilometers instead of 65,000 in 1961. This means that the Aral will be divided into three isolated stretches.

The fate of the sea is linked to a great degree to the development of irrigated farming. The region has favorable land and thermal power engineering resources for farming different grain, cucurbitaceous and commercial crops. But this requires the maximum use of local water resources. The greater the scales of irrigated farming in the Aral region, the less water the sea will receive.

As the Aral dries up, large areas of the bottom will be exposed. Salt-saturated deposits can be exposed to wind transfer to the surrounding territory, the irrigated regions of Central Asia and Kazakhstan.

How can the negative consequences of Aral desiccation be eliminated or alleviated? This requires extensive scientific studies and planned developments to prevent the Aral region from becoming a desert and controlling the process of decline in the sea level.

It should be said that it is impossible to stop this process. It can only be slowed down. First, this can be done by means of careful planning of the intra-administrative and territorial distribution of local river flow as well as the introduction and broad application of economically advantageous types of irrigation (intradrop, overhead irrigation, etc.). These will somewhat reduce the diversion of water entering the Aral. Second, if the engineering systems on the run-offs are reconstructed, one could prevent water losses in the internal-drainage basins and increase the entrance of drainage water into the Aral. Finally, by extensively employing proved reserves of ground water for irrigation one can also reduce the consumption of run-off water and increase the replenishment of the Aral.

In addition, a whole series of different versions has been suggested for separating individual sections of the sea by dams that will reduce evaporation from the water surface and will preserve some of its sections for intensive fishing.

The suggestion to preserve the northern section of the Aral Sea after separating it from the remaining by a thick dam placed across the Berga strait, from the mouth of the Syrdar'ya River to Kokaral Island and further, with a regulating sluice gate to Karatyup Peninsula is of definite interest. In order to maintain the level in this separate reservoir at current marks it is necessary to send the flow from the Syrdar'ya River into it in a volume of no less than 5 cubic kilometers per year. The creation of this reservoir in the northern Aral will preserve the industrial enterprises associated with it and the populated areas, including the city of Aral'sk. The reservoir itself can be used for intensive, controllable fishing.

The western deep section of the sea can be preserved for these same purposes. It will be a lake reservoir roughly 200 kilometers long and 50-60 kilometers wide.

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This reservoir will be fed by Amudar'ya water in a volume of no less than 12 cubic kilometers per year.

The Aral problem is complicated, and it should be solved in a comprehensive manner. For example, the soil scientists and botanists should study the processes of desiccation of the Aral region and make specific recommendations to secure the shifting sands, to convert the dry sea bottom into pasture lands and to make them suitable for agricultural production. The hydrogeologists need to evaluate the operational reserves of ground water of the Aral region and to make suggestions for their use in different branches of the national economy.

The fisheries are faced with a large task. It remains to determine the means of developing commercial pisciculture, including development of recommendations for introducing into the Aral new salt-loving forms of food organisms and fish species, as well as suggestions for organizing commercial lake and pond pisciculture in the downstream of the Syrdar'ya River.

Sociologists and economists should be included in a solution of the Aral problem even now. It is necessary to determine the paths for developing the productive forces under altered conditions, and to formulate measures to improve the social aspect of the population living in the Aral region. At the same time they should focus serious attention on the possible changes in the medical and biological situation in this region.

Desiccation of the Aral places a whole series of problems on the agenda that are associated with a change in climate, the need for redirecting Siberian river flow into this region, etc. They can be solved with the broad and active participation of scientists and specialists of different profiles and departments.

The Aral problem is very complicated. It radically affects all aspects of many branches of the national economy and the living conditions of the population. The fate of the sea can therefore not be solved based on purely economic considerations alone. One should take into account the ecological importance of the Aral Sea, the nature of its interrelationship with the environment, as well as the possible general social and economic consequences of desiccation of the sea, a major and unique reservoir of Central Asia.

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UDC 551.482.215(-925.11)

BACKWATER PHENOMENA ON THE RIVERS OF WESTERN SIBERIA AND POSSIBLE CONSEQUENCES OF THEIR CHANGES IN RELATION TO THE REDISTRIBUTION OF STREAMFLOW

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOGRAFICHESKAYA in Russian No 5, Sep-Oct 80 pp 51-61

[Article by L. K. Malik, Geography Institute USSR Academy of Sciences]

[Excerpts]

Abstract: A study was made of the role of backwater phenomena as factors in attenuating the draining activity of rivers and increasing the overmoistening of the territory. The change in the backwaters on the tributaries of the Ob' and Irtysh in the zone of diversion of streamflow is characterized on the basis of computations which have been made and generalization of available materials.

A study of changes in the water regime of rivers, including backwater phenomena, is an integral part of the investigations carried out at the Geography Institute of the USSR Academy of Sciences in connection with the formulation of a prediction of change in the natural conditions in Western Siberia under the influence of withdrawal of part of the flow of the Ob' and Irtysh for transfer into the southern arid regions of the country.

Backwaters, an extremely commonly observed phenomenon in many lowland drainage basins, can substantially increase the duration and height of high waters in the lower reaches of rivers. However, nowhere do these features of the water regime occur so universally and have such far-reaching consequences as in the overmoistened regions of Western Siberia. There the concentration of great volumes of flood waters in the lower reaches of many rivers for a considerable period complicates the functioning of rivers as natural drains and during the period of high waters transforms a considerable part of the drainage factors into a source of stagnation and even temporary accumulation of surface and ground water (Gerasimov, 1967).

Until recent years the accumulation of flood waters in the lower reaches of rivers and the effect of backwaters on the degree of overmoistening of the drainage basins have not been a subject of special investigations by hydrologists and therefore to a considerable degree can be classified as inadequately studied phenomena. Observations of these phenomena in the network of hydrometeorological stations and posts for the time being are not mandatory (although observers on a number of rivers in Western Siberia note the duration of backwaters).

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Investigations of the hydraulic nature of backwaters carried out at the State Hydrological Institute made it possible under conditions of unsteady water movement to determine the zone of wedging-out of the backwater on a river as a region of interaction of the direct waves caused by the high water and propagating downstream and return waves, caused by the backwater and propagating upstream. That river reach in which the propagation of the direct and return waves is mutually compensated is defined as the peak of the backwater zone (Rozenberg, 1970, 1972).

However, up to the 1970's the hydrological literature contained no recommendations on computations of the characteristics of backwaters under specific conditions of river basins. In 1971 R. A. Nezhikhovskiy, on the basis of hydraulic formulas, for the first time proposed a specific way for determining the length and volume of the backwater zone and made computations of the volumes of water in backwater zones above the backwater-free level for the Sheloni River at Zapol'ye village (on the basis of data for 1962) and the Don at Kazanskaya station (on the basis of data for 1951).

The major role of backwater phenomena in Western Siberia and the need for their detailed study was already pointed out in the mid-1960's at the Geography Institute, USSR Academy of Sciences, where the inadequate draining activity of the rivers was regarded as one of the principal links in the chain of interrelated natural factors stimulating the aggressive onset of swampy areas into blind creeks in overmoistened regions of the plain. Over the course of many years the Geography Institute, USSR Academy of Sciences carried out expeditionary, semistationary and office investigations for systematizing and studying the nature of the backwater phenomena and their role in reducing the draining activity of rivers and clarified the factors favoring the formation and prolonged persistence of backwater zones on rivers of different magnitude. The hydrologists at the institute also began to devote particular attention to this problem in connection with prediction of the effect of the planned Lower Ob' hydroelectric complex in the event of whose construction the backwaters along the tributaries would become permanent and more extensive than under natural conditions. A number of studies for the first time examined the interrelationship of the passage of high-water waves on the Ob' and Irtysh, complicating the entry of Ob' high waters into the lower reach of the flow (Vendrov, Gerasimov, et al., 1966; Vendrov, Glukh, Malik, 1967, and others), and also the conditions for the formation of backwaters on second-, third- and lesser-order rivers and the method for computing the characteristics of backwater zones under the conditions prevailing in Western Siberia (Malik, 1969a, 1971, 1972a,b, 1973a, and others). In these and some other publications, and also at many conferences (Malik, 1969b, 1973b, 1975a,b) it has been repeatedly noted that the level of our knowledge concerning backwater phenomena cannot be substantially raised without the organization of an extensive network of water-gaging posts for special observations of backwaters. On the proposal of the Geography Institute, USSR Academy of Sciences in drafts of the USSR State Water Inventory to be published there will be observations of the characteristics of backwaters in reaches where there are gaging stations.

In the investigation of backwater phenomena the Geography Institute, USSR Academy of Sciences pointed out that the appearance of backwaters is associated with the action of various hydroclimatic and geomorphological factors favoring the formation of backwaters in different links of the fluvial network on the West Siberian

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Plain, and also with a considerable excess of the discharges of the main (supporting) river over the discharges of the tributaries. We will briefly examine these factors, using materials on backwaters on rivers situated in the zone of removal and transport of streamflow (lower course of the Ob' and Irtysh).

At the beginning of the article we noted that more than 10 years ago, in predicting the possible influence of the proposed Lower Ob' Hydroelectric Power Station, specialists at the Geography Institute, USSR Academy of Sciences analyzed the complex interrelationship of the propagation of high-water waves on the Ob' and Irtysh in the region of their confluence and for the first time, using many hydroclimatic indices, demonstrated the formation of a backwater in the initial stages of development of the high waters of the Ob' by the Irtysh (Vendrov, et al., 1966, 1967). This phenomenon was regarded as a factor inhibiting the propagation of Ob' high-water waves in the latitudinal reach of the Ob', which in combination with the great accumulating capacity of the Ob' valley should result in particularly unfavorable drainage conditions in the middle Ob' region.

As a result of the decrease in the high-water levels of the Irtysh under the influence of removal of flow its backwater by Ob' waters will become somewhat less in the first stage of diversion of flow, which will cause some local activation of drainage processes. However, according to existing concepts the improvement in drainage conditions in Western Siberia cannot lead to rapid and radical changes in the hydrothermal regime and nature of swampy landscapes in the peat bogs of the water divides and the high terraces, which to a certain degree have their own independent life (Ivanov, 1975; Neyshtadt, 1976, 1977).

With an increase in the volumes of diversion of flow the considered patterns of change in the characteristics of backwater zones can be fundamentally different, since there will be a change not only of the quantitative criteria.

On the Lower Ob', regardless of the volumes of removal of flow, the intensification of the draining role of the tributaries will be limited, as indicated above, in addition to other factors, also by the permafrost layer--a layer which is impermeable to water under the conditions prevailing in the northern part of Western Siberia.

On the Irtysh, with a further increase in removal of its flow it will not suffice not only at low water, but also during the spring-summer season. This will lead to a substantial cut-off of the Irtysh high water and an increase of the anti-flow of Ob' waters in it, which, however, will not attain the discharges of the natural high water on the Irtysh and the high water cut off in the first stage of flow. These circumstances should serve as a definite stimulus to a further decrease in the backwater of Ob' waters by Irtysh waters, observed under natural conditions in the first half of the high-water period. However, the backwater of Ob' tributaries by that river will persist in its middle course, which as before will cause unfavorable drainage conditions in the central regions of the West Siberian Plain. In addition, according to materials from the State Hydrological Institute, a decrease in levels on the Irtysh can even lead to an inflow of Ob' waters into its mouth, which will complicate drainage conditions in the lower reach of the Irtysh. As a result, and also as a result of intensification of underflooding in the upper pools at hydroelectric complexes at low water the positive effect of the removal of streamflow in a number of reaches of the Irtysh which will be observed with the removal of 25 km³ will become relatively insignificant.

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Thus, the complexity of the effect of the Anti-Irtysh system, the ambiguity of its influence and the influence of different stages of diversion on drainage conditions in the Irtysh and Ob' make it possible to assume that from the point of view of creating the prerequisites for meliorative transformation of Western Siberia it will be most reasonable to remove water without creating an anti-river system from the upper course of the Irtysh and Ob' under the condition of regulation of their streamflow.

The removal of water from the upper course of the Ob' and later, possibly, from the Yenisey, and the transfer of water into the Irtysh and then into the channel for the diversion of streamflow can be facilitated by the use of ancient latitudinal run-off troughs and corresponds to the interests of supplying water to the southern part of Western Siberia, including its lake system (Kulundinskoye, Selety-Tungiz, and other lakes), which assuming that it is supplied with fresh water can be used extensively in the national economy.

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REPORT FROM 1980 CONFERENCE ON PROBLEMS OF INTERZONAL WATER DIVERSION

Moscow GIDROTEKHNIKA I MELIORATSIYA in Russian No 10, Oct 80, pp 92-94

[Article by N. I. Koronkevich and L. L. Rozanov, candidates of geographical sciences, and Z. A. Krylova, engineer, Institute of Geography of the USSR Academy of Sciences: "Geographical Prognoses Regarding the Problem of Interzonal Diversion of River Flow]

[Text] In April 1980 in Moscow there was an all-union conference organized by the Institute of Geography of the USSR Academy of Sciences on the subject "Geographical Prognoses Regarding the Problem of Interzonal Diversion of River Waters." Participating in its work were representatives of scientific organizations of the USSR Academy of Sciences, scientific production associations and institutes of the USSR Ministry of Water Management, the Scientific Research Institute of the State Committee for Hydrometeorology and Environmental Control, the State Committee for Forestry, the State Committee for Construction Affairs, the State Committee for Civil Construction, the Ministry of Geology, the Ministry of Power and Electrification and the Ministry of the Fish Industry of the USSR, VASKhNIL and VUZ's of the country--a total of 170 specialists.

The conference was opened by the director of the Institute of Geography of the USSR Academy of Sciences, academician I. P. Gerasimov. He took note of the primary importance of scientific research on the problem of diverting water and the leading role of geographical prognoses in this problem, devoting special attention to such extremely crucial aspects of them as the future condition of the Aral, Azov and Caspian seas, the socio-economic consequences of territorial redistribution of water resources, the permissible amounts of water that can be removed from the north, the change in the soil under the influence of irrigation, and the quality of water in the main canal for diverting Siberian waters. In conclusion, I. P. Gerasimov emphasized that the increased importance of geographical predictions in the problem of territorial redistribution of water resources is determined by the fact that at the present time they are considered to be a necessary prerequisite for all technical development of planning organizations.

The first part of the conference was opened by a general paper by N. I. Koronkevich, M. Ye. Gorodetskaya, L. K. Malik and L. L. Rozanov (Institute of Geography of the USSR Academy of Sciences). It summed up the preliminary results of scientific research of the Institute and co-workers regarding the effects of diverting river flow on nature and the environment. It also analyzed the possible consequences of

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the diversion and made recommendations for optimizing them. The main conclusion from the research that was conducted consists in that the implementation of the first part of the diversion of the flow which was developed by planning organizations will not lead to significant changes in natural conditions on a large regional scale, although it will affect local features of the natural environment. Moreover the nature of the local changes can be fairly wide-ranging, depending on the specific technical decisions regarding the diversion of flow as well as local natural and economic conditions. The positive consequences of the diversion of water can be increased and the negative ones reduced as a result of improving technical plans, promptly implementing compensatory measures, and utilizing both local and diverted water resources more efficiently. The effects on nature and the environment of diverting large volumes of water will require further study.

A. P. Brattsev (Komi branch of the USSR Academy of Sciences) discussed the work on possible alternative variants to diverting flow from the Pechora River which cause less damage to the natural environment of the Komi ASSR; V. A. Freyndling (Karelian branch of the USSR Academy of Sciences) discussed the results of a study of possible compensation for the removal of water from Lake Onega, pointing out the inadmissibility of utilizing high-quality water from the Vygozero basin for these purposes; V. A. Afanas'yev (Soyuzgiproleskhoz) discussed the methods of evaluating the damage to forestry and ways of compensating for it with interbasin redistribution of water resources. The results of many years of research by the Institute of Geography of Siberia and the Far East of the Siberian Branch of the USSR Academy of Sciences on the effects of the diversion of water on natural environment in the lower Irtysh was the subject of the report of G. V. Bachurin, V. S. Mikheyev, and I. B. Petrov. G. V. Gel'dyyeva (Geography Sector of the Kazakh SSR Academy of Sciences) gave an evaluation of the natural conditions of the Tengiz water reservoir, which is earmarked to be on the route of the Asian diversion of the flow of Siberian rivers, and arrived at a conclusion regarding the limited suitability of the Tengiz basin for constructing a regulating body of water on it. The dynamics of the mineralization of water in this body of water were reported by a collective authors, including U. M. Akhmedsafin, S. M. Shapiro, G. M. Kurmangaliyev and M. Kh. Dzhabasov (Institute of Hydrogeology and Hydrophysics of the Kazakh SSR Academy of Sciences). L. G. Dobrin (Institute of Deserts of the Turkmen SSR Academy of Sciences) summed up the experience in the functioning and operation of the Karakum canal as a possible analog for the southern segment of the main canal for diverting part of the flow of Siberian rivers.

Participating in the discussion were V. G. Chigir (Institute of Agrochemistry and Soil Science of the USSR Academy of Sciences), V. A. Nikolayev (Institute of Geology and Geophysics of the Siberian Branch of the USSR Academy of Sciences), T. L. Varkhotov (Soyuzgiprovodkhoz) and N. I. Kronokovich (Institute of Geography of the USSR Academy of Sciences). They noted that a significant amount of research had been done, whose results can form a basis for the final report of the Institute of Geography of the USSR Academy of Sciences, taking into account the latest developments of scientific organizations that are engaged in prognostication concerning individual elements of the environment and the latest planning decisions.

The second part of the conference was opened with a report by N. T. Kuznetsov and M. Ye. Gorodetskaya (Institute of Geography of the USSR Academy of Sciences) in

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which they presented extensive information regarding work on the problem of the Aral Sea regarding the desiccation and the anthropogenic desertification of the Aral area which have been caused by increased volumes of unrecycled water, mainly for the needs of irrigation farming. The problem of the Aral and Aral area is extremely critical and should be resolved immediately. The work for drawing up technical and economic documentation regarding this problem was discussed by T. L. Varkhotov and I. G. Khorst (Soyuzgiprovdkhov). The work on technical and economic documentation was divided into three main stages:

measures requiring immediate implementation;

measures calculated for a longer period of implementation--up to the time of the diversion of the flow of the Siberian rivers;

the same, taking into account the utilization of some of the Siberian streamflow.

The third part of the conference was opened with a speech by the director of the Institute of Water Problems of the USSR Academy of Sciences, a corresponding member of the USSR Academy of Sciences, G. V. Voropayev. He discussed the main results of scientific research in the USSR regarding the problem of diverting streamflow, which were significantly elucidated in the summary report prepared by the institute in conjunction with other organizations. He noted that they had analyzed the quantity and quality of water resources in the country and made a prediction of their condition and the levels of the Caspian and Aral seas as well as the saline condition of the Azov Sea. A first comprehensive evaluation was made of the changes in the environment under the influence of the earmarked first section of the diversion of the flow, recommendations were developed for minimizing the negative consequences of territorial redistribution of water resources, and so forth. But certain important areas of research have not yet been properly developed. They include prognoses of changes in the ecological systems under the effects of the diversion of waters as well as in the bioproductivity of the water and dry land, prospects for utilizing land resources, prognoses of natural and climatic conditions, and a socio-economic evaluation of measures directed toward solving water problems.

Ways of utilizing potential natural resources of the south of the European part of the country and the Caspian and Azov seas in connection with plans for territorial redistribution of water resources were reported by a collective of authors including M. I. L'vovich, F. I. Kozlovskiy (Institute of Geography of the USSR Academy of Sciences), N. G. Andreyev (VASKhNIL) and V. F. Karpevich (All-Union Scientific Research Institute of Sea Fisheries and Oceanography). In their opinion, an important task in diverting the river flow of the European part of the country is to maintain the proper conditions for the development of fishing in the Caspian and the Azov. Therefore the main part of this report was devoted to prognosis of fish productivity and catches of fish in the Caspian and Azov.

M. I. L'vovich, G. P. Medvedeva (Institute of Geography of the USSR Academy of Sciences), V. P. Oodoplelov and A. P. Bratsev (Komi Branch of the USSR Academy of Sciences) analyzed the main variants for removing water in the northern part of the country's European territory: a limited removal of water from Lake Onega with the removal of water from the lower reaches of the Pechora or from its Ural

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tributaries; and with the freshening of the Onega Bay and the supplying of water to the south through Onega and subsequently into the Volga.

A. S. Berezner (Soyuzgiprovodkhoz) gave an analysis of the water management situation in the European part of the country. D. Ya. Ratkovich (Institute of Water Problems of the USSR Academy of Sciences) considered several variants of the future condition of the Azov and Caspian seas which envision various economic and climatic situations in their basins, including those which take into account measures for limiting the development of irrigation farming and diverting various bodies of water, including transferring Black Sea water into the Caspian along the Kumo-Manychskaya lowland, and also hydrotechnical measures for regulating the evaporation and water exchange of these seas.

The report of M. I. Neyshtadt, L. K. Malik, Yu. L. Rauner and N. A. Karavayeva (Institute of Geography of the USSR Academy of Sciences) emphasized the need for considering the diversion of streamflow in close connection with the task for land reclamation of Western Siberia and presented in detail the concept of progressive marsh formation in this uniquely marshy territory. Under these conditions it is unacceptable to have any significant flooding of the land on the surface or underground as a result of hydrotechnical construction, including for diverting streamflow. The removal of part of the water will contribute to the development of draining marshy territory in Western Siberia, but this positive effect should be reinforced in all ways by minimizing or completely eliminating dam structures and the implementation of a complex of measures for accelerating the removal of water from water catchment areas into the river network and, especially important, regulation of the stream flow into the upper reaches of the Ob' and Irtysh by "cutting off" a considerable part of the water and thus facilitating the drainage role of the river network.

The report of A. L. Yanshin, N. V. Vostryakova, V. S. Kuskovskiy and V. M. Savkin (Institute of Geology and Geophysics of the Siberian Branch of the USSR Academy of Sciences) dealt with the most typical characteristics of the natural conditions of Western Siberia and gave a quantitative evaluation of this territory's water resources, and also characterized the hydrogeological conditions along the route of the diversion of Siberian waters. They considered a large complex of water management questions in Western Siberia, which shows that non-recycled losses of water in the Ob' basin brought about by the development of the economy, by the time of the implementation of the first section of the diversion, will be comparable with the amount of removal of water. Such a reduction of the river flow can lead to a whole series of unfavorable consequences both for the national economy and for the nature of this region. Therefore, in the opinion of the speakers, it is necessary to put water resources from the Yenisey into the Ob' basin even at the first stage of the diversion of streamflow.

V. M. Erovenskiy (Institute of Soil Science of the Kazakh SSR Academy of Sciences) came to a conclusion in his report regarding the special urgency of the development of irrigation for grain production on the virgin lands of Northern Kazakhstan. Although the necessary volume of water for irrigation can be provided solely by the diversion of part of the flow of Siberian rivers, it is also necessary to discover unutilized possibilities of local water, including for the development of estuary irrigation. One of the key problems for Northern Kazakhstan consists in the possible degradation of the soil when it is irrigated, especially chernozem and dark chestnut soils. In order to avoid unfavorable consequences, it is recommended that

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sprinkling be done with small norms only during the most important phases of plant development (this method still needs to be tested). He gave the results of prognoses of the effect of diverting water on other elements of the environment as well. He presented a program for the organization of experimental research into the soil and ecological consequences of transferring part of the flow of Siberian rivers into Kazakhstan and Central Asia. He also indicated the prospects that are opened up by diverting streamflow for the development of the large industrial region of Bol'shoy Tyrgay.

Corresponding members of the USSR Academy of Sciences, A. G. Babayev and L. G. Dobrin (Institute of Deserts of the Turkmen Academy of Sciences) in their reports characterized the influence of the Karakum canal on the natural conditions of the adjacent desert territories. In particular, they devoted a great deal of attention to questions of filtration of water from the canal, showing that its efficiency factor increased from 0.3 during the initial period of its operation to 0.8 at the present time.

M. K. Grave, I. A. Klyukanova, V. P. Kotyuchenko, L. M. Grave, Ye. N. Minayeva and D. V. Panfilov (Institute of Geography of the USSR Academy of Sciences) discussed, in addition to the Karakum canal, the Amu-Bukhara, Karshin, and Northern Golodnaya Steppe canals as possible analogues for the southern part of the route for the diversion of the flow of Siberian rivers. It was noted that the undesirable consequences of creating canals are largely conditioned by the prolongation of construction and their periodic reconstruction for handling large amounts of water. This pertains especially to canals with earthen beds. Concrete beds and other anti-filtration measures sharply reduce the negative consequences for the surrounding environment and save a considerable quantity of water. This should be taken into account when designing the main canal for the diversion.

N. M. Reshetkina (All-Union Scientific Research Institute of Hydraulic Engineering and Reclamation), A. S. Kes', A. N. Krenke and I. D. Tsigel'naya (Institute of Geography of the USSR Academy of Sciences) discussed the condition and prospects for the utilization of local surface and ground water resources of Central Asia and Southern Kazakhstan. They noted in their report that even in the near future all available water resources in the Aral basin will be fully investigated for possible irrigation uses. Further development of irrigation farming here can proceed mainly through the use of water resources that are freed by improving old irrigation systems and supplying part of the streamflow of Siberian rivers. Neither of these ways can be considered alternatives. They are both equally valid and should be carried out in parallel. One of the urgent problems that requires an immediate solution, whether the diversion takes place or not is the desalinization of drainage waters. Increased mineralization of drainage waters and, consequently, river waters is an extremely unfavorable ecological factor in Central Asia, especially in the Aral area.

K. I. Lapkin and E. D. Rakhimov (Council for the Study of Productive Resources of the Kazakh SSR Academy of Sciences) gave the results of calculations regarding the determination of the economic effectiveness of diverting part of the flow of Siberian rivers. O. A. Kibal'chich (Institute of Geography of the USSR Academy of Sciences) considered the socio-economic prerequisites and consequences of inter-zonal redistribution of water resources in the central region.

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Reports were also given by M. M. Madenov and S. T. Aldiyarov (Council for the Study of Productive Resources of the Kazakh SSR Academy of Sciences), I. P. Druzhinin (Eastern Siberian Branch of the Siberian Branch of the USSR Academy of Sciences), I. A. Volkov (Institute of Geology and Geophysics of the Siberian Branch of the USSR Academy of Sciences), G. V. Bachurin (Institute of Geography of Siberia and the Far East of the Siberian Branch of the USSR Academy of Sciences), M. Kh. Dzhabasov (Institute of Hydrogeology and Hydrophysics of the Kazakh SSR Academy of Sciences), T. G. Voynich-Syanozhentsskiy (All-Union Scientific Research Institute of Water Supply, Sewer Systems, Hydraulic Engineering Structures and Engineering Hydrogeology), V. S. Kaminskiy (Institute of Water Problems of the USSR Academy of Sciences), B. V. Fasnchevskiy (TsNIIKIVR), A. V. Avakyan (Institute of Water Problems of the USSR Academy of Sciences), Yu. V. Titov (Soyuzgiprovodkhoz) and A. S. Epshteyn (VNIETUSKh).

The closing address was given by academician I. P. Gerasimov. He took note of the fruitful work of the conference and emphasized that the discussion of problems concerning the diversion of waters will continue at workers' meetings.

Participants in the conference adopted a detailed decision. It noted the large amount of productive work on the problem of diverting the waters that is being done by the Institute of Geography of the USSR Academy of Sciences, the Institute of Water Problems of the USSR Academy of Sciences, the Siberian Branch of the USSR Academy of Sciences, the Kazakh SSR Academy of Sciences, the Turkmen SSR Academy of Sciences, the Uzbek SSR Academy of Sciences, the Komi and Karelian Branches of the USSR Academy of Sciences and other departments and organizations. It was recognized as necessary to further develop this research in close contact with planning institutions. A proposal was made concerning prompt generalization of the materials of scientific and scientific-technical developments regarding the development of diverting streamflow for the Asian part of the USSR into a single special problem entitled "The Central Region."

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EXTENT OF UZBEK ACADEMY'S STUDY OF RIVER REVERSAL DISCUSSED

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 11, Nov 80 pp 3-13

[Report on USSR Academy of Sciences Presidium discussion of work of Uzbek SSR Academy of Sciences: "Main Directions and Development Prospects of the Uzbek SSR Academy of Sciences' Scientific Research"]

[Excerpts] The USSR Academy of Sciences Presidium discussed at its meeting the results of the activity of the Uzbek SSR Academy of Sciences.

The report was delivered by Academician A. S. Sadykov, president of the Uzbek SSR Academy of Sciences.

The acceleration of the development of scientific-technical progress is confronting the Uzbek SSR Academy of Sciences with increasingly new tasks. It is essential for their successful accomplishment to examine certain scientific-organizational questions.

One of the main ones is the complex of problems connected with the further development both of cotton growing and the entire farming of the republic as a whole, which are caused by the increased shortage of water for irrigating the fields. A computation and evaluation of the land and water resources of the Central Asia region have shown that considerable areas of vacant land cannot be used owing to a water shortage. It has been determined that regulating the flows of the Amudar'ya and Syrdar'ya and also measures to improve the irrigation network will not help in fully solving these problems. The question of conducting scientific research and the implementation on its basis of a planned study connected with the problem of diverting part of the flow of northern and Siberian rivers to Central Asia, Kazakhstan and the Volga basin was raised in timely fashion at the 25th CPSU Congress. We believe that it is essential to return the Institute of Water Problems to the Uzbek SSR Academy of Sciences for an in-depth and comprehensive analysis and solution of these global problems.

Having dwelt on the question of the diversion of part of the flow of Siberian rivers to Central Asia and Kazakhstan, V. A. Kotel'nikov stressed that the main problem here is not only how to divert this water but whether it can be drawn off and to what this will lead. We are as yet studying this problem only in a very small way. If, on the other hand, we now elaborate merely the engineering solutions and the business is thus advanced, we will at some point find ourselves incapable of answering the main questions: Is it possible (and is it necessary)

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to do this in principle and if so, in what volume? For this reason it seems to me that these questions should be studied persistently not only in the republic but in the USSR Academy of Sciences also.

I would like to say a few words about the diversion of part of the flow of Siberian rivers to Central Asia. The study and solution of this problem is a political and social question. It is connected with the development of a huge area embracing the territory of more than just our republic and with the destiny of the millions of people who live there. This directive of the 25th party congress is supported by all the Central Asian republics.

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MODERN PROBLEMS OF THE CASPIAN SEA

Moscow PRIRODA in Russian No 1, Jan 81 pp 60-73

[Article by Grigoriy Vasil'yevich Voropayev and Aleksey Nilovich Kosarev]

[Text]



ABOVE: Grigoriy Vasil'yevich Voropayev, corresponding member USSR Academy of Sciences, Director of the Institute of Water Problems USSR Academy of Sciences, Chairman of the Scientific Council of the USSR State Committee on Science and Technology and the USSR Academy of Sciences on Comprehensive Study of Caspian Sea Problems. specialist in the field of general hydrology, land improvement and water management. Recently has been heading work on the scientific validation of territorial redistribution of water resources.

BELOW: Aleksey Nilovich Kosarev, doctor of geographical sciences, senior scientific specialist in the Oceanology Department Moscow State University imeni M. V. Lomonosov. Deputy chairman of the same council. Concerned with problems in the hydrology of the southern seas of the USSR, especially the Caspian Sea. Author of the monograph GIDROLOGIYA KASPIYSKOGO I ARAL'SKOGO MOREY [Hydrology of the Caspian and Aral Seas], Izd-vo Moskovskogo universiteta, 1975.

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The fate of the Caspian Sea constantly attracts attention. This is attributable to several factors: the uniqueness of the nature of this sea, not having equals among the water bodies of the earth; its sociohistorical significance in the life of the country; finally, the enormous role which the Caspian basin and the sea itself play in our national economy.

The basin of the Caspian Sea occupies more than half the area of the European USSR, including parts of the territory of the RSFSR, Azerbaijan, Kazakhstan and Turkmenia. Almost 70 million people live here; about 100 million hectares of agricultural lands are exploited; more than one-third of the industrial and about one-fifth of the agricultural production of the country come from here; 34 major hydroelectric power stations have been built and operate here, producing a third of the electric power of the country. The gross production of the Caspian basin is about 3% of the gross production of the country.

The Caspian Sea is one of the principal fishing basins in the USSR, yielding one-quarter of the total fish catch in the internal water bodies of the country and up to 90% of the world catch of sturgeon. This is a region of major reserves of gas and minerals, of highly important water transportation routes -- intraunion and international, a region of intensively developing resorts, places of rest and tourism.

The great saturation of the basin and the sea surface with natural resources and the high degree of development of different branches of industry and agriculture has had its effect: the anthropogenic pressure on the sea has greatly increased during recent decades. And the intensification of one of the branches of the economy in the Caspian region sometimes inflicts losses on another branch. As a result, the ecological systems of the sea function under a considerable overload and situations close to critical are being created in some elements. Thus, under modern conditions the problems associated with the Caspian Sea are becoming more and more complex and require the joining together of scientific forces for their solution.

The principal events in the life of the Caspian Sea in the current century have repeatedly been discussed at conferences and seminars, in the specialized and popular literature. The Caspian theme has also become traditional for PRIRODA, where articles on the Caspian problem have been published by such well known specialists as B. A. Apollov, T. S. Rass, L. A. Zenkevich, Yu. Yu. Marti, and others. What is the state of affairs with the Caspian today?

Water Balance and Level

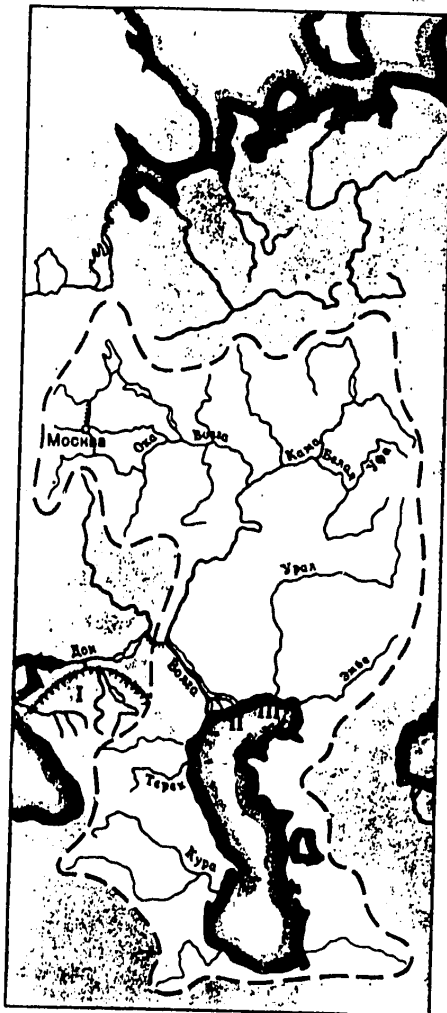
A major part of the problems relating to the Caspian Sea in the last analysis is the result of the fact that this is a closed water body not having any connection to the world ocean and it experiences considerable long-term level fluctuations.

Already in the 1950's-1960's the problem of the Caspian Sea began to be raised as the problem of control of its regime, especially its level regime, and then, as the problem of controlling all the other regimes associated with it, determining the overall state of the water medium.

The water balance (or to be more precise, budget) of the sea consists of the following principal components: receipts -- river flow precipitation, inflow of ground water; losses -- evaporation and flow existing up to 1980, into the

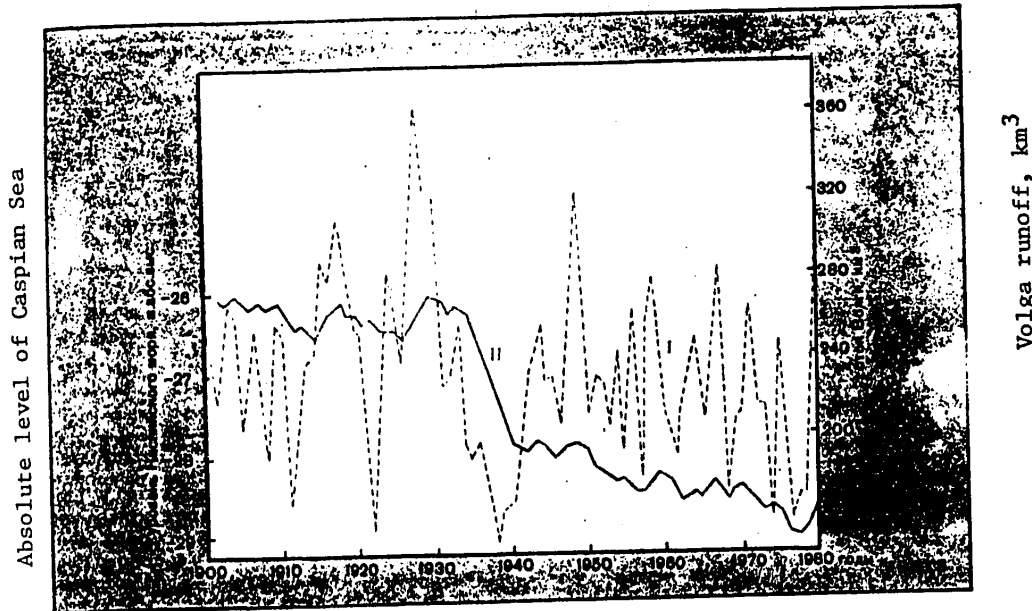
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Kara-Bogaz-Gol. Precipitation and evaporation over the long term vary little and during 1940-1970 averaged 74.5 and 359.5 km³ of water annually. The magnitude of the underground inflow is usually also assumed to be constant and equal to 4 km³ annually. The flow of water into the Kara-Bogaz-Gol gulf changed from 26.2 km³ in 1929 to 5 km³ in 1978.

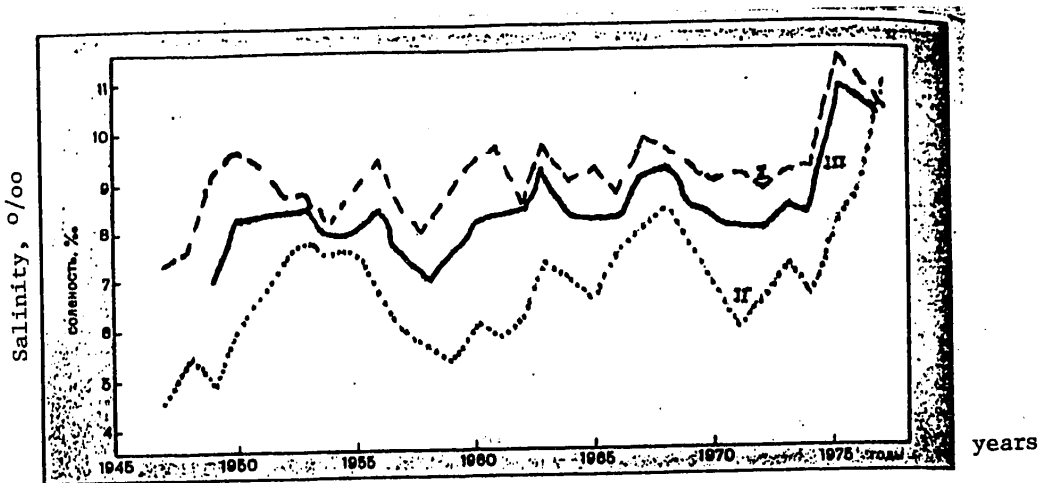


Caspian Sea basin. The figure shows the scheme of hydraulic structures for regulating the level regime of the Caspian: I) Black Sea-Caspian Canal; II) dam separating the surface of the Northern Caspian; III) dam separating off northeastern shallow waters. The dashed lines represent the boundaries between the Northern, Middle and Southern Caspian.

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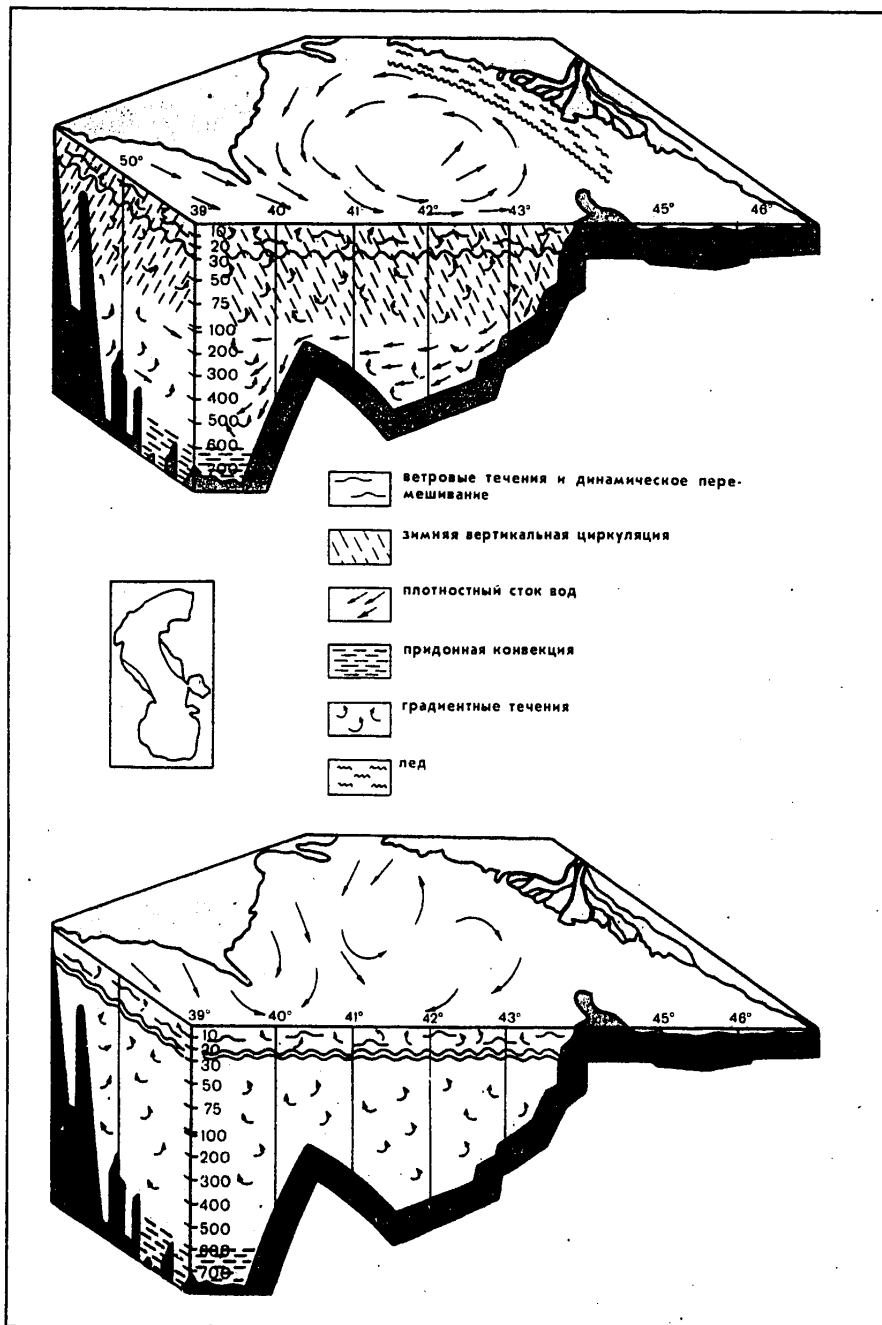
Streamflow of Volga and level of Caspian Sea during period 1900-1979. I) streamflow of the Volga at Volgograd; II) mean annual sea level.



Changes in mean annual salinity values in the Northern Caspian during the period 1949-1979. I) western part; II) eastern part, III) Northern Caspian. According to data of D. N. Katunin.

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Hydrological processes in the Caspian Sea during the winter (at top) and summer (at bottom) seasons. The insert shows zones of upwelling. Top to bottom: wind currents and dynamic mixing; winter vertical circulation; density flow of water; natural convection, gradient currents, ice

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The mean total flow of rivers into the Caspian Sea during the period 1880-1972 was 294 km³ per year, of which 95% was from the Volga, Ural, Kura, Terek and Sulak. More than 80% of the total flow into the sea is the waters of the Volga -- 251 km³ annually during the period 1881-1950. Thus, the main receipt component in the balance, compensating evaporation, is river flow into the sea. In the 1930's in the Volga basin there was a deficit of precipitation, which led to a substantial decrease in the water volume carried by the river. The mean flow of the Volga during the period 1930-1945 dropped to 216 km³ annually.

Accordingly, there was also a change in the level of the Caspian Sea. Between 1830 (the beginning of instrumental observations of the Caspian level) through 1930 the sea level remained at readings between -25.2 and -26.6 m (absolute reading) and on the average was -25.8 m. Beginning in 1930 a marked decrease in sea level began (20 cm per year); this lasted until 1941. In 1956 the sea level was already 2.5 m lower than in 1929.

In the 1950's a phase of increased moistening began in the Volga basin and the level of the Caspian could increase, according to the computations of I. A. Shiklomanov, by approximately 1 m by 1975. However, the Kuybyshevskoye and Volgogradskoye Reservoirs were created on the Volga precisely in the 1950's and their filling required a considerable volume of water. In addition, there was an increase in the withdrawal of water from the river for economic needs, primarily for irrigation (at the present time these losses amount to about 20 km³ annually). By 1977 the sea level had dropped to the reading -29.0 m, the lowest in more than 400 years. True, during 1978-1980 there was some increase in the level and now it is at the reading -28.5 m. This reading also is the most probable modern position of the Caspian level. A sea level with a reading -28.5 m is the lowest admissible level for the branches of the national economy associated with the sea -- navigation, marine production of petroleum and especially fishing. And what are the possible prospects?

The formulation of superlong-range predictions of the level of the Caspian Sea is an exceedingly complex problem. Science, unfortunately, for the time being does not have methods for preparing predictions of the hydrometeorological regime for such water bodies as the Caspian, for 30-50 or more years. The fact is that for the time being we cannot predict the changes in climatic conditions which determine the character of humidity and water resources of a territory. It is only possible to give stochastic predictions, proceeding from the premise that the process is stationary, by means of extrapolation of the components of the water balance of the sea. In predictions some researchers use the correlation between fluctuations of the level of the Caspian and the indices of atmospheric circulation or other indices characterizing the moisture cycle conditions in the northern hemisphere.

All researchers come to the common conclusion that beginning in the 1950's the phase of increased moistening of climate in the Volga basin will continue and due to natural climatic factors one should expect a substantial increase in sea level.

At the present time the Caspian does not receive approximately 35-37 km³ of river flow per year in comparison with the time when the flow was not regulated. According to data from different organizations, by the year 2000 the volume of non-returned water consumption in the Caspian basin will be, approximately, from 66

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to 100 km³ annually. Even with the withdrawal of 66 km³ each year, the level of the Caspian, according to computations of the State Hydrological Institute, with the mean natural inflow, by the year 2000 will drop by 1.4 m.

In order to maintain the level at least at the modern, quite undesirable low reading (absolute elevation -28.5 m) urgent measures must be taken for reducing the nonreturned losses of river water. The total maximum consumption of water for all the five principal rivers of the Caspian basin must not exceed 60-65 km³ annually, and in the Volga basin -- 40 km³ annually.

At the present time, according to data from R. V. Nikolayeva, the total area of the Caspian Sea is 360,700 km². Since 1929 the area of the sea has been reduced by almost 40,000 km², primarily due to drainage of the shallow-water Northern Caspian.

Northern Caspian

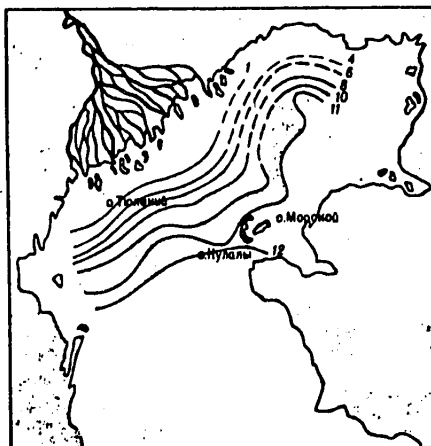
The Northern Caspian contains less than 1/2% of the total volume of water in the sea. However, precisely this part of the Caspian is the principal area ensuring the reproduction of fish and sustaining the high productivity for which the Caspian Sea is famed. The great value and uniqueness of fauna in the Northern Caspian is one of the principal reasons that several national preserves were created here. The consequences of a decrease in sea level are reflected in the Northern Caspian more rapidly and more intensely than in the deep basin of the sea.

The changes recently transpiring in the Northern Caspian were discussed in detail at a special conference held in Astrakhan' in November 1979. The conference was organized by the Scientific Council on Comprehensive Study of Caspian Sea problems of the USSR State Committee on Science and Technology and the USSR Academy of Sciences, whose task includes the coordination of all the investigations carried out by different organizations interested in Caspian problems.

As a result of regulation the flow of the Volga changed not only with respect to volume, but also with respect to distribution within the year. The volume of spring high water decreased from 150 km³ (in 1881-1955) to 83 km³ (in 1971-1977), and in 1975-1977 was even less than 60 km³. The high-water hydrograph changed, becoming worse for fishing. Under natural conditions the increase and the dropoff of high water occurred gradually. Now there is a later beginning of high water, early passage of its peak, and a substantially earlier onset of low water. At the same time, there was some increase in flow during the autumn-winter months. There are also changes in the chemical composition of the river flow. We note that the fishing industry requires an increased inflow of water at high water, water transportation must have adequate depths at the time of summer-autumn low water, whereas the production of hydroelectric power requires a high flow in winter.

There was a substantial change in the distribution of flow in the distributaries of the Volga delta. There was a decrease in the flow through the Staraya Volga, Bolda, Kizan' and Buzan distributaries and an increase in Bakhtemir distributary as a result of the constant implementation of work here for the deepening of the bottom. As a result, about 25% of the Volga flow now is carried into the Middle Caspian and does not participate in bioproduction processes in the northern part of the sea.

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Salinity (‰) in Northern Caspian in August (low water) 1976.

The change in the water regime of the Volga led to considerable changes in the natural conditions of its delta region and mouth embayment. There was an intensification of salinization of the soil cover in the delta, shoaling and spreading of swamps around the mouth embayment, making it difficult for the fish to go upstream for spawning and for the young to pass downstream into the sea.

There was a considerable change in the morphometric and hydrographic characteristics of the mouth region of the Volga. Due to the rapid dropoff of sea level and the retreat of the sea margin of the delta a buffer zone with a width of 35-60 km with depths for the most part less than 1 m was formed between the delta proper and the deeper zone of the mouth embayment. This buffer zone was heavily overgrown with above- and below-water vegetation. Within the limits of this zone there is a considerable transformation of the biogenous and solid flow of the Volga and the sea receives fewer mineral forms of phosphorus and nitrogen compounds and more organic forms. In the shallow-water part of the embayment there was a considerable weakening of dynamic processes -- waves, currents, surges. It is interesting that despite the general decrease in sea level, in the buffer zone there is a stabilization of level and even an insignificant increase. As a result, this zone in essence dropped out of active use for fishing.

With a further decrease in flow these tendencies in the change in the natural characteristics of the mouth region of the Volga will continue in a direction unfavorable for fishing.

During recent years there has also been a strong decrease in the flow of the Ural (during 1974-1978 it was only 4.8 km³ per year), which now exerts almost no freshening influence on the waters of the eastern part of the Northern Caspian. The decrease in sea level led to a change in water exchange between the western and eastern parts of the Northern Caspian: the entry of Volga waters into the eastern regions became difficult.

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The salinity of the Northern Caspian continues to change under modern conditions. In the shallow-water regions of its western part it is decreasing; in the remaining area of the sea, especially in the eastern part, it is increasing (to 9.7-10.7^o/oo in 1977-1978, in comparison with 6.5-8.7^o/oo in 1949-1958). The area of the freshened zones of the Northern Caspian has sharply decreased and there has been an increase in the arrival of the more saline waters of the Middle Caspian here. In the southeastern region of the Northern Caspian in individual years zones are formed in which water salinity attains 13-15^o/oo. The annual variation of salinity in the Northern Caspian now is controlled to a greater degree by the discharges of water by the hydroelectric power stations on the Volga.

In the region bordering on the Middle Caspian during recent years there has been an increase in the formation of extensive zones with an oxygen deficit in summer. Over the entire area of the Northern Caspian there has been a reduction in the reserves of biogenous substances and the primary production of organic matter has decreased by more than half.

The mentioned changes in the physiographic and hydrological-hydrochemical conditions in the Northern Caspian have been reflected unfavorably in the biological productivity of the water body. For example, the biomass of phytoplankton during recent years has been reduced almost by a factor of 3 (especially in the eastern part of the Northern Caspian). The low level of development of zooplankton already established in the 1950's persists. There was a decrease in the biomass and range of saline water- and slightly saline water complexes of bottom fauna organisms and at the same time an increase in the production of salt-loving forms. These changes cause a marked deterioration of the feeding base for roach and bream, although for the time being they ensure favorable conditions for the successful development of sturgeons.

As a result of changes in ecological conditions in places of reproduction (lower reaches of rivers) and growth and development (northern part of the sea) of freshwater semimigratory and river fish their numbers have been reduced and the catch has been reduced by almost a factor of 2.5.

The banning of the catching of sturgeons in the sea, the regulation of their catching in rivers and the preservation of the natural and development of artificial reproduction have made it possible to improve the supplies of sturgeon in the Caspian basin. [In the 1980 season there has been artificial reproduction of more than 70 million white, Russian and starred sturgeons, the highest index for all years. Special aquarium ships deliver the young fish to the parts of the Northern Caspian favorable for further development.] However, in the low-water years 1973, 1975-1977 the replenishment of the numbers of starred and Russian sturgeon by young fish was unfavorable.

The speediest possible implementation of the project for diverting part of the flow of northern rivers into the Caspian Sea basin can be of fundamental assistance in improving the natural-ecological conditions in the Northern Caspian. At the same time, other measures are being proposed for optimizing the water-salt regime of the Northern Caspian and the mouth regions of the Volga and Ural and increasing their biological productivity.

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One of the measures involves the need for improving the functioning of the water divider in the Volga delta. This is a special reinforced concrete dam constructed several years ago 50 km above Astrakhan. By opening and closing the openings in the water divider by the use of gates it will be possible to distribute the flood waters uniformly in all the distributaries of the Volga. Unfortunately, the rules for operation of the water divider, providing for the flooding of the spawning grounds in the eastern part of the Volga delta, for the time being are still not being obeyed.

Another important measure is the construction of the Volga-Ural Canal for the purpose of shifting into the Ural from 1.5 to 4.0 km³ of Volga water in the interests of fishing. Indeed, the Ural is unregulated and despite its very small flow and small high waters, ensures up to 40% of the sturgeon catch in the Caspian basin.

It is also necessary to carry out the reconstruction of the mouth region of the Volga, in particular, deepening and broadening of the channels used by fish. There is a need for improving the delta for fishing purposes, as is also true of the shallow water part of the mouth embayment and the Volga-Akhtubinsk floodplain, taking into account the tendency in development of natural processes and the influence of anthropogenic factors.

In order to improve the conditions for the reproduction of sturgeons it is recommended that there be an increase in the area of artificial spawning grounds in the rivers of the Caspian basin and that all spawning grounds of sturgeons be declared off limits. In all branches of the national economy in the Caspian region it is necessary to reduce the consumption of water by means of improving the technology of production, introduction of water cycling and repeated, multiple use of water.

Now, when rapid and substantial changes are occurring in the natural conditions of the Northern Caspian, there must be very careful monitoring of the environment in the region.

Middle and Southern Caspian

In comparison with the Northern Caspian, the hydrological-hydrochemical conditions in the deep basin of the sea -- the Middle and Southern Caspian -- are considerably more stable relative to external effects, which is attributable to the inertia of the water masses due to their great volume. [According to data from R. V. Nikolayeva, the total volume of waters in the Caspian Sea is 78,000 km³: in the Northern Caspian -- 346 km³, Middle Caspian -- 26,500 km³, Southern Caspian -- 51,200 km³.]

The ecological system of the Middle and Southern Caspian functions for the most part due to the internal cycling of biogenous substances, whose reserves to only a small degree are dependent on the direct influence of river flow. The salinity of the open regions of the sea also changes little and its level rarely exceeds 12.7-13.2‰. All this causes stability of the ecological conditions for the fish living here -- Caspian sprat, sea herring, adult sturgeons, and others.

Biogenous substances in the Middle and Southern Caspian actively move from the deep layers into the upper productive layer of the sea due to the well-developed processes of mixing of sea water during winter.

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The process of density mixing in the Caspian Sea is considerably facilitated by the fact that the thickness of its waters is extremely poorly stratified with respect to salinity, so that this closed sea differs advantageously from the Black Sea. In the open regions of the Caspian the vertical change in salinity does not exceed tenths of 1⁰/oo, whereas in the Black Sea, due to the entry of more saline Sea of Marmara waters into its deep layers, the salinity increases from 17-18⁰/oo at the surface to 22.5⁰/oo at the bottom.

In the deep basin of the Caspian Sea an intense vertical exchange of waters is ensured by the following factors: wind currents and dynamic mixing in the upper layer (in summer it is limited from below by the thermocline); gradient currents in the deep layers; winter vertical circulation and density flow of cooled waters from shallow waters into the deep layers; bottom convection in the Southern Caspian; in summer -- mixing due to internal waves excited in the thermocline; surge circulation (upwelling), developing in the coastal regions of the Middle Caspian, especially along its eastern shore.

Winter vertical circulation occurs due to the cooling of waters and an increase in their density. Under average conditions in the middle part of the sea it attains 150-200 m, in the southern part --- 100 m (in severe winters the depth of propagation of convection is considerably greater, especially in the Middle Caspian). In the mixing and ventilation of the deeper layers of the sea an important role is played by the density flow of waters from the northern shallow-water regions of the sea and from the gulfs along the eastern shore, also greatly cooled in winter. The waters with a high density forming in winter in the region of the ice edge on the boundary between the Northern and Middle Caspian have the possibility of flowing along the bottom slopes to the greatest depths of the Middle Caspian depression, and then, flowing across the Apsheron sill, enter into the deep layers of the Southern Caspian. In the bottom layers of the southern part of the sea the mixing processes can be intensified due to the appearance of bottom convective circulation, excited by the heat flow from the sea floor.

The winter vertical circulation and density flow of waters ensure a good saturation of the deep water layers with oxygen and cause a compensatory rising of deep waters enriched with biogenous substances into the upper layer of the sea. All these processes create extremely favorable conditions for the formation of a high biological productivity in the Middle and Southern Caspian.

The water temperature, the content of oxygen and biogenous substances in the deep basin of the Caspian Sea, have almost not changed during recent decades, which is evidence of the stability of these characteristics. There has been a small increase only in the year-to-year changes in salinity, a salinity of 13.0-13.2⁰/oo has come to be observed most frequently, but these salinity changes are not significant for biological processes.

Biologists assume that the change in the inflow of river waters and the decrease in sea level have had no significant effect on the indices of productivity of plankton and benthos in the Middle and Southern Caspian. The feeding base of the most numerous anchovy-like sprat and adult sturgeons for the time being is persisting in a stable state and ensures the formation of their great reserves and stable catches.

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It is also interesting to note that the decrease in river flow in the northern part of the sea was the reason for the substantial change in the oxygen regime of the deep waters of the Caspian, favorable for the development of bioproduction processes here.

It is known that in the 1930's the presence of hydrogen sulfide was observed in the bottom layers of deep depressions in the Caspian. This was evidence of their inadequate ventilation. In the 1940's, and especially in the 1950's, after a sharp decrease in sea level, the hydrogen sulfide contamination in the bottom layers of the Middle and Southern Caspian disappeared, and the oxygen content became 3.0-3.5 and 1.5-2.5 ml/liter respectively. What specifically is the reason for such sharp changes in chemical conditions in the sea?

The decrease in Volga flow and the salinization of the Northern Caspian led to an increase in the density of Northern Caspian waters, which during the winter cooling afforded a possibility for the deeper subsidence of these waters in the Middle Caspian depression to its very bottom. Computations indicated that prior to the falling of sea level such a possibility did not exist because the density of the bottom layers of water in winter nevertheless remained higher than that of the surface layers. Ventilation of the deep layers of the Southern Caspian is occurring as a result of entry of Middle Caspian waters. Since the depth of subsidence of these waters along the southern slope of the Apsheron sill increased, there was also an improvement in ventilation of the bottom layers of the Southern Caspian. This process, in turn, caused an intensification of the compensatory rising of deep waters toward the surface. On the whole, during recent decades there has been an improvement in mixing in the entire thickness of the sea, ventilation of the bottom layers and their supply with oxygen; the entry of nutrients into the photic layer of the sea became more active.

It must also be remembered that due to the shoaling of the eastern distributaries of the Volga and the concentration of its flow in the western distributaries the biogenous substances transported by the river enter into the western region of the Middle Caspian and then are transported by the current into the southern part of the sea.

Whereas the lowering of sea level associated with definite types of anthropogenic effects for the time being have exerted an unfavorable influence for the most part on the productivity of the Northern Caspian, other types of economic activity exert a negative influence on the conditions for the life of organisms in the entire sea by contamination of its waters.

Contending With Contamination

The problem of contending with the contamination of Caspian waters is of exceptionally great importance. Due to the very high degree of industrial use of the sea shores and intensity of development of sea production of petroleum, the sea waters are considerably contaminated by petroleum hydrocarbons and heavy metals, and the waters of the Northern Caspian -- by pesticides. Contending with contamination is no easy task, requiring time, experience and investment of much money.

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The Party and government are devoting great attention to this problem. In 1968 a decree of the USSR Council of Ministers entitled "Measures for Prevention of Caspian Sea Contamination" was adopted. In 1972 this was followed by a decree of the Central Committee CPSU and the USSR Council of Ministers entitled "Measures for Preventing Contamination of the Volga and Ural Rivers by Unpurified Waste Waters." In 1977 a decree entitled "Additional Measures for Preserving the Caspian Sea from Contamination" was issued. These decrees provided for a broad range of measures for preserving the waters of this unique water body.

During the past decade 400 million rubles were invested on water preservation measures in the basin of the Caspian Sea. More than 300 purification structures were put into operation. The discharge of contaminated waters from ships of the fleet was completely eliminated. Unfortunately, for the time being the discharge of contaminated waste water into the water body by some industrial enterprises situated on the sea shores is still continuing.

The measures adopted have already begun to yield results. According to data of the Kaspvognadzor Administration of the USSR Water Management Ministry, which was made responsible for the preservation of waters in the entire Caspian basin, during the last five-six years there has been a stable tendency to a decrease in the general level of water contamination.

At the present time active work is being done on creation of different methods for the purification of waste and industrial waters, chemical methods of a dispersing, sorbing and collecting nature for contending with petroleum spills in the sea.

All petroleum refining plants in Azerbaijan have been changed over to a closed water supply system. Under the program for a radical reconstruction of the branch, water cooling of industrial apparatus is being replaced by air cooling. The ballast waters from the holds of tankers are pumped out at purification stations. All the ships in the petroleum fleet are supplied with apparatus preventing the entry of petroleum products into the sea.

The ministries and departments whose enterprises are situated in the Caspian Sea basin have formulated measures for the complete cessation (by 1985) of contamination of the water body and the rivers flowing into it.

Kara-Bogaz-Gol

There are many projects for optimizing and regulating the level of the Caspian, for example, such as the diverting of part of the flow of northern rivers. Other projects provide for the maintenance of level only in individual regions of the Caspian (local regulation). Still others are directed to reduction of the loss (discharge) component of the water budget of the water body. To be sure, in this article it is impossible to examine all the projects, but some of these, the most timely or disputable, should be discussed. One of the projects for lessening the discharge part of the water budget of the Caspian has already been realized: in 1980 Kara-Bogaz-Gol gulf was separated off from the sea. Changes in the nature of this unique gulf are transpiring literally before our eyes.

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Under natural conditions the Kara-Bogaz-Gol gulf constituted the world's largest lagoon, separated from the Caspian by sand bars forming a strait about 9 km long and with a width from 120 m at the origin to 800 m at the mouth. Caspian water entered the gulf through the strait and was completely evaporated in the gulf. The level of the gulf was therefore below sea level. The difference in the levels between the sea and gulf varied in dependence on the volume of Caspian water entering the Kara-Bogaz-Gol, which in turn was dependent on the position of the sea level. A decrease in the flow into the Kara-Bogaz-Gol, caused by a decrease in the level of the Caspian, led to a reduction in the area of the gulf from 18,300 (1930) to 9,600 km² (1979). The maximum depth of the gulf decreased from 13 m in the 1930's to 3.5 m. The mean depth of the gulf now does not exceed 1 m.

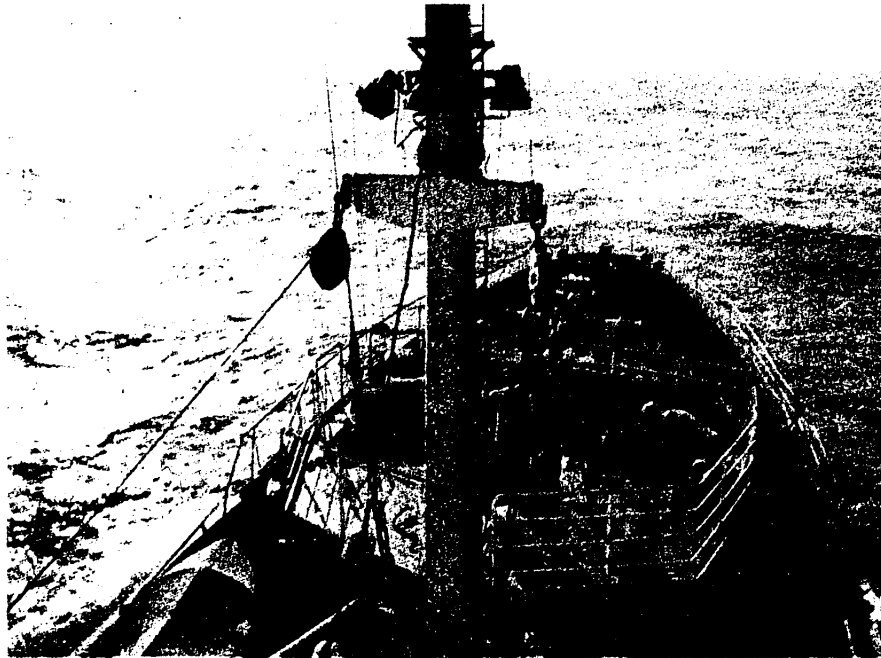


Delta of the Volga. Photo by A. V. Gidirimskiy and M. S. Red'kin.

Due to the difference in the levels of the sea and gulf, and also due to the fact that near the mouth of the strait hard rocks extend toward the surface, the world's only natural sea waterfall was formed here in its time; during recent years the height of this waterfall was about 3.5 m.

All taken together: the strait, waterfall and the part of the gulf adjacent to it amidst the surrounding desert created an unduplicated and charming impression, and this tiny corner of the nature of the Caspian Sea has left a deep impression in the spirit of those who have had the good fortune to see it.

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Scientific research ship of the Caspian Scientific Research Institute of Fishing "Aksiom" in the Northern Caspian. Photo by A. V. Gidirimskiy and M. S. Red'kin.

As a result of evaporation of the Caspian water entering into the gulf and the additional evaporation of "secular" water reserves in the gulf, its waters constitute sea water of greatly increased density, brine, whose salinity attains 300^o/oo or more.

The brine is a concentrated water solution of sodium, magnesium and potassium chlorides, magnesium sulfate with a relatively small quantity of rare and disperse elements.

The total reserves of salts in the gulf are estimated at billions of tons. The Kara-Bogaz-Gol is the largest deposit of sodium sulfate in the USSR. This is the only place in the world where the crystallization of various mineral salts occurs on an industrial scale.

The chemical composition of the brine in the gulf and the order of precipitation of salts into the sediments are dependent on the brine concentration and therefore changed considerably with time in dependence on the quantity of sea water entering the gulf. In May 1980 the authors of this article visited the Kara-Bogaz-Gol.

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The small AN-2 aircraft landed on a sand strip not far from the strait. And here we see a dam. How the strait has changed! The channel has already almost dried up; only on the bottom is there a little brownish fluid. The exposed rocks of the sill look dejected. The noise of the waterfall has fallen silent and all the singularity of this landscape has disappeared against the background of the surrounding desert. A pity? To be sure, it is. But such sharp intervention of man in nature was caused by the need for each cubic kilometer of Caspian water.

A new stage has come in the life of the Kara-Bogaz-Gol. The cessation of flow into the gulf has caused its gradual shoaling, the concentration of surface brine, the precipitation of salts, the transformation of the gulf into a dry salt basin. One must also expect other changes in the hydrochemical and hydrogeological conditions in the gulf, some of which for the time being cannot be foreseen because the natural changes transpiring here have no analogues elsewhere. For that reason there is need now for the closest observation of all the changes transpiring here in the gulf and in the surrounding territory.

The blocking of the strait does not preclude in the future the construction of regulating devices in the body of the dam for the admission of definite quantities of sea water into the gulf in case it is necessary to change the chemical composition of its raw material base.

Accordingly, it is deemed necessary that the personnel of a number of institutes carry out further multisided investigations in the Kara-Bogaz-Gol region during the Eleventh Five-Year Plan.

Projects for Helping the Caspian

After the blocking off of the Kara-Bogaz-Gol, the next simplest and most feasible technical solution is the project for using a dike to separate the eastern shallow waters of the Northern Caspian from the sea.

In 1977 R. V. Nikolayeva and R. Ye. Pereslegina made computations for the variant of the layout of a dike running from Cape Burunchuk to Zhilaya Kosa village, including the shore zone within the limits of the contour -26.0 m. The sea area which would be cut off was equal to 4,600 km².

In the part of the sea to be cut off there is a predominance of depths up to 1.5 m and the bottom slopes are very small. The territory adjacent to the sea is a sea floor which was recently dried out (an area of about 10,000 km²), also with a very gentle slope. The quantity of evaporation in this region considerably exceeds precipitation during almost the entire year. The wind conditions are such that they cause frequent surges, due to which considerable expanses of coastal land are inundated. The above-mentioned authors feel that the implementation of this project will make it possible to save about 7 km³ of water annually which is now lost in evaporation.

The best known project for the local regulation of the level of the Caspian Sea, developed in greatest detail by B. A. Apollov, is the separation of the Northern Caspian from the rest of the sea by a dike and the creation of the Northern Caspian

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Reservoir. According to this project, the dike should run from the western shore of the Northern Caspian 30 km to the south of Kaspiyskiy city to the Buzachi Peninsula. The total extent of the dike would be about 430 km and the area of the Northern Caspian Reservoir cut off by it would be 76,000 km². However, as a result of dike construction there would be a substantial change in salinity of the Northern Caspian. According to the computations of Ye. G. Arkhipova, if the mean salinity of Northern Caspian waters prior to construction of the dike was 5‰ and the salinity of the entering river waters was 0.5‰, after only 3-4 years the mean salinity of the reservoir would be less than 1‰. The construction of the dike would lead to a change in the dynamics of waters in the reservoir: the water would stagnate and the biology of the water body would change. At the same time, in the Middle and Southern Caspian, with a decrease in the volume of less saline waters entering from the Northern Caspian, the salinity will possibly increase and a considerable drop in sea level will put the principal ports out of operation.

It must be added that in winter, with a limited water exchange with the Middle Caspian, under the ice cover of the Northern Caspian Reservoir there could be formation of an oxygen deficit and fish could perish from a lack of oxygen.

Other undesirable effects for biological productivity of the northern part of the sea are also expected. As a result of the considerable freshening the relict complex of mollusks living in slightly saline waters will disappear. There would be a considerable deterioration in the conditions for growth and development of semimigratory fish and young sturgeons. Some productive zones of the Northern Caspian will be behind the dike barrier. It would separate the zone of reproduction and propagation of young sturgeons from the pastures of young fish which are situated in the Middle and Southern Caspian. These factors make it possible to consider the construction of a dike separating off the Northern Caspian to be undesirable and this project has now been abandoned.

Among the projects for stabilizing the level of the Caspian Sea by supplying waters from other basins is the proposal to construct a canal from the Black Sea to the Caspian. Recently this project was analyzed in extremely great detail by N. A. Dzyadevich, who sets forth the following considerations.

According to the project, the canal will collect Black Sea water in the region to the north of Novorossiysk and will pass along the eastern shore of the Sea of Azov, then along the Manychskaya depression to Kizlyarskiy Gulf in the Caspian Sea. The volume of the proposed diversion is 60-100 km³ of water annually. The existing difference in levels between the Black and Caspian Seas is about 28 m and the favorable relief separating their territories will make it possible to feed Black Sea water into the Caspian by gravity.

Since the Caspian Sea is a closed water body, the salts entering with the Black Sea waters (in the case of a flow of 100 km³, about 2 billion tons of salts annually) will gradually accumulate in it. After approximately 200 years from the beginning of functioning of the canal the mean salinity of the Caspian will increase by a factor of 1.5, that is, it will become comparable to the salinity of the Black Sea. In the more remote future the salinity of the Caspian Sea will attain the salinity of the Mediterranean Sea -- up to 38‰ or more, and eventually the Caspian will be transformed into a water body almost deprived of ichthyofauna -- an evaporator of the waters of the world ocean similar to the Kara-Bogaz-Gol.

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The mean salinity of the Northern Caspian under the influence of the great masses of Black Sea water with a salinity not less than 15⁰/oo, entering into the region of Agrakhanskiy Gulf, even after a few years will increase, approximately doubling, and only then will the salinization process here proceed parallelly with the slow increase of salinity in the entire sea.

Even the relatively small salinization of the Northern Caspian during recent decades -- as we have seen -- caused an appreciable deterioration of the conditions for its biological productivity. A total increase in salinity in the Northern Caspian by a factor of 1.5 will lead to a strong decrease in saline waters (salinity up to 5-6⁰/oo), and this will cause a final degradation of the fauna of Caspian semi-migratory fish.

In addition, it must be remembered that the saline and denser Black Sea waters entering into the Caspian will partially subside into the deep layers of the Middle Caspian, as a result of which there can be reformation of the stagnant hydrogen sulfide zone, a decrease in the compensatory rising of deep waters rich in biogenous substances into the upper layers.

Thus, the construction of the Black Sea-Caspian canal (like the dike separating the northern part of the sea) does not ensure solution of the most important of the formulated problems -- preservation and increase in the productivity of the unique Caspian ichthyofauna. On the contrary, this expensive canal in the coming decades can become the principal factor in degradation of this ichthyofauna, and in the future time -- the entire ecological system of the Caspian Sea. In addition, the shores of the canal, filled with saline water, along its entire extent would remain lifeless.

All the considered measures for assisting the Caspian Sea must be regarded not as an alternative to the diversion of part of the flow of Siberian rivers, but as an auxiliary means for decreasing unproductive water losses. They cannot fully compensate the growing nonreturned water consumption in the basin of the Caspian Sea.

The development of the project for diverting part of the river flow from the north into the basin of the Caspian Sea at the present time has approached the stage of preparation of the technical-economic base. It provides for the collection of water from Lakes Vozhe, Lacha and Onega, and in part from the Sukhona and Pechora Rivers. It is proposed that all this water be concentrated in the Volga and be carried through it into the Caspian Sea.

However, on the basis of available studies, recently it has been concluded that it is possible to withdraw not more than 20 km³ of water, not 40-60 km³, as proposed earlier. These 20 km³ of water with timely delivery could be of substantial assistance to the Caspian Sea.

Such is the situation. What are now the principal scientific problems of the Caspian Sea?

First of all, to be sure, the prediction of the water and salt balances of the sea, its level regime, for not less than 30-50 years.

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It is also necessary to formulate forecasts of changes in the ecosystems of the Caspian Sea under the influence of anticipated changes in its water-salt regime, natural conditions of the mouth regions of the rivers and other regions of the sea.

Another task which remains is improvement of methods and means for collecting information on the state of the water medium of the sea and the especially strongly changing Northern Caspian.

Economic problems should occupy a special place in the range of Caspian scientific problems. Unfortunately, up to the present time in planning and scientific research work it frequently still remains unclear what losses the national economy will experience in connection with the transpiring changes in the natural conditions of the sea and what changes from the economic point of view should be expected if the sea level drops down still more, or, vice versa, rises. Accordingly, there is in essence nothing with which to compare the expenditures necessary for the implementation of different projects for assisting the sea.

A result of generalization of all the investigations and forecasts of the state of the Caspian Sea should be the development of a unified strategy making possible scientifically sound control of its regime.

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