

AMUR RIVER BASIN: REGIONAL AND GLOBAL IMPORTANCE

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The Amur River system, originating from the Argun and Shilka Rivers, is one of the largest river systems in Asia. After the Amur River is joined by the Songhua River (China), and the Ussuri River (China-Russia border), and the Zeya and Bureya Rivers (Russia), it flows to the north until it reaches its estuary to the Tatar (Mamiya) Strait. It is one of the ten longest rivers in the world (approximately 4,345 km), and its basin covers approximately 2.09 million km². Water resources in the basin are extensively used for agricultural, industrial, energy production and domestic purposes, supporting a wide range of human economic activities. The transboundary issues in the Amur River Basin cover a wide range of water and natural resources issues, as well as environmental and sustainable development issues.

The Amur River basin hosts some of the world's most diverse and productive habitats and encompasses extensive areas of complex and unique ecosystems. Particular attention has to be paid to globally significant biological diversity, and transboundary impacts of human activities in the basin on such globally-significant biological diversity, particularly endangered, threatened and rare species. Included in these species are several migratory bird species, such as Oriental White Storks (95% of global population breed in the basin), Red-crowned crane (65%), White-naped crane (50%), and Hooded crane (30%). The basin includes key stop-over sites for shorebirds, ducks, geese and swans along the Northeast Asian Flyway. Approximately 2.4 million ha of wetlands on the Russian side of the basin have been significantly modified into pastureland. In Russia, human-induced fires have frequently occurred, destroying the important wetland habitats. In the Heilongjiang Province of China, approximately 60 % of wetlands have been lost or degraded over the last decades. Due to the current efforts in P.R. China and Russian Federation, approximately 5 million ha of wetlands are under different levels of official protection, and a total of eleven natural protected areas were designated as Ramsar sites. The Amur River Basin provides a habitat of 104 freshwater fish species, of which 18 are endemic and 8 are endangered, including Kaluga sturgeon. In China alone, there are over 40 kinds of economic fish species. 7 migratory salmon species are considered to be important living resources. Further, it is recognized that the basin includes approximately 2,800 vascular plant species, and 40,000 species of insects.

The Amur River input affects the ocean current and quality of the Sea of Okhotsk, in particular, the waters in the continental and Sakhalin Island coastal areas. The Songhua River, a tributary of the Amur River system has its basin of 460,000 km², having experienced rapid agricultural, urban and industrial development, resulting in degradation in its water quality (excessive nutrients, organochlorine, and heavy metals). The Songhua River Basin has its population density of 105 people/km² and includes most of the large cities in the Amur River Basin (Harbin, Jilin, Mudanjiang, etc.). The other parts of the river basin where pollution is prominent are Nizhneargunsky and Komsomolsky areas in Russia.

Floods in the Amur River basin cause significant damages to human life and properties. In Russia, flood impacts on economic activities and life conditions are larger in comparison with other Russian provinces. A row of cities in the Amur River Basin is partly flooded during high-water seasons. Amongst them are: Blagoveshensk, Birobidzhan, Khabarovsk, Dalnerechensk, Lesozavodsk and others. Agriculture suffers from flooded fields, pastures and hay making sites. In China, in 1998, devastating floods in the Nen and Songhua River Basins caused large economic loss as well as human death and injuries. The Government of China considered environmental degradation (land degradation, deforestation and wetland loss) to be underlying causes for floods, and embarked on the rehabilitation of these conditions in the basin. In Russian, in the last 10-15 years, local flooding, caused by forest cuttings and fires in the valleys of small and medium rivers, negatively influenced economic activities in the Amur River Basin. For the last five years, such flooding took place in Bikin, Khor, Bolshaya Ussurka, Sililnka, Bira and other rivers.

Hydropower development in the river basin is one of the significant factors of change in the water regime in the Amur River. At the end of the 1940s, the Fenman Hydropower station was constructed on the Songhua River. Large influence on the water regime of the Amur River is caused by the Zeyskaya Hydropower station, whose reservoir started to be filled in 1975. The area of the Zeya river basin, embraced by this hydropower station, makes up 35-40% of the river run-off. The station's impacts on the Amur River are significant, especially in winter seasons. Under the natural conditions, before the Zeyskaya Hydropower Station construction, the river run-off rate was 60-100 m³ per second in winter seasons. Since the station was put into operation, its run-off rate increased up to 600-700 m³ per second.

The Russian part of the Amur River Basin is one of the most developed territories in the Russian Far East. Historically, the development of the Russian Far East took place in the 18th-19th centuries along the left bank of the Amur River. Then in the beginning of the 20th century, it was supplemented with the Trans-Siberian Railway that was laid along the Amur River. The Russian part of the Amur River Basin, situated in the natural zone of temperate mixed broadleaved and coniferous forests, and forest steppe, has large natural resources potential.

The favorable economic and geographic location of the region, good opportunities for shipping along the Amur River and its tributaries, proximity to Trans-Siberian Railway, various available natural resources, and good comparable climatic conditions serve as a basis for concentration of considerable social and economic facilities, cities and settlements, industries and agriculture in the region. In the beginning of this century, there are about 4 million people, 27 cities and over 1,500 settlements in the Russian part of the basin. 35% of industrial potential and over 75% of agricultural potential concentrate here.

This region continues to be an attractive for both Russian and foreign businesses. One of the last examples of international economic collaboration is the project of the main oil pipeline "Eastern Siberia - Pacific Ocean" that is developed according to the order of the President of Russia for creation of a new export direction of transportation of the Russian oil on market of Asian Pacific Region, occupying today the first place in the world on rates of development.

The line of an oil pipeline “Eastern Siberia - Pacific Ocean” will pass through settlements Taishet, Kazachinskoye, Skovorodino and will reach the Sea of Japan in the Perevoznaya bay in Primorski Krai. Objects of petrowire system will be placed in territory of Irkutsk region, Republic of Buryatiya, and also in the Chita, Amur, Jewish autonomous region, Khabarovsk and Primorski Krai. Its total extent makes 4188 km from which above the ground will pass only 583 km, all other parts of the pipeline will be latent under the ground. Diameter of the main pipes - 1220 mm that will allow overtaking 80 million tons oil per year. Besides along the line a reservoir capacity will be built in total amount about 4 million cubic meters. And in the Perevoznaya bay will appear a bulk-oil complex for reception of tankers by deadweight up to 300 thousand tons.

Cost of construction of an oil pipeline is estimated from \$11 billion up to \$14,5 billion or \$2,6 million - \$2,9 million on one kilometer of the pipeline (according to the order of the government of Russia from December, 31, 2004, after May, 1, 2005 offers on increase of economic efficiency of construction may appear).

38300 people will be involved at a stage of construction of an oil pipeline “Eastern Siberia - Pacific Ocean” and 7945 people - at an operation phase of this object.

According to the researches which have been carried out by developers of “Substantiations of investments into construction of petrowire system Eastern Siberia - Pacific Ocean”, construction of the pipeline will cause changes in industrial and non-productive spheres of an economy and will be reflected in employment of the population. So, at a stage of construction of this object new jobs with a high wage level in the building industry, and also in sphere of service will be created. The basic branches which will receive development during construction of oil pipeline - the industry of building materials, transport and an agriculture. Presumably, commodity circulation in territories will seriously increase during intensive construction. At an operation phase of oil pipeline in regions of passage of a line will receive additional stimulus to development such branches, as oil refining, transport, an agriculture and a forestry. The maximal benefit from the project will be received with those areas where it is planned to place more two or three oil-transfer stations.

At present the substantiation of investments into construction is executed (the resource base of Western and Eastern Siberia is estimated, the analysis of the oil market of the APR countries is carried out, descriptions of the basic technical decisions are prepared, volumes of construction are planned and its price is designed).

At a construction of oil pipeline all global innovations will be applied in the field of construction of pipeline transport of oil and the advanced equipment. It will allow minimizing damage for an environment. Nevertheless, questions of ecology represent doubtless importance at designing and construction of an oil pipeline already even because the offered oil pipeline can pass on a catchment basin of Baikal Lake - the object of the world natural heritage of UNESCO.

Let's result some data connected to geography of construction.

- An oil pipeline in the extent over 4188 kilometers the JSC “Transneft” is going to lead in part on Irkutsk region - more than 800 km of a line from station Taishet and up to border with Buryatiya.

- Further on Republic of Buryatiya it is planned to lead 555 km to the north from Baikal Lake on territory of North Baikal and areas Mujsky districts of Buryatiya, in extremely difficult engineering - geological conditions (high seismicity up to 10 points, extensive sites of a permafrost, mudflow dangerous sites, etc.).
- The oil pipeline also will pass on the Chita and Amur regions, on the Khabarovsk and Primorsky territories.
- About half of line it is planned along border with China.
- At station Taishet and in the Perevoznaya bay it is offered to construct large oil-transfer stations, and also to place on a line 30 intermediate stations and 14 stations with capacities. Prospective volume of swapping of oil is 80 million tons per year.
- From the Perevoznaya bay oil will be transferred in bulk-oil tankers up to destination.
- According to developers of projects, 50 % of a line are in a zone of dangerous natural processes (flooding, mudflows, snow avalanches, etc.) and seismic intensity more than 7 points.
- Practically, all line concerns to fire-dangerous areas.
- The greatest danger is represented with a site to the north from Baikal Lake where earthquakes reach 10 points.
- In Irkutsk region the oil pipeline is planned along a Baikal-Amur railway); it crosses numerous rivers largest from which are Angara, Lena, Vitim.
- Already in Buryatiya the oil pipeline crosses the river Verhnyaya Angara, large inflow of Baikal Lake.

For the optimum decision of questions of designing of the pipeline and the subsequent estimation of a condition of an environment (monitoring) under impact on it from this object it is important to have a good database about a background condition of an environment. This task is solved by carrying out of special researches which are expedient for organizing in 4 stages:

1. Preliminary gathering the available background information by all alternative variants with revealing nature protection restrictions (for example, the spawning rivers or strictly protected natural territories) and natural dangers (for example, tectonic breaks).
2. The profound gathering the background information by the chosen variant of a line with the analysis of available gaps in the information, an estimation of necessity of carrying out of additional field researches and planning of their volume.
3. Field researches for completion of available gaps in the description of background conditions.
4. Monitoring the conditions of the natural environment at construction and operation of object which is carried out under the authorized program, in conformity with normative requirements.

For planning and coordination of work the working group with representatives of all key organizations - executors of the project will be established.

At gathering the information and carrying out of researches it is necessary to take into account, that in a result the complex information on all directions (from tectonics up to invertebrates) should be received. Therefore all programs of gathering the information it is expedient to organize in a uniform complex.

Drawing up of the complex program of long-term gathering the information and forecasting the influence of construction and operation of the pipeline on an environment will be carried out in coordination with nature protection bodies of subjects of Russian Federation on which territory it is planned to build an oil pipeline.

By our estimations for performance of full amount of works on background monitoring it is required to involve more than 200 qualified experts from 15-20 specialized organizations for initial gathering the information and about 10 specialized organizations for qualifying field researches.

Probably, the separate structure will prosecute subjects of logistic that experts, for example, on ornithology, hydrology and geology used one camp, one transport and so forth. Such structure can be, for example, JSC "REA-Consulting" which experts have experience of similar work on Sakhalin projects, and this company participates in performance of ecological projects within the framework of the general agreement with Far Eastern Branch of the Russian Academy of Sciences.

For gathering the preliminary information in each subject of the Russian Federation on the basis of one of organizations - executors of the project the regional coordination centers which duty, besides other, will include the help in carrying out of field researches, creation and operation of permanent stations of background monitoring in chosen areas, storage and maintenance in readiness of not constantly used equipment and so forth will be established during performance of the project. It is supposed, that in the Amur region it will be FEBRAS Branch of Regional Geology and Hydrogeology, in the Jewish autonomous region - Institute of Complex Analysis of Regional Problems, in Khabarovsk territory - Institute of Water and Ecological Problems, in Primorsky territory - Institute of Biology and Soil Sciences.

The most reasonable result of monitoring works, in our opinion, can be a computer database in GIS form, "incorporating" in it all diverse collected information. It will allow using rather easily the information at all stages of development of the project and for all contractors (from designers up to builders).

The preliminary list of directions of studies and engineering researches with the subsequent monitoring for the pipeline:

- Topography and maps in various scales
- Meteorology and quality of atmospheric air
- Geology
- Engineering geology and dangerous geological processes
- Geochemical researches
- Hydrogeology
- Landscape-geochemical researches
- Soil researches

- Hydrological researches
- Hydrochemical researches and quality of superficial waters
- Hydrophysical researches
- Geobotanical researches
- Zoological researches
- Hydrobiological researches
- Ichthyological researches
- Ornithological researches
- Radiation-ecological researches
- Sanitary-and-epidemiologic researches
- Toxicological researches
- Microbiological and parasitologic researches
- Virologic and bacteriological researches
- Researches of anthropogenous infringements of natural landscapes
- Social and economic researches
- Strictly protected natural territories
- Objects of the limited access (military bases and so forth)
- Archeological researches.

Performance of all above-mentioned actions allows guaranteeing not only economic benefit from realization of the civil-engineering design and operation of an extended oil pipeline, but also preservation of the unique nature of Eastern Siberia and the Russian Far East.

Last decade studies allowed identifying regions with highly polluted atmosphere in the Amur River Basin. Mostly they are located near Chinese and Russian cities. Estimating water pollution we may pick out three areas: lower Argun River, lower Sungari River and Amur River near Komsomolsk-na-Amure.

Governments of China, Russia and Mongolia pay attention to environment protection issues. They established numerous specially protected wildlife territories. But lot of problems still exists for the Amur River Basin. It is necessary to note main ecological threats:

- Transformation and damage of historically formed natural ecosystems, decrease of their resistance to external impacts;
- Biological diversity threatening;
- Overall worsening of environmental situation;
- Increase of pressure on environment and decrease of ecological regional potential.

Complex social, ethnic, ecological and economical problems in the Amur Basin are very important too:

- Health and life-style problems;
- Human life conditions worsening;
- Local communities traditional life-style problems;
- Regional resources and ecological potential quality reduction and destruction.

All these problems should be considered under the implementation of FEBRAS program on the complex research of the Amur River Basin. Main goal of our study is survey of present-day status and dynamics of Amur basin natural environment, viewed within global changes and anthropogenic impacts expansion, to work out recommendations on creation of favorable social and ecological conditions for future economic development of the region.

Main tasks of the program are:

- Amur River environment situation analysis and indication of most vulnerable ecosystems;
- Environment component data survey to reveal their development tendencies;
- Studies of unique and endangered natural processes, biodiversity in the Amur basin;
- Prospects for environment transformations.

Key expected results of the program should be:

- Complete survey state of ecological research of Amur Basin;
- Natural dynamics studies of the main components of various natural complexes;
- Assessment of anthropogenic impact on most dynamic and unstable natural complexes;
- Qualitative and quantitative parameters development for Amur Basin water resources and setting priorities for land and water use issues.

FEB RAS invites partners from other countries to join our research. Our project was supported by the National Science Foundation, USA during the Washington meeting (December 2004) of the members of the Northern Eurasia Earth Science Partnership Initiative, or NEESPI, that is a currently active, yet strategically evolving program of internationally-supported Earth systems science research, which has as its foci issues in northern Eurasia that are relevant to regional and Global scientific and decision-making communities (NASA – RAS).

Other active project directed to the Amur River Basin is “Integrated Management of the Amur/Heilong River Basin” that is supported by the Global Environment Facility through its implementing agency - United Nations Environmental Program. The governments of participating countries (People’s Republic of China, Russian Federation, and People’s Republic of Mongolia) are the project contributors too.

Overall goal and objectives of the project are:

- Develop a Regional Framework and initiate pilot activities for the Integrated Management of the Amur River Basin and its associated continental and Sakhalin Island coastal areas, to achieve integrated management of resources and ecosystems in the basin and associated coastal areas, based on the ongoing and planned national and regional projects;
- Develop a replicable, multi-national co-operation model between the countries in the region and among all stakeholders at varying levels to address threats to resources and biological diversity in the Lake Khanka basin in an efficient and cost-effective

manner within an overall Regional Framework for the Amur Basin and its associated continental and Sakhalin Island coastal areas.

Regional governments of the Russia's provinces in the Amur River Basin pay significant attention the regional environmental issues. On October 4, 2004 in Blagoveshensk the Governour of Amurskaya province Leonid Korotkov signed Memorandum on cooperative efforts in ecosystem conservation and providing sustainable development of the Amur River Basin regions. Thus, Amurskaya province followed the example of heads of Khabarovsky, Primorsky, Chitinskaya, Jewish and Aginsky Buryatsky autonomous provinces and became the last out of six Russian provinces situated in the Amur River Basin that officially announced about participation in the joint program aimed at stabilizing the environmental situation in the Far Eastern river basins.

The meaning of this truly historical document is hard to overestimate. The Memorandum provides the mechanism of cooperation between Russian provinces that are interested in the solution of Amur problems. Of course it is important to address the issues to Moscow but not less important to coordinate own efforts. Judging by the fact that each of the provinces has already made some steps trying to solve common issues the document will not be a simple declaration. Besides, the document suggests mechanisms for issues addressing in a trans-boundary aspect – the Amur River ecosystems are located in the junction of Russia, China and Mongolia and ecosystems conservation is impossible without trans-boundary collaboration. Today issues of international cooperation in the Amur River Basin ecosystem conservation are solved by signing agreements between separate Russian and Chinese provinces but Memorandum will allow addressing the issues on the state level.

To perform intentions, set in Memorandum, the Amur River Basin Coordination Committee on Sustainable Development was formed. The Committee acts under leadership of deputy heads of provinces and includes representatives of state, scientific and non-governmental conservation organizations.

One of the most important tasks of the Committee is to advise Russian Government, as well as member-provinces, on coherent Russian position on Amur basin environmental issues in Russia's dialogue with China and Mongolia, and facilitate involvement of Chinese and Mongolian partners in solving common environmental problems. Four priorities for cooperative work declared at the first meeting of the Committee were:

- prevention of trans-boundary pollution,
- biodiversity conservation,
- sustainable land use,
- improving welfare of local communities dependent on natural resources of the Amur River Basin.

Finalizing the overview of the Amur River Basin importance for regional and global communities we may conclude that not a single province, not a single state is able to solve huge problems of Amur. But now we clearly see raised interest of states, provinces, scientific and non-governmental organizations towards cooperation and this makes us hope that together we could improve the situation.