

COMPLEX SURVEYS OF THE AMUR RIVER BASIN

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The Amur River Basin constitutes a megaecosystem, spread for over 1850 000 sq. km of different geographic regions with diverse natural conditions, forestation, swamping and water resources. Its eastern part belongs to a climate zone with monsoon characteristics, whereas its western part has obvious continental climate features. The river (the Amgun including) is 4444 km long, 5 km wide and 56 km deep in some places. It is ranked among the tenth biggest rivers in the world. The biggest river tributaries are the Sungary, Zeya, Ussury, Shilka, Argun and Bureya. There are more than 60 000 lakes in the Amur Basin, the largest being Khanka, Chukchagirskoye, Bolon, Udyl, Bolshoe Kizi, Evoron, Chlya.

The river undergoes active bank transformation processes with bank washing out rate 15-20 or even 50 km per year. The river easily forms and washes out its islands and discharges into the sea millions of tons of suspended substances. The river flood plain is characterized by well-defined eolian processes that result in 10-12 m high ridges, gradually being covered with grass and forest. The Amur Basin is famous for its biodiversity of genes, species and ecosystems, mix of different flora and fauna forms, their intervening in river valleys and mountain divides, thus forming communication channels and ecological corridors that ensure gene exchange between different species and their distribution. All these make Priamurje (Amur Region) a unique and important biogeographic spot for East Asia. Representatives of Beringian, Angarian, Manchzhurian (with Indo-Malay elements) flora and fauna, as well as fauna species, ranging from lowland to highland, are found in Priamurje. Local flora includes more than 3 000 vascular plants (500 Red Book species). Local fauna is represented by 520 vertebrates (9 amphibians, nearly 15 reptiles, over 400 birds and 96 mammals). Different estimations indicate 123-135 fish species in the river, 10% of which inhabited the Amur in recent 40-50 years.

Priamurje population data fluctuate between 70-80 mln. people, 5 mln of which live in Russia, 65-75 in China, less than 50 000 in Mongolia. North Korean part of the Amur Basin is mostly unpopulated. Local aborigines, such as nanai, udege, ulchi, nivkhi people, live here since ancient time and till nowadays continue their traditional life practices like fishing, hunting, deer breeding, etc. Taken as a whole Priamurje resource and ecology potential is rather high and can provide a wide range of activities. Nevertheless, natural and anthropogenic impacts on ecosystems and human environment cause several serious ecological problems.

The following processes can be considered as natural factors:

1. wide fluctuation amplitude of Amur water discharge (from minimal 600 cu m/sec up to summer maximal 40 000 cu m/sec at Khabarovsk) and water level (up to 14 m in Khingan mountains to 5-6 in plain areas);
2. changes of Amur water amount in year (low water and high water years interchange);

3. specific water supply pattern formed by rain (75-80%), snow (15-20%) and underground waters (5-10%);
4. natural water quality specifics (e.g. originally high "phenol background");
5. seasonal changes in Amur discharge distribution in the Tatar Strait (to the north into the Okhotsk sea predominantly in winter and to the south into the Sea of Japan in winter);
6. originally big number of flora and fauna species (49% of vertebrates), which exist in Primorje at the very borders of their natural habitat (with an evident dynamic trend);
7. significant vulnerability of biota to external pressures as it contains conservative, not numerous, endemic, relict, even rare and extincting species, included into the Red Books of regional, national and international levels.

Main anthropogenic factors that cause Amur Basin ecological problems include:

1. high population density, unevenly distributed from country to country;
2. development of populated landscapes (urban including), industries and agriculture, hydropower station constructions, mining, timber harvesting, hunting and fishing;
3. ecologically not sustainable economy and use of resources;
4. forest and meadow fires;
5. ecosystem pollution with untreated or poorly treated industrial, agricultural and household waste waters and other spills, caused by low environmental problems awareness and concerns, unsuitable practices of resource use;
6. insufficient development of special protected areas net.

Coupled with natural factors anthropogenic impacts cause a whole range of problems in the Amur River Basin, the main of them being:

1. transformations and decay of historically formed natural ecosystems, weakening of their ability to confront external pressures;
2. reduction of biological diversity;
3. general quality decrease of natural environment;
4. ecological tension growth and territory ecological capacity reduction;

Besides, several complex social, ethnic, ecological and economic problems immerge, such as:

1. Population life and health threats;
2. Worsening ecological safety conditions of human environment;
3. Shortening of local communities life space and their opportunities to practice their traditional activities;
4. Region resource and ecology potential reduction, destruction and worsening of its quality.

These problems should be quickly addressed, especially in the frame current ecology concerned management practices of use and optimization of resource potential and natural environment. Nevertheless, management priorities indication, their development and effective application seem only possible, when profound knowledge of natural and ecological specifics of the region, of its natural systems functional regularities, natural components state and

dynamics, their reaction to anthropogenic impacts is taken into consideration. That is why, one of the priorities in acquiring such knowledge should be a complex survey of the Amur River Basin, that will provide a solid foundation to improve the existing management practices of nature use to serve for the benefit of man and nature itself.

For the time being in the Amur Basin no complex research of such a kind has been undertaken. Meanwhile, the research institutes of the Khabarovsk and Amur Scientific Centers, Far East Branch, Russian Academy of Sciences have accumulated rather substantial data on different natural objects, complexes and ecosystems, as well as on natural-economic systems, their dynamics and transformations under natural processes and human activities. Some ethnic issues were also studied. Some other data are also available at several institutes of the Primorsky Scientific Center, FEB RAS, industry research and development institutions. Time has come to survey the collected data and information. Nevertheless the shortage of data on several natural components is quite evident, namely on flora and fauna of land and water ecosystems, on certain specifics and mechanisms of their anthropogenic transformations. Some geological issues have not yet been studied to the full. Processes in polluted water ecosystems and aquatic organisms and factors that cause them are not clear. Quite important and urgent are issues of river-bed transformations, soil and swamping formation, landscape dynamics (pyrogenous successions including), nature reserve net efficiency and some others. Scarce are studies on regional ethnic history and ethnic ecology aspects of regional economic development. Ecological and economic specifics of regionally adaptable resource and land-use practices and other issues of this kind have not been assessed.

Since 1960-ies the Institute of Water and Ecology Problems, FEB RAS have carried out research on natural ecosystems and environment in Priamurje. Dozens of expeditions to the wild were organized, hundreds of scientific papers published, dozens of recommendations on nature conservation, regulation and ecological adaptation of land-use processes were submitted to local and federal authorities, complex research programs were undertaken. Working contacts are established with colleagues from Japan, Mongolia and China. Most pollution of the Amur water ecosystem is caused by economic activities in the Chinese part of the basin. As the range of Amur basin problems is so wide, much broader scale of international scientific cooperation becomes necessary and urgent. It should involve the efforts of scientists, who are not only capable to study and assess the present-day condition of particular natural objects, describe their transformation tendencies, identify ecology hotspots and problems, but also propose constructive solutions to these problems and measures to improve the environment. To define the concept and develop a Program for the Amur River Basin complex survey (2004-2008), the Presidium of FEB RAS organized in 2003 a working group under the Institute of Water and Ecology leadership. The program concept has been approved already by the Presidium of FEB RAS and draft program has been worked out, negotiated with potential participant and submitted to the Presidium of FEB RAS for approval.

Main program tasks are focused on the following issues.

1. Correlation of existing data on development tendencies of certain components of natural environment and ecosystem as a whole.

2. Amur basin ecological condition analysis and indication of ecosystems, most exposed to anthropogenic impact.
3. Study of unique natural processes, vulnerable natural complexes and biodiversity in the Amur river basin.
4. Prediction of future possible environment changes (natural complexes and their components).
5. Recommendations for nature protection and natural environment quality improvement; creation of conditions for ecosystem productivity growth, reconstruction of reproducible natural resources; natural resources and land-use practices efficiency.
6. Draft proposals for the Federal Law “On the Amur River Protection”, International program on sustainable ecological and economic development of the Amur river basin (Russian part), regional environmental legislature.

The program is composed of 10 blocks (sections).

1. Natural ecosystem formation factors in the Amur river basin and their research history.
2. Nature-resource potential and ecosystem anthropogenic transformations, caused by its use.
3. Population and economic activities.
4. Conditions of natural water and continental water ecosystems.
5. Ecosystem state and development prospects in fresh and sea water mixing zone of the Amur estuary.
6. Ecological condition, genesis and classification of soils.
7. Vegetative cover, flora and plant biodiversity.
8. Animal world, fauna and animal biodiversity.
9. Information data base and modeling of natural processes.
10. Dynamics and conservation of Priamurje ecosystems; ecosystem approach in rational use of natural resources.

Each section is divided into 5-15 subsections. Each program block is directed by one or two coordinators and each research sphere (oceanography, geography and economics, inland biology, marine biology, ichthyology, history and ethnography, geology and mineral resources) are guided by supervisors. The program is to be carried out by 19 FEB RAS research institutes, 3 institutes of the RAS Siberian Branch, 10 educational and industry research and development institutions, as well as government experts from the regions involved. Opportunities are open for other organizations interested, for scientists and specialists from China, Japan, Mongolia and both Koreas.

The following program results are targeted.

1. Reliable and complete evaluation of a present state of Amur river basin environment studies.
2. Nature dynamics picture for the main environmental components of different natural complexes.

3. Anthropogenic transformations assessment for the most dynamic and unstable natural complexes and particular environment components.
4. Qualitative and quantitative parameters of water resources transformations and ways to overcome main hydroeconomic problems.
5. Understanding of biotic complexes changes under natural and anthropogenic influence and measures to prevent negative tendencies of their development.
6. Present state assessment of resource and economic potential.
7. General assessment of the Amur basin ecological situation (Russian part).
8. Multipurpose functional zoning of the Amur basin (Russian part).
9. Identification of territorial and ecological limitations for various nature-use practices.
10. Guidelines complex development to improve and conserve high environmental quality and unique biological diversity in the region, to create favorable conditions for reconstruction of reproductive natural resources.
11. Set of monographs entitled "Nature and Man in the Amur River Basin"
12. Atlas "Nature and resources of the Amur Basin (Russian part)"

In 2004 fourteen field research teams will be working in different Amur basin spots. Overall cost of program activities comes to 30 million roubles.