Journal of Asia-Pacific Studies Vol. 23 No. 3 (2016)

The Threats of Natural and Technogenic Hazards in the Russian Far East as a Part of Northeastern Asia and the Directions of International Cooperation*

Baklanov P. Ya.** Kachur A. N.***

| Contents |

Ⅰ. Introduction
Ⅱ. Basic ecological threats and problems
Ⅲ. Assessment of extreme natural conditions
Ⅳ. On directions of international cooperation as conclusion

| Abstract |

High probability of natural catastrophes in the Russian Far East and in Northeast Asia as a whole is connected with their geographical position at the interface of Eurasia and two oceans: the Arctic and Pacific oceans. The threats of natural catastrophes caused by the extreme natural processes, such as volcanism and earthquakes, tsunami, storms, cyclones, typhoons and flooding are singled out. The threats of technogenic catastrophes connected with possible spills of oil and oil products, with forest

* This article represents a contribution to the project funded by the Russian Research Fund 'Factors, mechanisms and types of structural transformation and modernization of regional socio-economic systems of Pacific Russia' (No. 14-18-03185).

** First Author: Academician RAS, Professor, Pacific Institute of Geography FEBRAS.

*** Second Author: Deputy Directoron scientific issues, Pacific Institute of Geography FEBRAS.

fires, with extraction of natural resources on the sea-bottom are distinguished. Specific threats are connected with the trans-boundary transfer of the water and air contamination into the trans-boundary watersheds
of the rivers (the Amur River, the Tumen River, and others) and into the seas (the Sea of Japan – the East Sea). The paper gives the examples of natural catastrophes – the extreme flooding in the Amur River watershed (July – August, 2013) and technogenic catastrophes – extreme technogenic contamination of the Sungari River (December, 2005). A small-scale natural-economic zoning of the Russian Far East, including identification of four zones with various danger to economic activities, and fractional natural-economic zoning, including identification of 24 areas with the different combinations of possible extreme processes, are carried out.

The projects of UNEP on protection of the sea environment in the Northwest Pacific, including the sea oil spills, contamination of the seas by other kinds of technogenic substances, the trans-boundary transfer of air contamination and others are considered. The directions of the international cooperation on minimization of the negative consequences of natural and technogenic catastrophes, including the conclusion of the international contracts on the trans-boundary watersheds (rivers, lakes, and seas), the formation of the joint international programs, commissions, insurance funds, and monitoring systems are offered.

▪ Key Words: Extreme Natural Processes, Ecological Threats and Problems, Natural and Technogenic Catastrophes, The Russian Far East, Zoning

Ⅰ. Introduction

High extremeness of many natural processes leading to catastrophic phenomena in Northeast Asia is determined by its geographical position

and the type of natural conditions. A marginal position of the region on the joint of the largest continent in Eurasia and the greatest Pacific Ocean and the coldest Arctic Ocean sets a huge differentiation in natural patterns. The greater part of its territory has a mountain character of the relief. There is hyper volcanic and seismic activity in Kamchatka, the Japanese Islands, Sakhalin, and the Kuril Islands that resulted in the development of catastrophic earthquakes and tsunami. The well-pronounced monsoonal climate is peculiar on its greater part. It defines non-uniformity of humidity by the seasons and the constant possibility of the catastrophic phenomena connected with it (typhoons, heavy showers, floods, formation of soil erosion, landslips etc.). High differentiation of natural conditions leads to non-uniformity of economic development and concentration of a high anthropogenic press on certain sites of the territory and a coastal water area.

Active economic activities, especially for the last 100 years, essentially changed the shape of many areas, in particular of Northeast China, the states on the Korean Peninsula, the Russian Far East, composition and the structure of flora and fauna, i.e. a biodiversity (Baklanov et al. 2010, 379-412). For example, for more than the 300 year period of the economic development of the Russian Far East the areas with various specializations, with the different types and levels of development formed there. So far there exist huge economically underdeveloped areas: the north of Yakutia, Chukotka, and the north of Kamchatka; there are similar territories in the southern zone. In such are as the crucial environmental problems aremissing. Simultaneously there are the areas with a rather high level of mastering: the zones of open-pit mining of ores of nonferrous metals, diamonds, gold, coal; the areas of long-term intensive timber industries; and the zones of the urban settlements. As a whole, these are the areas over the Trans-Siberian Railway, along the Baikal-Amur Railway, by the Amur

River, and at the southern and southeast sea coast. Sakhalin and the southeast of Kamchatka refer to the developed areas. These are the zones of development of contact structures and functions, including developing international cooperation (Baklanov 2000, 31-39; Baklanov 2001, 23-24; Ishayev & Minaker 1998, 69-75). These territories can experience possible natural and technogenic hazards (Baklanov et al. 2003, 109-119).

Ⅱ. Basic ecological threats and problems

On the basis of generalization of numerous references and sources the authors (Baklanov & Kachur 2008, 219-231) singled out the basic ecological threats, which can probably manifest themselves in Northeast Asia (NEA) in the long term as a result of natural and anthropogenic extreme processes:

1. The threats of large earthquakes practically in all the areas of NEA, first of all in Kamchatka, Sakhalin, the Kuril Islands, and Japan. A natural accident, the strongest earthquake and tsunami near the northeast coast of Honshu (Japan) in 2011, caused a technogenic accident - a run-off of liquid radioactive wastes from the Fukushima nuclear station into sea waters. It is known that then seacurrents brought radioactive contamination into the Pacific coast of the USA. It is an example of possible development of technogenic hazards within the vast North Pacific trans-boundary macro-region.

2. Catastrophic floods, first of all, in the Amur River watershed, its inflows, and also in the basins of the rivers of the eastern slope of Sikhote-Alin (the Primorsky and Khabarovsky Krais). So, in July-September, 2013, on the Amur River, a catastrophic flood happened. Caused by extreme showers proceeding about two months, it

was the strongest one for the whole history of instrumental observations. The flooding covered the entire watershed the Amur River, including the vast territory of the Russian Far East and northeast areas of China. The highest water levels on the river parts, more than 1,000 km (from Nagibovo Village in the Jewish Autonomous Oblast to Takhta Village in Khabarovsky Krai), exceeded its historical maximums by 0.4–2.11 meters. In this case, dangerous high water period was preserved about one month and more nearby the large cities of Khabarovsk and Komsomolsk-on-Amur, and duration of flooding of the floodplain at a depth of 2–4 m was about two monthsand more (FSGMMOC 2014, 5).

At the peak of the flood the outstanding maximum water runoff (46 thousand of cubic meters per second) had occurred near Khabarovsk, which repeatability is estimated at 200–250 years.

According to the data of the Ministry of Emergency Measures of Russia, 366 settlements with population of over 170 thousand dwellers, over 13,000 houses, over 600,000 hectares of agricultural lands, over 1.7 thousand kilometers of roads, 185 bridges, over 500 kilometers and 5,000 posts of power transmission lines were flooded and under-flooded in the Amur River watershed and in adjoining territories. Such large cities as Khabarovsk and Komsomolsk-on-Amur experienced significant flooding. Ten thousand people were evacuated; many lost their houses and property. By a final estimation of the Government of the Russian Federation, flooding has caused a direct damage to economy of the country in the amount of 88 billion rubles; and the indirect one – 439 billion rubles. In 2013 the total amount of flood damage made 527 billion rubles.

Northeast provinces of China were also significantly damaged. By the estimations of the Chinese authorities, five million people suffered from flooding. By the data of August, 19, 2013, at least, 105 persons

died and 115 were reported missing. Over 60,000 houses were destroyed and 840,000 people were evacuated from the zone of disaster in the provinces of Heilongjiang, Jilin, and Liaoning (FSGMMOC 2014, 6-7).

3. The threats connected with trans-boundary transfer of the air and water pollutants from the neighboring countries to other ones, located between the Peoples Republic of China, the countries of the Korean Peninsula, Japan, and the Russian Far East. Serious ecological problems can be connected with trans-boundary transfer of pollutants within the trans-boundary basins of the seas and the rivers, in particular for such a watershed as that of the Amur River (Baklanov & Ganzei 2008, 104-119).

Contamination of surface waters is particularly strengthened in the zones of industrial development: in the areas with development of mining industry by heavy metals, sulphur compounds, and others (the watersheds of Zerkalnaya, Rudnaya and other rivers), in the areas of manufacturing and processing of agricultural products, contaminated by organic substances, nitrogen, and others (the watersheds of the Razdolnaya, Tomen andother rivers).

Negative ecological consequences are possible in connection with the plans of industrial development of the Tumen River Economic Zone. Now this area is already one of the most polluted ones in the region, while 15-20 years ago contamination in this watershed was insignificant (Sergienko et al 2002, 89-107). Many enterprises on the territories of the Peoples Republic of China and Democratic People's Republic of Korea spew out their wastes into the waters of the Tumen River. By the national classification of the Peoples Republic of China, water composition of the very river refers to the 4^{th}-5^{th} classes (i.e. heavily contaminated). Not only the Marine Nature Reserve in Peter the Great Bay, but also many adjacent coastal and sea aquatories are

vulnerable.

Technogenic hazards can be very dangerous in trans-boundary watersheds. For example, in 2005, as a result of large accident at one of the chemical enterprises in Northeast China, about 100 tons of the substances containing nitrobenzene were spewed into the Sungari River (Baklanov & Voronov 2010, 19). As a result, the river water was dangerously contaminated. Later on, this contamination extended to the mouth of the Sungari, then passed to the Amur River and spread to the lower reaches of the river. Despite high dilution capacity of the Amur River, concentration of harmful substances was above the standards levels in the river water for a long time. It is necessary to notice, that dangerous air pollution was also transferred from the place of accident to eastern direction, including the south of Primorskii Krai.

4. The threats connected with exploration of oil and gas resources.

Exploration of the sea oil and gas resources, in the Far East of the Russian Federation, first of all, on the shelf of the Sakhalin Island, is a matter of especial importance.

On the shelf of Northeast Sakhalin the areas of exploration of sea oil-carrying deposits, coincide with the traditional areas of commercial fishing and seafood. This area of the Sea of Okhotsk is an important place for feeding of small fry of commercial species of fish and the Okhotsk-Korean population of the largest whale. This is the smallest population (about 100 individuals) in the world among the largest whales. In 2000, the International Union for Conservation of Nature (IUCN) included this population of whales in the list of the most endangered species.[1)]

Being realized at present, oil extraction considerably affects the state of bio-resources in a number of the sites of the shelf of Northeast

1) The IUCN Red List of Threatened Species, http://www.iucnredlist.org. (accessed on May 8, 2016)

Sakhalin, because drilling wastes with a considerable quantity of pollutants is being dumped into the sea. This process is somewhat leveled by active coastal hydrodynamics, but bio-resources still experience the negative influence. Besides, it is necessary to take into account high litho-dynamic and seismic activity of the Sakhalin area.

5. The threats connected with transportation of gas and oil products. For example, those realized within the framework of the Sakhalin projects: the underground pipelines from Chaivo to De-Castri through the Sakhalin gulfs, the numerous rivers and the Strait of Nevelskoy (about 200 km of water barriers) represent a considerable potential danger in case of breach of pipeline, oil contamination and silting.

In this case, it is possible not only to directly damage to valuable species of fish (salmons on spawning rivers), red-book species of birds, reptiles, mammal (including sea), but also to destroy a forage base of shallow gulfs on Northeast Sakhalin that will also impact a forage base of coastal sea biocenosis, including grey whale - their important component.

In 2008-2010, the largest main oil pipeline - Taishet - Nakhodka (the Bay of Kozmino) - has been constructed from Eastern Siberia to the Far East, to the sea coast in the south of Primorskii Krai. It is necessary to follow the rules of its exploitation, and also to assume the measures to minimize negative consequences, in case of emergencies happen, especially in area of oil loading terminal in the Bay of Kozmino).

6. The threats connected with irrational nature use in unique land ecosystems, first of all in the watershed of the middle and low currents of the Amur River, in the cedar-broad-leaved forests of Sikhote-Alin, in the watershed of the spawning rivers of Kamchatka Peninsula, Sakhalin Island, and the Kuril Islands. The threats connected with irrational forest use can be especially considerable. As a whole,

within NEA only the insignificant growth of the use of wood resources (wood and non-wood) in natural forests is admissible under strict compliance with scientifically grounded environmental regulations and restrictions.

7. The threats connected with possible over-catch of seafood excessing an annual allowable catch. So, for example, the perspective forecast of the TINRO-Center (Vladivostok, Russia) of the potential total catch in the Far Eastern seas for 2015 is determined in 4.87 million tons, including 3.98 million tons of fish. On the one hand, it is a considerable increase since in 2000, for example, by the official data, the Russian fleet caught 2.34 million tons of fish and seafood; 0.26 million tons were caught by the foreign fleet. The total makes 2.6 million tons, including 1.4 million tons of pollock, 0.35 million tons of herring, 0.22 million tons of salmons, 0.11 million tons of flatfish that has made 80% of the total catch. However these volumes of catch did not include the shadow and illegal catch. Various experts estimate that in 2000 the total catch was about 3.0 million tons of fish and seafood or, probably, a little bit more (Shuntov et al. 2002, 3-11).

8. The threats connected with extraction of mineral raw resources, first of all building raw materials, from the sea-bottom. It can lead to irreversible negative reconstructions of the sea ecosystems, especially the valuable coastal ones (Preobrazhensky et al. 2000, 232-245).

9. The threats connected with extensive forest fires.

10. The threats connected with technogenic contamination of the marine environment. It is especially important to Northeast Asia, where the coastal sea areas take a big place. For example, characterizing contamination of coastal waters of the Sea of Japan (East Sea), it is necessary to notice that its state strongly differs in different parts. Available data show that by the degree of pollution of coastal-sea waters the western (Russian) coast of the Sea of Japan can be divided

into four areas: the Amur estuary, the Northern, Central and Southern areas of Primorskii Krai. (Kachur & Tkalin 2000, 470-475; Kachur et al. 2001, 52-71). Besides, it is also necessary to consider coastal-sea waters of the Korean peninsula and the Japanese islands as separate areas.

Composition of waters of the Amur estuary is determined mostly by the run-off from the Amur River, and also by the coastal settlements of Sakhalin Island. In estuary waters the higher content of detergents, oil-hydrocarbons, heavy metals, and a rather high level of muddiness is marked. The influence of transfer from the estuary to coastal waters of the Sikhote - Alin Nature Reserve is traced by heavy metals. For the last years there are concerns for the sea ecosystems' environment that is connected with the development of oil and gas extraction on the shelf of Sakhalin Island.

Northern area of Primorskii Krai stretches from Cape *Zolotoy* to Cape *Povorotny.* Within its limits there are some local centers of considerable pollution of coastal waters, basically by the wastes of the mining and mountain-chemical industries. The main of them are located near the *Rudnaya* and *Zerkalnaya* bays. Pollution is characterized by the presence in considerable quantities in the dissolved and suspended forms of ore elements, first of all, Pb, Cu, Zn, Cd, As, B, and others. In the zones of pollution, accumulation of the pollutants in the bodies of sea hydrobiont is also revealed and, therefore, they are of little use for the food purposes.

The central area covers coastal waters from Cape *Povorotny* to Cape *Gamov.* Anthropogenic pollutionis continuous there, especially in the Amur, Nakhodka and Ussurii bays. It is caused by the high level of industrialization and agricultural development of coastal territories. The spectrum of pollutants is very wide. Their accumulation is discovered everywhere in the sea hydrobionts; therefore, in certain areas they are

unsuitable for the food and technical purposes. Practically the entire coastal water area of Vladivostok does not fit for the recreational purposes because of a considerable quantity of unclear sewage water. The deposit of therapeutic mud is practically ruined on the water area of the Amursky Bay (*Sadgorod* resort).

For the last years three described areas are characterized by a small decrease in pollution, especially in the zones where anthropogenic load was very high earlier. The level of pollution decreases because large treatment complexes were brought into operation (2012-2014).

Another picture is observed in southern area. It includes coastal waters of *Posiet* Bay from *Gamov* Cape to the Tumen River. There pollution of waters has a point character and is connected with household wastes and industrial ones in a small volume. Accumulation of pollutants in hydrobionts is insignificant. They could be used for the food purposes under the selective control. At the same time in recent years an increase in pollution from the Tumen River is marked in this area (Kasyanov 1998, 36-41).

By the available data the same picture is also typical of coastal-sea waters of eastern coast of Korea, which on the one hand experience pollution from the discharges from the peninsula, and on the other hand do a strong influence of transfer from the Liaodong Bay by the Korean Current.

As a whole, characterizing the present situation, it is necessary to mention that waters near the coasts of the south of Primorskii Krai and the Korean Peninsula are most polluted.

The peculiarities of formation of regional compositionof surface air are the most important specific feature of the ecological-geographical conditions of the Russian Far East.

Having implemented by Far Eastern Regional Hydrometeorological Research Institute and Pacific Geographical Institute of the Far Eastern

Branch of the Russian Academy of Sciences, estimation of various inputs to the formation of composition of surface air in the center of the Russian part of the Sea of Japan basin (in Skhote-Alin biospheric reserve) revealed that over 70% of polluting substances come from the Peoples Republic of China and the Korean Peninsula (Kachur et al. 2001, 53-71). At the same time the data show that the most polluted air masses are transferred from the east, i.e. by the trajectories from Japan and the south of the Korean Peninsula. The available literary data show that the basic sources of pollutants in our sub-region are on these directions.

In the south of the Far East of the Russian Federation, the zones of higher deposition of sulfur and nitrogen are well-pronounced. It can be connected both with the local sources of emissions, and with their trans-boundary transfer from the territories of the Peoples Republic of China and the Korean Peninsula (Shulkin 2007, 26-31; Shulkin & Kachur 2014 p. 22-28).

Ⅲ. Assessment of extreme natural conditions

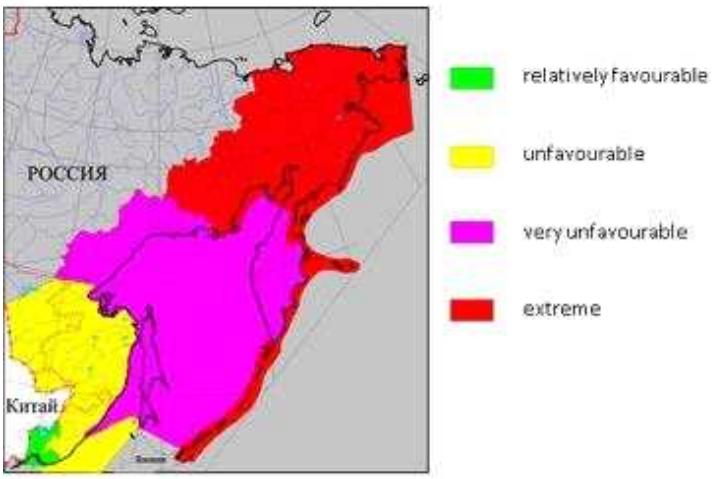
We (Baklanov & Kachur 2008, 219-231) offer such indicators as the geographical gradients of extremeness of natural processes as the quantitative estimations of the extreme factors of an environment. It is possible to measure them in the form of the difference or the ratio between the average indicators (monthly, seasonal, annual) and possible extreme manifestations of the same process in the same place (an area). For example, the difference of a mid-annual water level in certain place and that of in case of the maximum flooding between the average quantity of precipitations and the extreme one, between the average speed of the wind and the extreme one, and others.

In this respect it is necessary to assess natural-economic conditions separately for the land, sea and coastal zones, and the last one is characterized by the most difficult conditions for economic activity. We develop a special zoning of territories and coastal water areas to single out the zones, in the limits of which there is a larger or smaller probability of manifestation of extreme natural processes. We carried out such a zoning for the territory and the coastal water areas of the Russian Far East. Four natural-economic zones have been defined by the degree of extremeness of the possible dangerous natural phenomena in the region under consideration (<Figure 1>). The notion "natural-economic" means the possible influence of extreme natural processes on economic activities.

The notions "extreme," "especially unfavorable," "unfavorable" and "rather favorable natural-economic conditions" reflect two basic aspects: the degree of climate severity and frequency of the extreme natural processes in territories and coastal water areas. Climate severity (in the first approximation is conditionally linear) decreases from the north to the south. Accordingly, the conditions of economic activities improve to the south.

In this case, the increase in exposure to the extreme processes in the territory does not mean simple degradation of conditions for economic activities. Unfavorable conditions claim increased demands to informative, organizational and technical support for nature management and economy. In compliance with these requirements, final economic efficiency of nature management can be acceptable in a sufficient measure in all specified zones.

<Figure1> Natural-economic zones of the Far Eastern region



The areas of the Far North (Kolymskaya-Chukotskaya area) are included in the zone of extreme natural-economic conditions. They are characterized by the severe sub-arctic climate, and in northern part by the Arctic one, a mountain relief, the development of continuous multi-year permafrost far and near, and a short vegetative period. Natural systems are distinguished by small stability; ecosystems are easily vulnerable. The border of the zone on the land coincides with the watershed of the Okhotsk and East-Siberian seas, and in approaching to the sea coast, the Bering Sea (near Cape Dezhnyov) it sharply deviates to the south, going down along the eastern coast of Kamchatka and covering the entire area of the Kuril Islands. While moving to the south, the change of the factors defining extremeness of natural-economic condition soccurs. If in the north of the Bering Sea these are a heavy ice situation and the danger of ice accretion on ships, then to the south these conditions become more favorable, but there is a big danger of earthquakes and tsunami. Besides, it is extremely difficult for small ships to pass through the passages between the Kuril Islands.

The entire northern coast and water area of the Sea of Okhotsk, the north of the Sea of Japan (East Sea), and also Sakhalin Island and Kamchatka Peninsula refer to the area of very unfavorable natural-economic conditions. It goes without saying, that natural conditions of all theabove-mentioned areas are different, but nevertheless they are united by one feature, i.e. each of them possesses those or other factors, which sharply complicate economic activities. These are severe climatic conditions, a big (about 5meters) wind-wave rise of water near the coasts, seismically dangerous and tsunami-dangerous areas, the places of heavy typhoons and others. It is necessary to notice that the Kamchatka-Kuril belt, as a whole, is also characterized by big seismic and volcanic activity.

The zone of unfavorable natural-economic conditions covers the most part of the south of the Far East, and only southern part of Primorskii Krai belongs to the area of relatively favorable natural-economic conditions. These are the warmest areas of the Far East with the monsoonal climate, covering the forest-steppe territory and southern ranges of Sikhote-Alin.

In natural-economic zones a certain homogeny of geochemical flows manifests itself. On the land these are the water and air transfers. Under the conditions of such a highland as the Far East, the regional air transfer is generally defined by the character of the relief, whereas the water one is conditioned by the river watersheds. Therefore, on the land the border of natural-economic zones are quite distinct: they coincide with the main watersheds of the river basins. Taking into account extreme natural phenomena, 24 fractional areas are singled out in the Far East (<Figure 2>) (Baklanov & Kachur 2008, 228-230).

In developing the scheme of fractional natural-economic zoning of the Far East (Arzamastsev et al. 2010, 222-242) we considered the following factors, including the extreme ones.

(1) climatic belts (including the degree of watershed ice cover).

(2) the risk of catastrophic flooding.

(3) the dynamic risk connected with seismicity of the territory, the character of geology and geomorphology defining stability of landscapes.

(4) the energy and mineral resources, which exploitation can result in extreme anthropogenic processes and destruction of biological resources (the risk of technogenic pollution).

(5) biological resources.

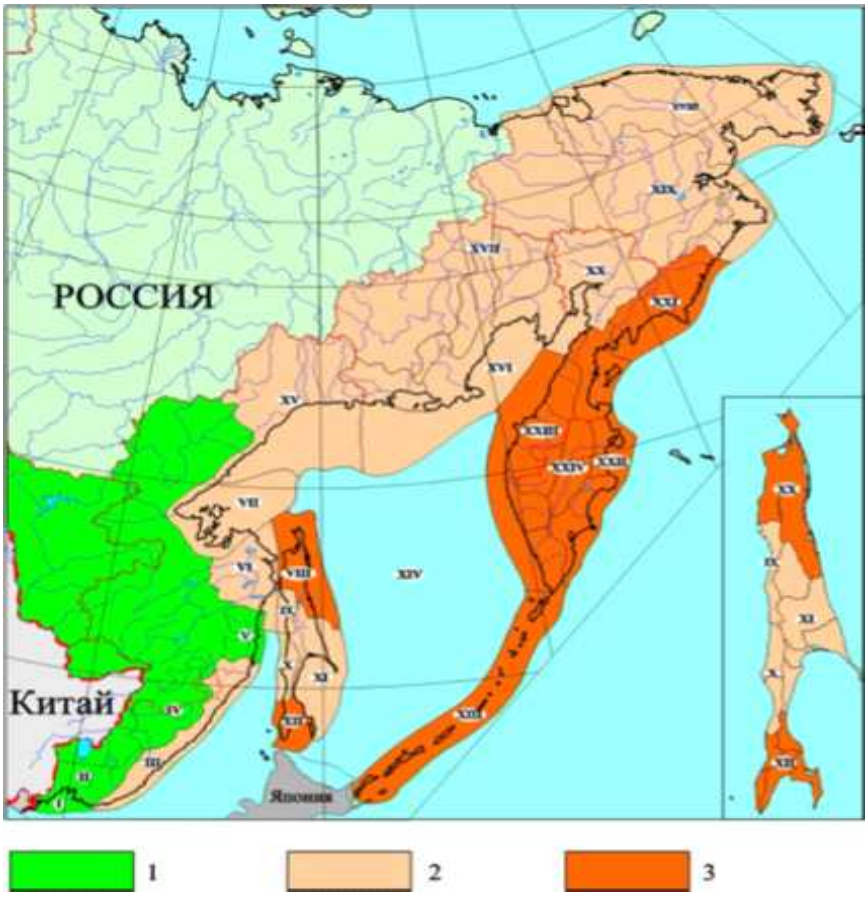
(6) the basic technological complexes developed in the coastal territory and having the direct or indirect impacts on the land and sea environments.

(7) the presence in the territory and on the water areas of the biological objects included in the Red Book.

(8) exposition of a coastal line to the epicenters of the most frequent earthquakes and its exposure to tsunami and other hazards having ecological consequences.

All listed characteristics are combined differently in various territories and on the sites of the sea aquatory, in different proportion, and the very combinations define specificity of that type of nature management, which can be more effective in this or that fractional area.

<Figure 2> Fractional natural-economic zoning of the Far East, taking into account extreme natural phenomena



* 1: The areas with the least potential danger. 2: The areas with the average degree of danger of extreme natural processes. 3: The areas with the high level of potential danger of extreme natural processes. / Fractional natural-economic areas; I: Peter the Great Bay, II: Ussuriisky, III: Primorsky, IV: Sikhote-Alinsky, V: Vaninsky, VI: Lower-Amursky, VII: Shantarsky, VIII: North-Sakhalinsky, IX: West-Sakhalinsky, X: Kholmsky, XI: East Sakhalinsky, XII: South-Sakhalinsky, XIII: Kurilsky, XIV: Central-Okhotomorsky, XV: Okhotsky, XVI: Magadansky, XVII: Anadyrsky, XVIII: Chukotsky, XIX: Kolymsky, XX: Penzhinsky, XXI: Koryaksky, XXII: East Kamchatsky, XXIII: West Kamchatsky, XXIV: Central-Kamchatsky.

We carried out typology of fractional natural-economic areas by different potential danger of the combinations of extreme natural processes. Three groups of areas are singled out (<Figure 2>).

(1) The areas with the least potential danger. Floods, storms, storm surges, small tsunami, and forest fires are possible in these sites. I: Peter the Great Bay, II: Ussuriisky, IV: Sikhote-Alinsky, V: Vaninsky.

(2) The areas with the average degree of danger of extreme natural processes. The combinations of heavy floods, stormy winds, earthquakes of the middle force and tsunami are possible. III: Primorsky, VI: Lower Amursky, VII: Shantarsky, IX: West-Sakhalinsky, X: Kholmsky, XI: East-Sakhalinsky, XV: Okhotsky, XVI: Magadansky, XVII: Anadyrsky, XVIII: Chukotsky, XIX: Kolymsky, XX: Penzhinsky, XXI: Koryaksky.

(3) The areas with the high level of potential danger of extreme natural processes. The combinations of the eruption of volcanoes, heavy earthquakes, tsunami, and storms are possible. VIII: North-Sakhalinsky, XII: South-Sakhalinsky, XIII: Kurilsky, XXII: East Kamchatsky, XXIII: West Kamchatsky, XXIV: Central-Kamchatsky, XVIII: Chukotsky, XIX: Kolymsky.

By the present time, the set of tools of estimations of ecological threats and restrictions, forecasting and prevention of consequences from the dangerous natural phenomena and technogenic hazards in the present nature protection practice has been developed and approbated for the territory of the Russian Far East. They include.

(1) The systems of regional ecological monitoring of extreme natural processes (typhoons, earthquakes, tsunami, forest fires, and others).

(2) Mapping and zoning of extreme natural phenomena and their

territorial combinations.

(3) Establishingof ecological restrictions: the levels of seismic danger on the territory; restriction of certain kinds of economic activity on the territories, identification of nature protected areas.

(4) Modeling of extreme situations, including natural and technogenic hazards.

Organization of sustainable nature use, including the areas, which experience extreme natural phenomena, is impossible without conservation of natural biodiversity, first of all, biodiversity of ecosystems. Therefore, the formation of a necessary sustainable ecological carcass, which consists of four basic groups of territories, is the key one (Baklanov et al. 2010, 340-360).

(1) A system of especially natural protected areas and water areas (NPAs), having a special scientific and nature protecting meaning, providing preservation of the standards of nature, unique natural complexes, a genetic fund of plants and animals, and noteworthy natural formations in a natural condition. These are state reserves (including the biosphere ones), state national parks, nature monuments, refuges, certain research field stations, and others.

(2) The cultural-historical zones representing the places of the greatest concentration of monuments of great antiquity and the Middle Ages.

(3) A system of “ethnic territories,” providing preservation of national culture and the way of life of native small people and nationalities in the places of their historical habitation.

(4) A system of the standard territories located outside the zones, having a special scientific or cultural meaning. Allocation of such territories and the regime of their protection are regulated by

legislative enactments, departmental rules and instructions.

Ⅳ. On directions of international cooperation as conclusion

Natural disasters and technogenic hazards traditionally are not the object of active international cooperation, due to their unpredictability and irregularity. Only in some cases other countries participate in liquidation of consequences and help in different ways to suffered areas or population. At the same time, the above-mentioned examples of the large natural and technogenic catastrophes, which occurred in recent years in Northeast Asia, have the trans-boundary character that demands larger international coordination of the efforts on their forecasting and minimization of negative consequences.

Formation of the following institutional structures could be the important perspective direction of cooperation on the decrease in the threats of natural and technogenic accidents, minimization of their damage in Northeast Asia.

(1) The international contracts on regulation of nature management, including those under the conditions of extreme situations in trans-boundary areas.

(2) The international systems of warning.

(3) The international system of ecological monitoring.

(4) The coordination structures within the limits of trans-boundary sea basins.

(5) International insurance funds.

(6) The international programs on sustainable nature management in

trans-boundary areas.

The similar international institutional structures could provide more advance prevention of extremal situations and more effective liquidation of its consequences. There were created several such international institutional structures of environmental and conservation profile in Northeast Asia.

For instance, since 1974, UNEP implements the Regional Seas Program, aimed at the struggle against accelerated degradation of the World Ocean and coastal areas. The purpose of the Program is to assist sustainable management of the use of the sea coastal environment, and also to involve the neighboring maritime countries in the embracive and concrete actions on protection of their common sea environment. At present more than 140 countries participate in 13 sub-programs founded with assistance of UNEP in the framework of the Regional Seas Program.

In 1994, Action Plan for protection, management and development of the marine and coastal environment of the Northwest Pacific region (NOWPAP) as a part of the UNEP Regional Seas Program has been signed at the intergovernmental level. NOWAP Action Plan is realized by activity of four specialized thematic centers (Regional Activity Centre, RAC), i.e. by one specific coordination center in each country of the Region of NOWPAP, and by the Regional Coordination Unit (RCU).

These centers carry out the coordinating role on application of new methods of assessment of the sea environment (CEARAC in Toyama, Japan), including the struggle against spills of mineral oil and especially dangerous chemical substances (MERRAC in Daezhong, Republic Korea), and also exchange of ecological data between the countries of the region (DINRAC in Beijing, the Peoples Republic of

China).

In Russia in 2002, Pollution Monitoring Regional Activity Centre (POMRAC) has been created, which operates in Vladivostok on the basis of the Pacific Geographical Institute of the Far Eastern Branch of the Russian Academy of Sciences.

The main objective of POMRAC has been formulated as coordination of activity and establishment of cooperation on monitoring of the sea and coastal environment of the Northwest Pacific.

As part of this work the Center identified potential threats in the region, which can lead to new trans-boundary environmental problems. In particular, information on the sources, the ways of trans-boundary transfer of especially dangerous substances, and existing technogenic objects, which are potentially dangerous from the point of view of possible technogenic hazards, was obtained.

The materials on the experience of the struggle against the extreme environmental situations, first of all connected with hazard oil spills, and poisonous substances in the adjacent countries are obtained.

The works on coordination of the measures in the field of monitoring of atmospheric precipitations, a river runoff, the state ofthe sea environment, and also exchange of information in case of an extreme situation were begun (Shulkin & Kachur 2014, 119-125; Shulkin et al. 2014, 109-149; Yasuyuki et al. 2014, 185-215).

In spite of these several working international commissions and institutions, more efforts are needed for international coordination, including in the sphere of scienti.

| References |

1. Journals and Book

Arzamastsev, I. S. et al. (2010). *Coastal and marine nature management (themanagement problems in the Russian Far East).* Vladivostok: DalNauka.

Baklanov, P. Ya. (2000). "Contact geographical structures and their functions in Northeast Asia." *Izvestiya.* Moscow: The Russian Academy of Sciences, pp. 31-39.

_____ (2001). *The Russian Far East: the problems andpreconditions of sustainable development.* Vladivostok: Dal Nauka.

Baklanov, P. Ya., V. P. Karakin et al. (2010). *Geosystems of the RussianFar East on the boundary of the 20th-21stcenturies.* Vol. II. Vladivostok: Dal Nauka.

Baklanov, P. Ya. and A. N. Kachur (2008). "Ecological threats and ecological-geographical restrictionsof nature management in the Russian Far East, taking into account extremenatural and anthropogenic processes." *The dangerous natural phenomena on land surface: the mechanism and catastrophicconsequences.* Moscow: The Russian Academy of Sciences, pp. 219-231.

Baklanov, P. Ya. and B. A. Voronov (2010). "The global and regional risks of sustainable nature management inthe Amur River watershed." *Izvestiya.* Vladivostok: The Russian Academy of Sciences, pp. 17-24.

Baklanov, P. Ya. and S. S. Ganzei (2008). *Trans-boundary territories.* Vladivostok: Dal Nauka.

Baklanov, P. Ya., V. L. Kasyanov and A. N. Kachur (2003). "The main environmental problems of the Russian Far East and the directions of theirdecision." *Vestnik of FEBRAS.* No. 5, pp. 109-119.

FSGMMOC (2014). *Extreme high water of 2013 in the Amur River watershed.* Moscow: FSGMMOC.

Ishayev, V. I. and P. A. Minakir (1998). *The RussianFar East: realities and possibilities of economic development.* Khabarovsk: the Far Eastern Branch of the Russian Academy of Sciences.

Kachur, A. N. and A. V. Tkalin (2000). “Seas at the Millennium: An Environmental Evaluation.” *The Sea of Japan.* New York: Elsevier Science, pp. 467-480.

Kachur, A. N. et al. (2001). “Ecological-Geochemical problems of the land and coastal marine landscapes ofthe coastal zone of the Russian part of the Sea of Japan basin.” *Vestnik of FEBRAS.* No. 5, pp. 53-71.

Kasyanov, V. L. (1998). “Ecological aspects of the project of economic development of the Tumen River from the position of possible changes of the environment.” *Works of the Professorial Club.* No. 3, pp. 36-41.

Preobrazhensky, B. V., V. V. Zharikov and L. V. Dubeikovsky (2000). *Thebases of underwater landscape studies.* Vladivostok: Dal Nauka.

Sergienko, V. I et al. (2002). *The trans-boundary diagnostic analysis/RAS/98/G31 - the Program of development of the UN/FUND Global Environment Facility - the Strategic program of actions for the Tomen River wate rshed.* Vladivostok: DalNauka.

Shulkin V. and A. Kachur (2014). *State of the Marine Environment Report for the NOWPAP region.* Vladivostok - Busan: NOWPAP POMRAC.

Shulkin V. et al. (2014). *Integrated coastal planning andecosystem-based management in the Northwest Pacific Region.* Vladivostok - Busan: NOWPAP POMRAC.

Shulkin, V. M. (2007). *State of the Marine Environment Report in the NOWPAP Region United Nations Environment Program Northwest Pacific ActionPlan.* Vladivostok: Pollution Monitoring Regional Activity Center.

Shuntov, V. P., E. P. Dulepova and I. V. Volvenko (2002). “The present status and long-term dynamics of thebiological reserves of the Far Eastern economic zone of Russia.” *Izvestiya.* Pacific Research Fishery Center, pp. 3-11.

Yasuyuki, Shibata et al. (2014). *Regional overview of PTS and POPs issues of ecological concerns in the NOWPAP region.* Vladivostok - Busan: NOWPAP POMRAC.

2. Others

The IUCN Red List of Threatened Species. http://www.iucnredlist.org. (accessed on May 8, 2016)

| **논문투고일** : 2016년 08월 17일 |
| **논문심사일** : 2016년 08월 25일 |
| **게재확정일** : 2016년 09월 05일 |

국문초록
아태연구 제23권 제3호 (2016)

러시아 극동지역의 자연재해와 기술적 재난에 대한 동북아시아 국제협력의 방향

바클라노프·카추르
(러시아과학아카데미 태평양지리연구소)

러시아 극동지역과 동북아시아에서 자연재해 발생률이 높은 것은 북극해와 태평양의 교차점에 위치한다는 지리적 특성과 관련이 있다. 자연재해로 발생하는 위협은 화산폭발, 지진, 쓰나미, 폭풍우와 태풍, 홍수와 같은 극한의 자연현상에 의해서 야기된다. 그러나 석유 유출의 가능성, 석유 관련 제품의 개발, 해저 광물자원 추출 등 기술적 재난은 인간에 의해 야기된다.

이 지역은 대기 및 수질오염 물질의 하천(아무르강, 두만강 등)과 바다(동해)를 통한 주변국으로의 유입으로 인한 월경성 위협도 크다. 본고는 월경성 환경문제의 예로 2013년 7-8월에 발생한 아무르강 유역의 홍수를, 기술적 재난의 예로 2005년 12월 중국 동북부의 송화강지역 개발을 제시했다. 또한 러시아 극동지역을 자연-경제구역으로 구분, 인간이 경제활동을 할 때 나타나는 위험요인에 따라 4가지 자연-경제구역을, 극한의 자연현상에 따라 24개의 세분화된 지역을 상정했다.

자연재해와 인재(人災)로 인한 부정적인 결과들을 축소시키기 위한 국제적 협력을 위해 국경 간의 해양경계지역(강, 호수, 바다를 포함한)에 대한 국제적 협약 결과를 포함하는 공동 국제프로그램, 위원회, 보험기금, 그리고 모니터링 시스템 등의 제도적 구조들이 마련되어야 한다.

▪ Key words: 자연재해, 기술재해, 러시아극동, 국제협력, 유엔환경계획