Review of biodiversity research results from Russia that directly contribute to the sustainable use of biodiversity in Europe

Introduction

It's difficult to give overview on the biological researches in so big and non-uniform country as Russia with huge areas different types of landscapes and geographic zones. In table 1 we're bring an information on main bioms of Russia and their state (Materialy…, 1998).

Table 1

The area and degree of anthropogenous transformation of main bioms in Russia

Bioms	Area **(S)** Thousands of square km	% from area of the country and economic zone	Destroyed natural ecosystems (% from **S**)	Transformed natural ecosystens (% from **S**)	Disturbed productivity of natural ecosystem (% от **S**)	General degree of biom's diturbance (% from S)	Share from general area of disturbed natural ecosystems (%)
Aquatories (in the borderd of economic zone)							
Open ocean	31.8	0.135	0	0.2-0.6	1-2	0.27	0.004
Pacific ocean seas	2125.3	9.05	0	0.8-1.5	6-10	1.18	0.17
Barentsev sea	1216.9	5.18	0-0.1	2-4	15-20	2.70	1.50
Other seas of Arctic ocean	2835.5	12.08	0	0.0-0.2	0-1	0.08	0.10
Baltic	6.8	0.029	1-2	15-22	40-50	11.55	0.04
Azov, Black sea	3.2	0.014	2-5	25-40	60-65	19.50	0.02
Coastal zones	79.1	0.337	0.0-0.1	1-2	10-15	1.75	0.06
Russian Kaspii	78.1	0.33	1-2	8-15	10-12	6.45	0.23
Territories (including land water)							
Baikal	31.5	0.13	1-2	2-4	6-8	3.30	0.05
Other lakes	400.5	1.704	2-4	4-8	5-7	5.40	0.99
Rivers	237.6	1.01	0-1	20-25	10-15	8.50	0.92
Near rivers and deltas	525.1	2.24	12-14	10-12	?	17.00	4.07
Marshes	804.8	3.43	0.5-1.5	?	?	5.22	1.92
Tundras	2298.1	9.79	0-0.1	8-11	14-16	4.40	4.61
Forest-tundra	2443.9	10.41	0.1-0.2	8-10	12-14	4.15	4.62
Northern taiga	1889.4	8.05	1.0-1.5	12-13	1.5-2.5	5.20	4.48
Meddle taiga	2630.7	11.21	1.5-2.2	10-12	3.0-4.0	5.50	6.60
Southern taiga	3527.3	15.03	10-11	14-16	3.0-5.0	15.40	24.74

Wide-leaved forests	1316.7	5.61	32-34	13-15	3.0-4.0	37.55	22.53
Steppe, half-deserts	950.6	4.05	39-41	37-39	1.0-2.0	51.55	22.34
Highlands	41.0	0.174	0	?	?	0.2	0.004
Total		100					100

It's possible to subdivided whole pool of investigation on formal ("official") direction that configurated in announced national conception of biodiversity (Nacional'naja Strategija…) that richly supported by internal system of financial support (Russian foundation of fundamental investigation, federal budget programs, awards) and factually controlled and especially are addressed to concrete narrow circle of persons on a top of academic hierarchy (bureaucracy in Russian science still very strong). That way is only one of the methods to get good money from the government. This lay contains an old scientific information mixed with some elements of false that can be called "parascientific phraseology". So the part of this results enough useless for ERBS purposes. In other words we have the quite good laws and if they were observed all it would be wonderful.

But there is another part of honorable scientists and scientific investigations that have interesting results and really can be used for halting the loss of biodiversity.

We supposed that most useful for contribution to the sustainable use of biodiversity in Europe can be information on State and Russian academy of science plans connected with conservation of biodiversity of the country, because some regional decisions in Russia can be equal to one on the level of international communities on the West. In connection with that fact we gives news on inventarisation of biodiversiry in Russia. The information can be used in EU countries for analysis of biodiversity state compare with levels of human-made landscapes transforming and pollution. This comparative analysis can give an information and evaluation on main trends in biodiversity changes and it’s conservation. Very significant facts on forest’s biodiversity because Russia have about 26% of world’s forests (Action A2.1.3). Similar situation is in the field of sea biodiversity. Russia has the most productive shelf in the world and the longest sea borderline.

Investigations on genetic biodiversity of the forests, agriculture species and some other organisms gives new significant information on the reasons of species extinction and backgrounds of biodiversity loss and biological resources (Action A2.1.11). Some negative data on severe radioactive polluted areas of Russia can be very indicative to show main threats that can be successfully avoided by EU (Action 2.1.6).

We also included the data on urban ecology, because in European countries about 80% of people living in the cities. So it’s possible to use some result from urbanised territories of Russia for comparance and as experience of ecological monitoring and bioindication methods (Action A2.1.5, A2.1.7, A2.4).

Situation with population’s point of view on the questions of biodiversity loss and protections measures in Russia is very differ from Europe. We may say public opinion needs in serious connection from the very begining – first steps of education. That’s why this question is also under discussion in the review (action A.4.1.6).

Description of main findings of the selected studies

The experts involved in development of National strategy and the National plan of actions determine specificity of conditions of Russia, which should be taken into account at realization of the strategic plans in the field of protection of wildlife (Materialy…, 1998). It was:

1 a deep economic crisis, which has resulted in sharp reduction of volumes of the nature protection investments;

2 relatively small ecosystems transformation, especially in Asian part;

3 decrease of anthropogenous pressure on ecosystems for last years as a result of depression of industrial manufacture;

4 decrease of public attention to problems of wildlife protection;

5 absence of a real evaluation of a biovariety as most powerful element of national treasure of the country;

6 transitive economy, weak development of private sector, absence of the advanced market of sale and purchase of land;

7 incompleteness in development of legislative base in the field of conservation of a biodiversity (many laws still not accepted);

8 multinational character of the country, presence more than 50 groups of the small nationalities with the traditional forms of managing and differences in their understanding of biological resources and a biodiversity;

9 significant length of overland and sea borders and problems connected to preservation of a biodiversity of boundary territories and protection of migrating animals;

10 the large size of the country, variety of natural conditions (variety of geographicl zones, presence of large mountain systems and plains, river pools, lakes, Arctic archipelagoes);

11 the significant share of undisturbed ecosystems, especially on the North, in the Asian part of Russia (more than 26% of virgin forests of a planet are in Russia);

12 presence of advanced, functioning more than 80 years, system of protected areas (about 2% of the territory of the country);

13 good scientific traditions advanced system of scientific support of measures on preservation of a biodiversity (wide system of scientific and educational institutions, tradition of taxonomy researches and realization of works on inventory, estimation of a condition of objects of wildlife e t.c.);

14 low efficiency of economic and financial mechanisms of preservation of a biodiversity.

All these positions are taken into account when National Strategy and Plan of Actions on preservation of a biodiversity was developed.

During three years (2003-2005) inside Russian academy of sciences functioned programm “Scientific basement of biodiversity conservation in Russia”. 34 institutes of RAS were included in this programm. Inside the programm it was 9 directions with 68 projects (Nauchnye…, 2006). It was finalized some steps on biodiversity invetarisation – publications of some monographs and development of information databases. Development of ecological monitoring methods on the different levels of biosphere structure also was included in the programm. Another part of programm was connected with historical analysis of biodiversity changes from ancient to present time. Members of the programm offered some concrete new methods for biodiversity conservation and it’s restoration.

Fifteen percents of vertebrate animal's species living in Russia and four percents of growing here plant's species are considered rare or are under threat of disappearance. The loss of habitats is most dangerous to them. Among other threats - illegal trade, pollution of environment, change of a climate, irrational use of natural resources.

It's possible to say that in Russia now we're at the beginning of complicated process of nature protection and halting of biodiversity loss.

There are two levels – first one is a level of biological resources when humans can use some species of wild nature as resource. That mean the state of this species is enough good. Another one is a level of biodiversity when it needs to support, conserve and protect some biological species.

One of the main tasks is to prepare new biological cadastres of main regions in Russia with the usage of modern taxonomy methods. Unification of the methods in the scale of whole country is very necessary in present time. In this field Russian science just at the begining of the road.

January 31, 2002 Zoological Institute of RAS (ZIN) has concluded the state contract on performance of research and skilled - design works on a theme "Information system on a biodiversity". Coexecutor of the project are: Institute of problems of ecology and evolution RAS (IPEE), Botanical institute RAS (BIN) and Institute of cytology and genetics Siberian branch of RAS (ICG).

The main task of the project "Information system on a biodiversity" (ISBD) creation of programm complex and data bases for typification of animals and plants, that will serve as a basement of information-search system (ISS) on Russia biodiversity that supporting non-uniform collections of information resources on systematic, collections and ecology.

Development of standarts, formats and methodology of united national database on biodiversity of all taxons (microorganisms, plants and animals) and information about collections supported by all institutes co-executors in Russian part of Internet also part of the tasks of the project.

The initial data for realization of work are served with results of researches of structural divisions ZIN, BIN, IPEE and ICG in the field of biology, including already scientific product, created and partially published by them, in the field of animals and plants systematic.

Objects of research are procariotes, protists, the mushrooms, plants and animal, living on territory of Russia and neighbour territories. The special place (occupies study of the Arctic animals and plants, due to which is especially felt significance of the contribution of the national scientists in biodiversity research of whole Earth.

During that work the theoretical and applied researches will be carried out, and also are developed and the applied programs, databases, information systems and Internets - sites on various taxonomic groups of organisms will be improved.

The information systems and databases under construction will be very helpful for decisions of many fundamentals scientific applied, educational and nature protection tasks connected with conservation of biodiversity in Russia.

From 1999 in Russia by appointment of Ministry of science it was selected three main directions there are: investigation of a status and inventory of a biodiversity of fauna and flora on the territory of Russia;

monitoring and preservation of a biodiversity, steady usage of components of a biodiversity.

One of significant parts in research of biodiversiry and it's protection is data on modern fauna and flora for any region. So the information on species and their territorial distribution for every systematic group of living organisms is a very significant step to sustainable environment, conservation measures and biodiversity protection. Last years in Russia was published books on biodiversity of amphibian of Far East (Kuzmin, Maslova, 2005), Reptiles of North Eurasia (Ananjeva et al., 2004), Fauna of European North-East of Russia. Cliking beetles (Medvedev, 2006). Vertebrate fauna of the Putorana Plateau (Vertebrate fauna…, 2004), Birds of Polar Ural. (Golovatin, 2003). Main newly published books on animal's biodiversiry are: "Guide on Diptera of Russia and neighbour countries", volume of "Fauna of Russia (Plecoptera)", monograph "Annotated and illustrated list of sea perches of world ocean", "Catalogue of Agnatha and Fishes of fresh and salter water of Russia", last volume of edition " Catalogue of freshwater fishes parasites of Nothern Asia", finished (vol.6) "Guide of freshwater invertebrates of Russia", first edition of "Catalogue of collections of Zoological institute of RAS", "Annotated catalogue of fishes and fish-like cretures of Russian seas and neighbour" (part 6), two part of monograph "Fauna and ecosystems of Laptev's sea and neighbour deep Arctic waters", second book from serie "Animal biodiversity" (City mosquitos), three volumes of guide "Biota of russian part of Japanise sea", three books "Guide of the insects of Russian Far East", Monograph on Nematoda of Russian Far East.

In the field of plant's biodiversity the main events was development of russian internet-site of fungai (http://www.binran.spb.ru/infsys/fun_map), published 4th volume of catalogue on Diatomea of Russia, published 8th and 9th volumes of "Guide of Lichens of Russia", "Guide of moses of Russia", "Plant's cover and plant resources of Polar Ural".

Creation of Red Data Books also one of the elements of strategy for halting the loss of biodiversity. In Red Data book of Russian Federation (Red Data Book of RF, 2001) included 414 animal species and subspecies, 516 plant species and 17 species of mushrooms.

On internet-site of IPEE RAS – www.sevin.ru developed information system with database on rare and disappeared species of Russia. There is two parts in the system. First - Red Data Book of Russia (animals) – 434 species, the second part - Red Data Book of Russia (plants) – 533 species.

Another step in this direction is regional Red Data Books creation on the basement of the new data on species composition, their numbers and territorial distribution. Last years in Russia was published some regional Red Data Books: Red Data Book of Chelyabinsk region (2006), Red Data Book of Bashkiria (2006), Red Data Book of Khanty–Mansiisky district (2004), Red Data Book of Yamalo-Nenetsky district (2005) e t.c.

Genetic resources are one of the components of biodiversity. By that reason investigations, connected with genetic-geographic history of species are also one of the priority in biodiversity protection. In this field researches connected with some new data on genetic status of *Triturus dobrogicus* (Litvinchuk, Borkin, 2002), species that consist from different genetic lines (Borkin et al., 2003), and different types of chromosomes system (Kupriaynova et al., 2003) for "eastern" and "western" genetic forms

(Kotenkova, 2006). All this data not only gives us possibility to reconstruct main directions of some evolution's steps in forming modern picture of species distribution (Borkin et al., 2002, Semerikov, 2003) or species and populations specific. Usage of this information joint with some genetic-population processes in itruder species can give us possibility of forecasting some changes in species compositions and ecosystem structure (Borkin et al., 2003; Vershinin, 2005a, b; Vershinin, Ivanova, 2006; Reshetnikov, 2001; Biologicheskie…, 2004). One of impressive examples of biological invasion is expansion of common kilka - *Clupeonella cultriventris* in Volga. This species moved 3000 km to the North and reached Beloye lake. By that reason communities composition and share of main species almost changed in present time. The process of invasion induced by changes of water speed flow and eutrophycation. In this new conditions species with short life cycle have advantage (Nauchnye…, 2006).

At present time for Russia is very significant the development of steady forest usage, special forest policy and laws, forming of ecologically responsible forestry business, protection of forests and protection of special valuable forest territories.

The preservation of forests is possible only on the basement of their protection, steady management and restoration in those places, where it is necessary. For this purpose it is required special measures: development of system of protected forest territories, demonstration of steady forest management in model forests, introduction of responsible ecological policy and international independent certification of forest managing on the system FSC by the Russian timber industry companies, struggle with illegal cuttings down and criminal trade in a wood, formation of modern national policy in forestry.

The important component of the plan of actions in a channel of this strategy is the direction that realising as the program «Development of methodological bases of monitoring of a biodiversity of forests». This direction headed by the Centre on problems of ecology and forests productivity of RAS (head - academician A.S.Isaev).

The efficiency of realization of forests monitoring is substantially determined by presence of the advanced information database with the characteristics of a condition and dynamics of forests fund, its ecological and resource potential, and also knowledge of the main conditions of growth and development of forest's ecosystems. Use of GIS technology ensuring collection, storage, processing, analysis and the display on an electronic card of diverse objects and phenomena, creates necessary conditions for realization of inventory works, creation of thematic cards and their further use. In this connection, during realization of the Program the scientific base for realization of the basic receptions of estimation and monitoring of forest's biodiversity of Russia was developed at use GIS. With the purposes of comparison of the data and standartisation of the approaches the experience of the international programs on system engineering of indicators and criteria of an estimation of a biodiversity, scales and levels of an estimation was used, the attention to questions of the data formats balance and their processing was given (Nacional'nyj …, 2003).

Russia is on the third place (after USA and China) by wasting of CO_2 and other «greenhouse» gases. Permafrost occupies near 60% areas of our

country. That's why prognosis and investigation on climatic change of Russia are very significant. As it was investigated natural border of forests in the Urals moving to the North during last thirty years (Mazepa and Shiyatov, 2003)

In IOGEN RAS (Russian Institute of General Genetics) it was developed database on variability of pine trees of th world in isoferments, heterozigotity, coefficients of inbreeding and cross systems (Nauchnye…, 2006). It's appeared that for coniferous forest significans factors influent on their genetic diversity are balancing and diversificate selection, inbreeding and history of spreading during Pleistocene and Holocene. Investigations of genetic structure of forest trees shows that clearcut and breaking rules of forest usage leads to genetic diversity loss in many regions of Russia. It needs to protect very rare non-disturbed primary forest. From the other side it's appeared that artificially repaired forests are genetic poor. So these forests with small hereditary diversity are very vulnerable to different kinds of pollution and pests.

Thanks to studying of Russian forests it was found six features of climax forest communities (coniferous species, wide-leaf tree species, soil invertebrates - reducents, leaf and wood-eating insects, wood destructing mushrooms and big mammals phytophags). It was shown that under conditions of free seeds spreading of some tree species (edificators) it will be possible restoration of coniferous - wide-leaf forests of Eastern Europe (Nauchnye…, 2006).

The basic technological principles of conservation and non disturbing usage of natural resources was developed for forestry, agriculture, fish industry and hunting (Altukhov et al., 1972, 2004), but not in use in modern Russia. Russian government lost control of biological resources of the country (Altukhov et al., 2004).

The Russian program Wetlands (under supervising of WWF, project - RU0056.02) directed on support of strategy of preservation water-marsh territories in Russian Federation. The program is directed on performance of the obligations of Russia on Ramars convention, assistance to development of national strategy of protection and use water-marsh territories, coordination of works on inventory water-marsh territories, monitoring of water birds, and also distribution of the information and training of the experts. Within the framework of the Program the development of the design offers on creation of the Moscow educational WETLAND-centre, and also on preservation of Russia marshes is conducted. It was developed new map of Russian marshes (Botanical Institute RAS) with additional investigation of small crustaceous species. On the basement of this data it was proposed new marshes typification and scheme of their successional development that can be used in the process of wetland restoration (Nauchnye…, 2006).

Russia is a unique country that bordering with 12 seas and one sea-lake (Caspium). Western coast of Kamchatka and Kurilsky islands bordering Pacific ocean. Summarized square of territorial water and exclusive economical zone of Russia is about 7 mln square kilometers (Sea…, 2004). Square of Russian continental shelf is about 5 mln square kilometers (it's 1/5 of a whole world shelf). So investigation of Russian experience (positive and negative) can be useful for EU because of it scale.

Far East sea reservance that was founded in 1978 is the only exclusively sea reservance of Russia. Sea wildlife is under protection in 14 the others Russian reservances, 3 protected areas (Map…, 2003; Bersenev et al., 2006).

Russian seas are unique because of high productive Barentsevo, Beringovo, Ochotsky and the most productive in the world West-Kamchatsky shelf (20 tonn per square km).

In the Far East seas of Russia the stocks of trade species that having world value are concentrated: the salmons, Kamchatka crab e t.c.

In Arctic and Pacific seas were kept considerably large (in comparison with Northern Atlantic) stocks crashes.

In the Russian seas - highest in the world a variety of sturgeon and salmon fishes.

Along coast of the Russian seas pass major ways of migrations of sea mammals and birds of northern hemisphere.

In the Russian seas are open unique ecosystems: relict community of Mogilny lake, relic kells ecosystems in Arctic Region (Chaunskaya guba), shallow termal water communities in gulfs of Kuril islands.

At present time nature of the Russian seas is exposed to powerful man's influence. The Black and Caspian seas - for last decades their ecosystems almost changed under effect of the natural factors and man's impact especially have suffered.

Overweening usage of sea biological resources, bringing about their exhaustion. Reasons: bad controlled fishing and bootleggers (Sovremennye ..., 2006; Vaisman, 2002).

There are strong pollution of the sea and disturbance of natural ecological processes. The reasons: production of petroleum and gas on a shelf (Seismic…, 2004) and intensive navigation. Another factor - pollution and other influences on the river's flow running into the seas of Russia ecosystems (Kuda …, 2006).

There are real ways to reduction and prevention of threats connected to influence of the man. Some of them was mentioned above: natural reservance, conservation and non disturbing usage of natural resources due to developed method of genetic diversity detection on the basement of allozyme diversity and satellite DNA restriction (Altukchov, 2003). Also it needs serious (non-formal) ecological expertise of any project.

Study of different breed lines of cattle shows on the process of decreasing of breeds diversity in Russia (Altukhov et al., 2004). This means that we have irrevocable genetic fund loss and disappearance of coadaptive gene’s complexes. The process leading to irreversible erosion of animal industries resources. In Russia still exist unique genetic resources of Yacoutia cattle, Yacoutia horse, genetically unique northern deed populations, yaks – *Poephagus gruinniens*. That’s why the human-made biodiversity of Russia also needs to be conserved. Unfortunately Russia is not cooperate with any country on the question of genetic resources of agriculture animals until now (Altukhov et al., 2004).

Genetic biodiversity of agriculture plants in Russia are also in danger. Genetic monitoring of some kind barley and wheat discovered process of decrease in genetic differences due to selection of clear lines. The danger of

the process is in potentially high vulnerability of these lines to natural catastrophy and different kinds of pests.

Another one aspect that characterized specific of biodiversity problem in Russia is negative experience and connected with radioactive pollution. The question is from those that can be described by sentence «to show how it is impossible to do the things». It's connected with Chernobyl's problem (The consequences..., 1996).

There are complex of severe problems in the areas that are under effect of radioactive pollution (Ukraina, Belorussia, and Russia). It was founded problems of livestock farming in these regions that arose due to the Chernobyl disaster (Pasternak, 1996). For example it is reported that veterinary service in Bryansk Region (Russia) has revealed approximately 500-fold excess of the radiocontamination level in southwest areas of the Region following the disaster over that in the pre-accident period. There are listed the developed and produced high-efficient compounds (different kinds of Gize salts and ferrocyne) application of which allowed considerable reduction in the radionuclide content in milk and meat, and decrease in production of non-standard cattle-breeding produce.

The influence acting on natural forests (Turko et al, 1997). It is estimated that Cs-137 allocation in the basic components of forest cenoses largely depends on the trees age. In young plantations about 94.6% of total Cs-137 activity is concentrated in the mineral part of the soil. Unformed forest litter contains 0.2% of total activity, and undergrowth vegetation contains 5.2%. In medium aged plantations trees accumulate 14,9% of total Cs-137 activity. Developed undergrowth vegetation with domination of moss holds 16% of radionuclides. The mineral part of soil and forest litter contain appropriately 34.8% and 34.3% of Cs-137 total activity of pine biogeocenosis.

An investigation of the effects of radioactive pollution on pine tree forests in contaminated area shows some cytogenetic changes in populations (Kalchenko et al., 1995). The genetic effects were estimated in *Pinus sylvestris* L. populations from the region of Kyshtym accident (East-Uralian radioactive trace), from the Chernobyl zone of the Chernobyl disaster and from the region of testing nuclear equipment on Semipalatinsk testing ground (Altai). There were analysed seeds of trees growing for 30 years in the region of East-Uralian radioactive trace, seeds of the 1^{st}, 2^{nd} reproductions of trees of trees from the control zone of the Chernobyl disaster and seeds of Altaic band forest trees exposed to radiation impact in 1949- 1989 as a result of tests on Semipalatinsk testing ground. Effects of enzyme loci mutations were indicated by electrophoresis method of endosperm extracts in polyacrylamid gel. Three types of loci mutations were revealed: 1) mutations changing isoenzyme structure as a result of which its charge and protein location in gel after electrophoresis are changed; 2) loss of enzyme activity manifesting itself in the absence of a stained band in gel after electrophoresis and, consequently, its display (null-variants); 3) emergence of two alleles of one locus in haploid endosperm. An increased level of mutagenesis was revealed in the all populations studied: $5 \cdot 10^{-3}$ of enzyme loci mutations per 1 locus for the East-Uralian radioactive trace, $3 \cdot 10^{-3}$ -n per 1 locus for the Altaic Region and $2 \cdot 10^{-3}$ for Chernobyl NPP zone. So, as for the frequency of enzyme loci mutations, the examined regions are arranged in the following descending sequence: East-Uralian radioactive trace – Altai-Chernobyl.

The earlier accidents aren't well known on the West. East-Uralian radioactive trace was appeared in 1957. Where it was found that under conditions of long term increased radiation impact affecting survival, growth, development and defining viability and mutability of their progeny are changed. The frequency of chromosome aberrations and resistance to additional irradiation were observed to increase. The rate of growth and development in these populations changed. Instability of the observed effects and increased lability of cytomorphological characters and physiological properties of individuals were founded (Pozolotina, 1996; Vershinin, Seredyuk, 2000).

Underground nuclear explosions in Komi region in 1976 (Taskaev, Zainullin, 1997) that still have significant consequnces on the nature of North East of European Russia.

Another accident with radioactive pollution has taken place near Tomks (Siberia) in 1993. Here it was founded frequency increasing of serious deviations in embryo development and their high mortality that rised under effect of radionuclids appearance (Moskvitina et al., 1995; Savel'ev et al., 1996; Kuranova, 1998)

Underground nuclear explosions in Tjumen region (1978-1985) and losses of 35 radioactive sources for geophysics exploration (Migunov, 2003) create situation of unpredictable future in the field of radioactive safety and genetic changes. Future genetic consequences of these accidents are very difficult to predict.

The other significant field of investigations that gives new important data is population's urban ecology. It's possible to say that problems of urban ecology are quintessence of modern ecology problems.

It was founded that there are some laws in changes of city fauna. Simplification of species communities on urbanized territory is similar for different systematic groups. First time evolutionary old species disappeared, but evolutionary young species have more advantages on the city territory (Vershinin, 2002; Vershinin et al., 2006).

It's possible to subdivide the levels of ecosystem transformation under urbanization ifluence as initial, average, and significant.

1. Attributes of an initial level of changes.

a) Changes in species composition. A good parameter of the initial environmental transformation stages is the change of species composition. When estimating changes in species composition, it is necessary to know the published information about species composition of the pasts in the area under study.

b) Fall in population size and density. Censuses of animal density show a significant decrease in comparison with forest habitats (Vershinin and Krinitsyn, 1985).

c) Negative changes in populations of forest species (decrease of specimen number and fecundity e t.c.). The limits of variability have appeared broader than in the forest population. Under conditions of pollution and environmental transformation, populations have a number of physiological adaptations at the level of the individual (Vershinin and Tereshin, 1999) that result in additional energy loss (Shvarts, 1980).

d) Accumulation of pollutants is another part of initial level indication.

For the estimation of initial stages of an ecosystem transformation, it is convenient to use changes in species composition, number of common and

widespread species, density, decreases of fecundity, increases of asymmetry as well as the accumulation of pollutants.

2. Mean level of changes. At a given level of change in connection with pollution and radical changes of vegetation.

a) Morphological anomalies and the increase of frequency of abnormal progeny. Increases of mutation frequency also are known.

b) Occurrence of physiological adaptations at the level of organism. Using biophysical investigations it's possible to indicate the presence of adaptive changes at the level of the organism with the absence of sharply expressed significant differences at the population level in other parameters. These features reflect the degree of anxiety and the pollution level under urbanization and the degree of adaptive changes in populations under anthropogenic environmental transformation (Vershinin and Tereshin, 1989). Thus, the mean levels of transformation and ecosystem pollution are well estimated on the basis of increased frequency of all types of morphological anomalies, increased mutation rates, frequency of abnormal progeny and the presence of physiological adaptations.

3. Significant level of changes. Specimens living in the zone of considerably transformed environment are characterized by the occurrence of a number of adaptive features of the level of population.

a) Specificity of population dynamics. For example - high mortality at early stages of development and a sharp decrease to the end of development (Vershinin and Trubetskaya, 1992). Dunson and Connel (1982), as well as Cecil and Just (1979), also recommend the use of mortality rate for an estimation of pollution level.

b) Phenotypic features. Data on population's morphology indicate specific of their morphological features.

c) Specificity of genetic structure. Change of territorial structure and high local density at low population number of the animals (Vershinin and Krinitsyn, 1985) result in significant changes of genetic structure. The frequencies of rare morphs increase (Lebedinsky, 1984). The increase of close relatives in these conditions results in external appearance of recessive mutations that usually reduces individual viability (Flindt, 1985; Gershenzon, 1985).

d) Occurrence of introduced species. Because of thermal environmental pollution appearing some species from other geographic areas. That means the appearance of populations of introduced species that are capable of existing only in man-changed environment.

Most of the data above was gathered by traditional techniques. I think that it is important to elaborate the basic directions of works that allows correct and quick monitoring and bioindication. The above parameters and methods are consciously given together with their particular results because we assume that depends on the particular purposes of the research and region, the choice of optimal techniques, and the species most adequately reflecting anthropogenic environmental changes. On one hand, it should be a common and widespread species, and on the other, the species should have sufficient sensitivity to biogeocenotic transformation. It is necessary to use new methods that allow one to carry out effective estimations of the state of ecosystems. For these reasons, I consider it important to conduct full-range population investigations at a modern level including new methods from adjacent scientific fields that allows not to ascertain the phenomenology of the observable facts and estimate the biological sense of the processes. Only complex, full-scale basic research will allow us to produce a high-grade output

in applied fields. It is useless to go the way of simplification and to search for a single integrative parameter. Only using this complex approach, we will discover very important and interesting results as described above.

In the city and other types of man-transformed ecosystems trophic chains became shorter and appeared changes in strategy of food resources usage in amphibian (Vershinin, 1995; 2006) and elateridae beetles (Vershinin & Seredyuk, 2000; Vershinin et al., 2006). Individual effectivity decreased, but population's one increased.

Reproductive strategy of invertebrates, amphibians and small mammals transformed on the urbanized territory. It was founded increasing of fecundity of rodents and insectivorous mammals in the city populations. In populations of moor frogs vise versa fecundity decreased, but survivalship of embryos increasing due to adaptive high tolerance of clutches (Vershinin, 1997; 2002). Elateridae beetles demonstrate more complicated reaction of changes in egg size and fecundity that depended from species, type of pollution and latitude of the city – so called "adaptive coin flipping" (Kaplan and Cooper, 1984).

One of the most interesting and significant fields of researches in city ecology is population's ecophysiology. Due long term study of populations of three species of Rana genius – *R.arvalis, R.temporaria* and *R.ridibunda* it was shown that ecophysiology allows to understand biological explanation of some zoological phenomena that was founded in amphibian populations under effect of urbanization (Vershinin and Tereshin, 1999; Vershinin, 2002).

It is known that individual accomodation, as a way of the adaptation to various conditions of environment is rather perfect, but energetically unprofitable. For this reason the serious qualitative differences in populations, that reducing a significance of physiological adaptations is much more important. The results of haemopoesis specific, skin penetration, nerve excitability and miocard contractivity of three species of frogs helps us to conclude that species adaptive potential in many respects is hereditary determined by the features of their physiology, specificity of populations polymorphism structure. Individual accomodation and the limits of its variability are preadaptive basis of population's stability to conditions of destabilised environment. The differences in species ecophysiology can explain some reasons of disappearance of one and tolerance of the other one under conditions of human-induced rapid environmental changes. So the information on species ecophysiology can help us to predict changes in communities under effect of growing urbanization and to propose effective measures for concrete species conservation.

The other dangers of biodiversity changes connected with phenotypic changes of urban populations induced by so called "synurbization" (Andrzejewski et al., 1978). We supposed synurbization is very close to domestication process, because both leads to serious morphological deviation from wild-type morphology.

It is necessary to note similarity of synurbization and domestication processes, expressing in changes of direction in natural selection and disappearances of some factors of natural mortality. It is known that selection on specimens with hereditary determined specific of nervous system can lead to biochemical changes, firstly - hormonal balance of organism and brings new features in phenotype, leaving the borders of formed polymorphism

(Belyaev, 1979). Thereby, stress impact of urban environment can influence on ontogenesis through nervous-hormonal system greatly changing spectrum of morphological variability.

By our opinion, there are several sources of morphological variability inflation in populations, inhabiting city territory: 1- high heterogeneity and instability of environment, 2- territorial isolation, inbreeding depression and high intensity of mutation process, 3- changes in hormonal background connected with pollution and selective survivalship of the animals with high stability of nervous system (Vershinin, 2005).

So it needs to know that city populations can be dramatically transformed by their morphology and this case their biodiversity also is in danger despite of their presence and reproduction.

Specific feature of city populations connected with another side of their morphogenesis – mechanism of shape forming stability increasing. Studies of proliferate activity of moor frog juveniles that conducted at the initial stages of frogs' terrestrial life shows that mitotic activity exhibited a slight positive correlation with the liver index, which indirectly reflects the general metabolic rate in young frogs. The combined estimation of proliferative activity, epithelial cell size, and relative liver weight had the highest information value. There was a relationship between the mitotic index and liver index in young frogs from habitats with the highest level of anthropogenic transformation. This indicates that morphogenesis is well-balanced and is likely to decrease the probability of morphological abnormalities in frogs developing in the unstable environment. This physiological property allows the populations to exist and reproduce in urbanized areas.

Investigation of fluctuating asymmetry of measurable parameters on juvenile moor frogs help us to make a conclusion that this features is ineffective as an indicator of population stress in amphibians (Vershinin et al., 2007). The ontogeny of city animals was not destabilized due to adaptive high degree of ontogenetic homeostasis in the urban populations (Vershinin & Kamkina, 2001; Severtsova, 2002; Vershinin, 2004).

Long term (1977-2006) studying of frequencies of good phenotypicaly marked mutations – dominant and recessive gives us possibility to conclude that in the conditions of a big industrial city homozigotity of these specimens can negatively influent on survivalship. Apparently, there is a complex of recessive traits that, being in the homozygous state, may be responsible for a low survival due to inbreeding depression (Simberloff, 1983).

The data on recessive mutation suggests inbreeding depression in urban populations and intense gene pool transformation on the urbanized territory. Urbanization is known to induce insulation of amphibian populations and arising of small communities, which results in a higher level of population homozygosity and accelerated gene pool transformation at the expense of gene drift and concomitant inbreeding. In our view, homozygosity have a negative effect on specimens viability. A single phenotypicaly expressed trait is apparently accompanied by a complex of homozygous recessive parameters leading to low viability because of inbreeding depression.

The dominant mutation increases among adult animals in urban populations. Based on the physiological specific of the carrier of this dominant mutation, it can be concluded that these specimens are preadapted to both natural and artificial geochemical anomalies of the environment. Phenotypic

manifestation of dominant mutation differs from recessive with high stability and its penetrance is independent from seasonal factors. Thus, dominant mutations can immediately increase adaptive success of their carrier. On the contrary - recessive mutations reduce chances of individual to survive (Vershinin, 2006).

One of significant investigations in the field of genetic changes on the urbanized and antropogenic-transformed areas was made at the Institute of General Genetics RAS. It was shown that habitat fragmentation and insulation of natural areas leads to decrease of level of heterozygosis (to 0,06 from 0,13-0,18 in natural populations of snails, and 0,07 from 0,33 in moor frogs accordingly). The most changed (degraded) populations consist from 94% of homozygotes (Makeeva et al., 2004a, b). High degree of homozygosity may have a negative effect on population's viability. A single phenotypicaly expressed trait is apparently accompanied by a complex of homozygous recessive parameters leading to low viability because of inbreeding depression (Altukhov et al., 2003, 2004).

The result of insulation – increasing of speed transformation of genetic structure due to negative processes – genetic drift and inbreeding. This means that definitely genetic drift is the main reason of dramatic decreasing of genetic diversity in small populations. Universality of the laws of population genetics gives possibility to extrapolate these results on every species with short range of activity (Makeeva et al., 2004 b). So we can conclude – the main reason of city fauna extinction have genetic basement.

In the field of development theoretical vews on the evolution process and differences in micro and macroevolution processes it needs to shows the data connected with investigations in the field of block principle in connection with genes evolution. It's appeared that mutations passed through natural selections not connected with active center of albumin's molecule. So the transforming in such case restricted on creation of existing genes and albumins polymorphism (Inge-Vechtomov, 2004).

Population's polymorphism is universal nature strategy that responsible for species integrity on the base of constant interaction of hereditary variability, genetic drift and natural selection in normally fluctuating environment. Genetic variability of the elementary populations (that traditionally considered as elementary units of evolutionary process) is no more than mechanism of adaptive stabilization hierarchical, historically composed species structure.

Isolated population (if it's not disappeared) can develop into "itself", supporting dynamic equilibrium with environment. Polymorphic population panmixed or subdivided (it doesn't matter) undergoes process of degradation, in the best case – specialization, without any evolutionary innovations. Exactly reorganisation of monomorphic part of genome is connected with interspecies differences (Altukhov et al., 2003). That's why habitat fragmentation and appearance of small isolated populations are very dangerous processes from genetic point of view.

A man is a part of urban ecosystems, so processes that going on in human populations are one of the parts of general process induced by urbanization. Similarity features and the differences of populational processes in human and other species populations are very significant for understanding of coevolution and for adequate decisions in overcoming from severe

ecological crisis. Human simultaneously are a main source and an object of his own technology impact.

Human populations in megapolis with huge volume have no sustainable genetic structure and it's (multiplication) reproducton. For big city agglomerations are distinctive centripetal migration, polyethnic composition of population and outbreeding type of mating.

Russian women characterised by maximal scale of outbreeging. Their descendant mainly choosing their mother's nationality. Deterioration of reproduction became for the country the main feature of last decade. The phenomenon was called "Russian cross". That means intersection of two lines – dramatic decrease of birth from one side and high mortality from the other.

Lowest birth leading to decreasing of the number of specimens in new generation to twice lower compare with the preceding one. Growth of interethnic differences by average fecundity lead to maximal adaptive success of "young" ethnic disperse groups from Caucasus (Altukchov, 2003).

It's appeared that city human genetic pool is not normal because of impossibility of it's reproduction in next generations. Internal genetic diversity in these pools are growing due to migration pressure, weakness of insidegroup selection, strengthening of intergroup selection, increasing of mutation process speed. It's possible to call the process disadaptive. That mean it needs special measures of genetic safety in order to guarantee of healthy genetic pool reproduction and to keep genetic variability on an optimal level.

The other problem facing modern Russia connected with unprecendent decreasing of male longevity in last decade (Altukhov, 1998). The high mortality in men's part of human population depends from elimination of a part of potential long-livers that it appeared to be more homozigous and more inadaptive to dramatic social changes that going on in the country last decade (Altukhov et al., 2000).

Ecological investigations in the most urbanized and man transformed areas to explore main mechanisms of community's reactions on the level of individuals, populations, species and biogeocenosis. That is necessary for understanding of key points that define communities transforming and biodiversity loss including genetic diversity (for concrete regions and concrete species).

Unify conception, methodology and methods basement for state system of ecological monitoring also serious problem because of "chemical" approach to control and ecosystems transformation criterion.

It needs development of legislation basement in the field of nature protection and biodiversity control. Increasing of involvement at international systems of ecological monitoring, nature protection laws and biodiversity control measures, as an instrument of restriction of bureaucracy, corruption and data falsification.

An another significant direction is studying of reparation processes in natural and man transformed ecosystems to develop effective methods of biodiversity restoration and environmental protection.

Development and increasing of the net of protected areas (natural reservance, national parks e t.c.) is one of the significant parts of Russian national strategy because of huge territory of the country (17 mln square km). At this time in Russia exists 101 state natural reservation, 35 national parks,

12000 protected natural areas with different status. These areas situated on Far East, Yakutia, Ural, Altai, Kamchatka, and Arctic region. Main problems of this field are - weak financial support, bad developed legislation protection (Zakonodatel'stvo…, 2001), underestimation and misconception from local population. Lack of normal execution power on the local places - serious problem of Russia.

One of the main tasks of national legislation development for nature and biodiversity conservation, sustainable development and care of rational usage of natural resources is ecologisation of national legislation. But factually this year was made antiecological changes in the City-planning state law. The decision connected with programm «Cheap home» - from january 2007 ecological expertise is not necessary procedure for building in Russian cities.

One of the serious problems in biodiversity conservation in Russia is low interest of population to this problem and lack of true and extensive information on the situation in this field.

So for cardinal changes in population opinion on this questions it's necessary creation and release of the newsletter on problems of preservation of a biodiversity; organization of public discussion of National strategy and National plan of actions on protection of wildlife; expansion focused on separate social layers and groups of the information about problems of nature protection in MASS-MEDIA, including on TV; development of the various forms of social advertising in the field of preservation of a biodiversity in a periodic press and on state TV channels, introduction of ideas of wildlife protection in the educational programs of initial, average, high education; information and organizational support of activity international and domestic nature protection institutions etc (Materialy…, 1998). Ecological education from early childhood also very significant for Russia because of sick and non formed civil society.

One of the main and significant measures for effective biodiversity conservation is integration of Russia in the international system to preservation of a biodiversity. Realization of operative tasks of the Convention on a biodiversity - preparation of the National report on preservation of a biodiversity, activity national "focal-point" etc.; expansion of sphere of participation in the Convention On protection of the world cultural and natural heritage - preparation new nominants for inclusion in the list of UNESCO of sites of the world natural heritage (Altai, Northern Caucasus, forests of Kareliya, Kamchatka, Far East etc.); development of the program of participation of Russia in the Pan-European strategy of preservation of a landscape and biological variety; connection to Bonn's and Bern's conventions etc.

Conclusion

For the purpose of EU biodiversity protection it's possible to use an information from developing "Information system on a biodiversity", genetic databases on pine tree forests, methods and scientific basements of coniferous - wide-leaved forest restoration.

Usage of proposed in Russian scientific institutes genetic methods for control, conservation and restorations of coniferous forests of Europe.

Organisation of non-disturbing usage of fish natural resources due to developed method of population's genetic diversity detection on the basement of allozyme diversity and satellite DNA restriction.

We suppose it will be useful to involve unique genetic resources of agriculture animals and plants of Russia into process of European cooperation by this question.

Block of urban ecology contains parameters that can be useful for existing system of ecological monitoring and bioindication in EU. The data on genetic of city human populations and negative processes inside have some some similar points with Europe. That means it needs special measures of genetic safety for human populations inhabiting big cities.

Finally, scientific biological collections of Russia – the biggest source of information on many directions – biological resources, genetic biodiversity, experience of working realities on huge territories have some similarities with questiones under decision due to appearance of European Union.

Involvement of Russian scientific biology resources and ideas for European tasks will be very useful for both sides and can improve situation with conservation of biodiversity as a whole.

REFERENCES

Altukhov, Yu.P. (1998), Allozyme heterozigous, sexual maturity speed and life duration // Genetika. Vol. 34, №7. P.908–919 (in Russian).

Altukhov, Yu.P. (2003), Geneticheskie protsessy v populyatsiyakh (Genetic Processes in the Populations), Ed. L.A.Zhivotovsky Moscow: Akademkniga (in Russian).

Altukhov, Yu.P., Salmenkova, E.A., Kurbatova, O.L., et al., (2004), Dinamika populyatsionnykh genofondov pri antropogennykh vozdeistviyakh (Dynamics of Population Gene Pools under Anthropogenic Pressures), Altukhov, Yu.P., Ed., Moscow: Nauka (in Russian).

Altukhov, Yu.P., Salmenkova, E.A., Omelchenko V.T. et al (1972), To a number of monomorph and polymorph locus in chum salmon population – one of tetraploid species of Pacific salmon // Genetika. V.8, №2. P.251-259 (in Russian).

Altukhov, Yu.P., Sheremetjeva V.A., Rynkov Yu.G., (2000), Geterosis as a reason of acceleration in human // Doklady RAN. V.370, №1. P.130-133 (in Russian).

Ananjeva N.B., Orlov N.L., Khalikov R.G., Darevsky I.S., Ryabov S.A., Barabanov A.V. (2004), Colored atlas of the reptiles of the North Eurasia (taxonomic diversity, distribution, conservation status). Ed. A.F.Alimov. Zoological Institute RAS. Saint-Petersburg. 232 p (in Russian).

Andrzejewski R., Babinska-Werka J., Gliwicz J., Goszczynski J., (1978), Synurbization processes in population of *Apodemus agrarius*. I.Characteristics of populations in an urbanization gradient // Acta theriologica. V.23. P.341-358.

Belyaev D.K. (1979), Destabilizing selection as variability factor in animal's domestication // Priroda. №2: 36-45 (in Russian).

Bersenev Yu.I., Tsoi B.V., Yavnova N.V. (2006), Osobo okhranjaemye prirodnye territorii Primorskogo kraja (Special protected natural territories of Primorsky area). Vladivostok. 64 p (in Russian).

Biologicheskie invasii v vodnykh i nazemnykh ecosistemakh (Biological invasion in water and terrestrial ecosystems). (2004), Ed. A.F.Alimov

and N.G.Bagutskaya . ZIN RAN. Moskva., S.Peterburg: KMK. 436 p (in Russian).

Borkin L.J., Litvinchuk S.N., Rosanov J.M., Milto K.D. (2001), Cryptic speciation in *Pelobates fuscus* (Anura, Pelobatidae): evidence from DNA flow cytometry // Amphibia-Reptilia 22: 387-396.

Borkin L.Ya., Litvinchuk S.N., Rosanov Yu.M., Khalturin M.D., Lada G.A., Borrisovsky A.G., Milto K.D., Faizulin A.I. (2003), Distribution of two kryptic forms of common spadefoot (*Pelobates fuscus*) on the territory of Volga pool // 3 Konferencija gerpetologov Povolzh'ja. Mat-ly region. konf. Tol'jatti; Samara. P.3-6 (in Russian).

Borkin L.Ya., Pashlova I.M., Litvinchuk S.N. (2002), Differences in termoresistence of skeletal muscles between diploid and tetraploid species of green toads (*Bufo viridis* complex) of Middle Asia // Citologija. V.44, N3. P.259-262.

Cecil, S.C., Just, J.J. (1979), Survival rate, population density and development of a natural occuring anuran larvae *(Rana catesbeiana).* - Copeia (3): 447-453.

Dunson, W.A. and Connel, J. (1982), Specific inhibition of hatching in amphibian embryos by low pH // J. Herpetol. 15 (6): 807-811.

Flindt, R. (1985), Untersuchungen zum Auftretein von misgeildeten wechselkroten *(Bufo viridis)* in einen Steinbruch in Vathingen Roswag.-Jahresh. Ges. Naturk. Wurttemberg (140): 213-233.

Gershenzon, M.S. (1985), Microevolution, polymorphism and dominant mutations // Priroda (Moscow) (4): 80-89 (in Russian).

Golovatin M.G., Paskhalny S.P. (2003), Pticy Poljarnogo Urala (Birds of Polar Ural). Ed. V.K.Ryabitsev. Ekatreinburg: Uralsky universitet. 560 p (in Russian).

Inge-Vechtomov S.G. (2004), Block's principle in evolution theory. Perspectives and paradoxes // Fundamental'nye zoologicheskie issledovanija. Teorija i metody. M.-Spb.: T-vo nauchnykh izdanij KMK. Ed. A.F.Alimov. Moscow – Saint – Petersburg. Scientific press Ltd. P.74-87.

Kalchenko V.A., Shevchenko V.A., Rubanovich A.V., Fedotov I.S., Spirin D.A. (1995), Genetic effect in Pinus sylvestris l. populations from the East-Uralian radioactive trace, the control zone of the Chernobyl npp accident and from the region of testing nuclear equipment on Semipalatinsk testing ground. // Radiatsionnaya biologia. Radioekologia. V.35, №5. P. 702-707 (in Russian).

Kaplan R.H., Cooper W.S. (1984), The evolution of developmental plasticity in reproductive characteristics: an application of the "adaptive coin-flipping" principle // Amer. Natur. V.123, N3. P.394-410.

Kotenkova E.V., Ambaryan A.V. (2006), Role of Hybridisation in evolution of commensal house mice of *Mus musculus sensu lato* superspecies complex and the problem of precopulatory isolating mechanisms // Populjacionnaja ehkologija zhivotnykh (Materials of international conference). Ed. Moskvitina N.S. Tomsk. P.37-38 (in Russian).

Kuda techet Amur? (Where to Amur is running?) (2006), Ed. S.A.Podolsky. Moscow: WWF of Russia. 72 p (in Russian).

Kupriyanova L.A., Zavyalov E.V., Tabachishin V.G. (2003), Viviparous lizard *Zootoca vivipara* (Lacertidae) on the North of Low Volga cytogenetic analysis and reproductive ecology // 3 Konferencija gerpetologov Povolzh'ja. Mat-ly region. konf. Tol'jatti; Samara. P.36-38 (in Russian).

Kuranova, V.N. (1998), Fauna i ecologiya zemnovodnykh i presmykayushchihsya yugo-vostoka Sibiri (Amphibian and reptiles fauna and ecology of southeast West Siberia). Ph. D. Diss. Abstr., Tomsk, 23 p (in Russian).

Kuzmin S.L, Maslova I.V. (2006), Zemnovodnye Rossiskogo Dal'nego Vostoka (Amphibians of Russian Far East). Ed. E.I.Vorob`eva. Moskva, KMK. 434 p (in Russian).

Lebedinsky, A.A. (1984), On amphibian adaptations to conditions of urbanized territory // Problemy Regionainoi Ekologii Zhivotnykh v Tsikie Zoologicheskikh Distsiplin Pedvuza. Vitebsk: 106 (in Russian).

Litvinchuk S.N., Borkin L.Ya. Distribution, ecology and conservation status of newt , *Triturus dobrogicus* (Amphibia, Salamandridae), on the territory of Ukraine and Moldova // Vestnik zoologii. V.36. N3. P.35-44, 99 (in Russian).

Makeeva V.M., Maluchenko O.P., Belokon' M.M., Bondarev A.E., Altukchov Yu.P. (2004a), The definition of gens fund state of natural snail's *Bradibaena fruticum* (Mull.) populations under conditions of antropogenious landscape of Moscow and it's neighbourhood // Genetika v 21 veke: sovremennoe sostojanie i perspektivy razvitija. V.2. Moscow. P.210 (in Russian).

Makeeva V.M., Maluchenko O.P., Bondarev A.E., Ross G.V., Leont'eva O.A., Altukchov Yu.P. (2004b),The definition of gens fund state of natural brown frog's populations under conditions of antropogenious landscape of Moscow and it's neighbourhood // Genetika v 21 veke: sovremennoe sostojanie i perspektivy razvitija. V.2. Moscow. P.209 (in Russian).

Map "Sea natural protected areas of Russia". (2003). Moscow (russ./engl.).

Materialy po Nacional'noj Strategii i Planu Dejstvij po sokhraneniju bioraznoobrazija Rossijskoj Federacii, odobrennye Kollegiej Goskomehkologii Rossii (Materials on National strategy and plan of actions on preservation of a biodiversity of Russian Federation, Approved by board of State Comitee on Ecology of Russia) (Protocol from 23 .11.1998 №13). 25 p (in Russian).

Mazepa V.S., Shiyatov C.G. (2003). Climate changes and density dynamics of sub tundra forests in their high border on the Polar Ural // Bjull. Rossiskogo nacional'nogo komiteta po mezhdunarodnoj gegrafo-biosfernoj programme. N.2. P.20-21 (in Russian).

Medvedev A.A. (2005), Fauna Evropejskogo Severo-Vostoka Rossii. Zhuki-shchelkuny. (Fauna of European North-East of Russia. Cliking beetles) Vol.VIII. (1). Spb.: Nauka. 158 p.

Migunov V.I. (2003). Ocenka urovnej radioaktivnogo zagrjaznenija okruzhajushchej sredy Khanty-Mansijskogo avtonomnogo okruga (Evaluation of radioactive pollution levels in Khanty-Mansiisky district environment). Ph. D. Diss. Abstr., Ekaterinburg, 23 p (in Russian).

Moskvitina N.S., Kuranova V.N., Savel'ev S.V. (1995), Embryopathology of small mammals and amphibian in connection with environmental

pollution // Fundamental'nye i prikladnye problemy okhrany okruzhajushchej sredy. Tez. dokl. T.2. Tomsk: Izd-vo Tomsk. un-ta. P.82 (in Russian).

Nacional'nyj doklad Rossijskoj Federacii po kriterijam i indikatoram sokhranenija i ustojchivogo upravlenija umerennymi i boreal'nymi lesami (Monreal'skij process). (National report of Russian Federation on criteria and indicators of preservation and steady management of temperate and boreal forests. Montreal process). (2003), Moscow: VNIILM. 84 p (in Russian).

Nacional'naja Strategija sokhranenija bioraznoobrazija Rossii (National strategy of biovariability conservation in Russia) http://bio.1september.ru/2004/28/5.htm

Nauchnye osnovy sokhranenija bioraznoobrazija Rossii. Osnovnye rezul'taty (Scientific basement of biodiversity conservation in Russia. Main results.). (2006), Moscow. 138 p (in Russian).

Pasternak A.D. (1996), Estimation of the chernobyl disaster consequences in livestock farming of Bryansk region // Khimia v selskom khozaistve. №1. P.24-26 (in Russian).

Pozolotina V.N. (1996), Adaptation processes in plants under radiation conditions. // Ekologia. № 2. P. 111-116 (in Russian).

Reshetnikov, A.N. (2001), [Influence of introduced fish *Perccottus glenii* (Odontobutidae, Pisces) on amphibian in small ponds in Moscow neighbourhood] // Zhurn. obshch. biol. V.62, N 4. P. 352-361 (in Russian).

Reshetnikov, A.N. (2003), Vliyanie introducirovannoi ryby rotana *Perccottus glenii* (Odontobutidae, Pisces) na amfibii v malykh vodoemah (Influence of introduced fish *Perccottus glenii* (Odontobutidae, Pisces) on amphibian in small ponds). Ph. D. Diss. Abstr., Moscow, 24 p (in Russian).

Savel'ev S.V., Moskvitina N.S., Kuranov B.D., Kuranova V.N. Deviations of embryogenesis in natural populations of vertebrates as indicator of evironmental conditions // Radioaktivnost' i radioaktivnye ehlementy v srede obitanija cheloveka. Tez. dokl. mezhdun. konf. Tomsk, 1996. P.388-391 (in Russian).

Sea natural protected areas of Russia. (2004), // Russian Conservation News. Summer 2004, N. 36 (in Russian).

Seismic risk and onshore pipeline portion of Sakhalin Energy investment company's Sakhalin-II Phase 2 project: UNANSWERED QUESTIONS. (2004). Moscow. 64 p.

Semerikov V.L. (2003), Conflicting phylogeies of Larix (Pinaceae) based on cytoplasmic and nuclear DNA // Molecular phylogenetics and evolution. V.27. P.173-184.

Shvarts, S.S. (1980), Ekologicheskie Zakonomemosti Ehvolyutsii (Ecological Regularities of Evolution). Moscow: Nauka Publ., 277 p (in Russian).

Simberloff D. (1983), What a species needs to survive // Nature Conserv. News. 33: 18-22.

Sovremennye problemy lososevykh rybovodnykh zavodov Dal'nego Vostoka. (Modern problems of fish-breeding farms of Far East). (2006). Ed. P.O.Sharov. Petropavlovsk-Kamchatsky. 248 p (in Russian).

Taskaev A.I., Zainullin V.G. (1997),. Testing consequences in the Novozemelsky ground for population of the Komi Republic // The Third International Conference on Environmental Radioactivity in the Arctic. Tromso, Norway June 1 - 5. P. 242-243.

The consequences of the Chernobyl catastrophe: Human Health. (1996). Edited by E.B.Burlakova – Moscow: Centre of Ecological Policy of Russia. 289 p.

Turko V.N., Irklienko S.P., Orlov A.A. (1997). CS-137 in basic components of pine biogeocenosis. // Abstr. III Congress on Radiation Research "Radiobiology, Radioecology, Radiation Safety" (Moscow, 14-17 October 1997). Pushchino. V. 2. P.370-371.

Vaisman A. (2002), Promysel v tumane. Rybolovstvo i torgovlja ryboprodukciej v rossijskoj chasti Beringova morja. Analiticheskij otchet. (Fishing industry in the fog. Fishing and trading of fish products in Russian part of Bering sea. Analytical report). Moscow. 80 p (in Russian).

Vershinin V. L., Gileva E. A., and Glotov N. V. (2007), Fluctuating Asymmetry of Measurable Parameters in *Rana arvalis*: Methodology // Russian Journal of Ecology. Vol. 38, No. 1, pp. 72–74.

Vershinin V.L. (1995), Feeding dynamics of one-summer-old brown frogs during metamorphosis termination // Russian Journal of Ecology. V.26. N1. P.58-64.

Vershinin V.L. (1997), Difference in Reproductive Strategy of Brown Frogs (*Rana arvalis* and *R.temporaria*) Under Conditions of Urbanization // Third World Congress of Herpetology. Prague, Aug.1997. Prague. P.219.

Vershinin V.L. (2002), Ecological specificity and microevolution in amphibian populations in urbanized areas // Ecological specificity of amphibian populations. Advances in amphibian research in the former Soviet Union. Volume 7. Pensoft Publishers. Moscow-Sophia. P.1-161.

Vershinin V.L. (2004), Hematopoiesis of Anurans: Specific Features of Species Adaptiogenesis in Recent Ecosystems // Entomological Review. Vol. 84, Suppl. 1. P.113–119.

Vershinin V.L. (2004), The Striata Morph and Its Role in the Ways of Adaptation of the Genus Rana in the Modern Biosphere // Doklady Biological Sciences. V.396, №2. (ISSN: 0012-4966) P.212-215.

Vershinin V.L. (2005), Expansion retrospective of *Rana ridibunda* Pall. on the territory of Yekaterinburg – natural experiment // Populjacii v prostranstve i vremeni. Tezisy VIII Vserossijskogo populjacionnogo seminara. Nizhnij Novgorod. P.51-53 (in Russian).

Vershinin V.L. (2005), Morphological deviations in population *Rana arvalis* Nilss. on urbanized territories: spectrum, topography, frequency // Ananjeva N. and Tsinenko O. (eds.). Herpetologica Petropolitana. Proc.of the 12th Ord.Gen.Meeting Soc. Eur. Herpetol., August 12 –16 , 2003 , St.Petersburg, Russ.J.Herpetol., St.Petersburg – Moscow. 12 (Suppl.). P.235 – 237.

Vershinin V.L. (2005), On the reasons of number and distribution decrease of common frog – *Rana temporaria* L. in antropogenious landskapes //

Bioraznoobrazie i rol' zoocenoza v estestvennykh i antropogennykh ehkosistemakh. Dnepropetrovsk: DNU. P.356-358 (in Russian).

Vershinin V.L. (2006), Role of Recessive and Dominant mutations in Adaptation the Genus *Rana* to Recent Biosphere // Russian Journal of Genetics. Vol. 42, №7. P.744–747.

Vershinin V.L. and Kamkina I.N. (2001), Proliferative activity of corneal epithelium and specific features of morphogenesis in postmetamorphic *Rana arvalis* Nilss. in urbanized areas // Russian Journal of Ecology. V32. N4. P.272-276.

Vershinin V.L. and Seredyuk S.D. (2000), Trophic specificity of the *Rana arvalis* population from the Eastern Ural radioactive trace in relation to the state of the soil mesofauna // Russian Journal of Ecology. V31. N5. P.330-335.

Vershinin V.L. and Tereshin S.Yu. (1999), Physiological parameters of amphibians in ecosystems of ubanized territories // Russian Journal of Ecology. V30. N4. P.255-259.

Vershinin V.L., Ivanova N.L. (2006), Peculiar features of the trofic relations of an introduced species *Rana ridibunda* Pallas, 1771 Depending on habitat conditions // Povolzhskii ecologicheskii zhurnal. N2/3. P.119-128 (in Russian).

Vershinin V.L., Seredyuk S.D., Chernousova N.F., Tolkachev O.V., Sils E.A. (2006), Puti adaptatsiogeneza nazemnyh zhivotnyh k usloviyam technogennyh landshaf tov (Terrestrial animals adaptive directions to the conditions of technogenious lanscapes). Ed. Syuzyumova L.M. Ekateriburg: Ural division of RAS. 183 p (in Russian).

Vershinin, V.L. and Krinitsyn, S.V. (1985), Density in moor frog groupings under urbanization degree // Problemy Ekologicheskogo Monitoringa i Nauchnye Osnovy Okhrany Prirody na Urale. Sverdlovsk: 9-10 (in Russian).

Vershinin, V.L. and Trubetskaya, E.A. (1992), Brown frog mortality in embryonic, larval and postmetamorphic period at different levels of anthropogenic influence // Zhivotnye v Usioviyakh Antropogenogo Landshafta. Ekaterinburg: 12-20 (in Russian).

Vertebrate fauna of the Putorana Plateau. (2004), Ed. A.A.Romanov. Moscow. 475 p (in Russian).

Zakonodatel'stvo Rossii ob ispol'zovanii i okhrane biologicheskogo raznoobrazija. Analiticheskij obzor. Federal'noe zakonodatel'stvo. (Legislation of Russia on use and biodiversity protection. Analytical review. Federal legislation). (2001), Ed. A.S.Shestakov. Moskva: Geos. 408 p (in Russian).