

UDC 504.064.2**Trends and prospects of strengthening of the “ecological carcass” of the region****Inna V. Mitrofanova**

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Abstract

The emission of pollutants from which the largest part is produced by metallurgical plants, oil and gas enterprises, petrol and chemical industry enterprises, growing car park, insufficient level of landscape gardening, irrational, disorganized waste dumping has a negative impact on the ecology of the city of Volgograd and the Volgograd region as a whole.

The main water pollutants are the housing and communal services, industrial enterprises, agricultural enterprises which actively discharge liquid wastes into the water sources. Special fears are caused by the quality of the surface water which does not correspond to standards. The changes in the hydrological regime of the flow of the river Volga have lead to the depletion and the shallowing of the bodies of water in the Volga and Akhtuba flood plain, reduction of the periods of the flooding.

Introduction of the innovative technologies of the water protection from the pollution, contaminants and exhaustion, use of efficient methods of prevention and elimination of harmful effects, protection of the rights of enterprises, organizations, establishments and citizens, strengthening of the legislation in the sphere of water relations are expected to be the primary goals for the implementation.

The article emphasizes the fact that the existing approaches to the conservation of ecological equilibrium in the region do not provide the necessary degree of ecosystem protection, have a low

efficiency of the reproductive function. The article analyses the opportunities of the creation of an efficient spatial model with the account of a key meaning of the already existing specially protected natural area.

The authors suggested the assessment of a number of measures that are being implemented in the Volgograd region for the improvement of the ecology or using the program and target approach. The main reference points for the correction of the regional ecological policy are revealed.

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Keywords

Regional ecology, atmosphere, hydrosphere, lithosphere, toxic waste, water pollution, soil erosion, specially protected natural areas, target programs, utilization, innovation, efficiency.

Introduction

The Volgograd region is situated in the south eastern part of Russia, occupies the territory of 112 877 square kilometers, the population is more than 2,4 million people. The administrative center is the city of Volgograd (surface is 859,3 square kilometers) where more than 1 million people live.

The ecological situation in Russia in the end of the XX century and in the beginning of the XXI century is one of the most unsuccessful in the world. About 200 cities are ecologically unsecure for the health of the population due to the pollution of the air and water.

The Volgograd region is a large old industrial region of the south of Russia. Due to a high concentration of industrial enterprises and industrial plants the region is one of twenty Russian regions with the increased volumes of polluting emissions into the atmosphere. Atmosphere, hydrosphere, lithosphere are influenced by a huge pollution. The vegetable world and especially the forest resources are suppressed. In the Lower Volga the Volgograd region occupies one of the leading ranks from the point of view of volume of polluting emissions into the atmosphere. According to the ranking of the regions of Russia made by the public organization "Green Patrol", the Volgograd region in 2015 fell from the 25th rank to the 40th in the list of the ecological well being.

Judging from the ecological point of view the center of the region, the city of Volgograd, is similar to many contemporary industrial cities of Russia. The emissions of pollutants, growing car park, insufficient level of landscape gardening, irrational, unorganized waste dumping have a negative impact on its ecology [Grigoriev, 2014; Revich, 2015; Mitrofanova, Pashkova, 2016].

Literature review

The analysis of the changes of the ecology of the regions of the Southern federal district of Russia connected with the human activity is made in the works of Girusov E., Grigoriev A., Revich B., Radzevich N., Pashkang K. and others.

Challenging directions of the conservation and modernization of the «ecological carcass» of the old industrial region such as Volgograd oblast are displayed in the papers of the scientists of the south of Russia: Vladimirov A., Mitrofanova I., Starokozheva G., Batmanova V., Shkarupa E., Yumaev M.M.

The statistical base of the research is presented by the data of the official statistics, departments of natural resources management of the regions of the south of Russia, of the department of the environmental protection and natural resources of the administration of Volgograd and other materials.

Methodology

Methodological base of the solution of scientific goals within the systematic and evolutionary approaches became the use by the authors of the general scientific and specific methods of research and knowledge: comparative method, subject and object method, historical and logical analysis, statistical method, method of expert estimation.

Ecological problems of the region

The cities of Volgograd and Volzhsky show the highest level of the air pollution. The main causes of the pollution are the large concentration in the territory of the car transport (60-80% of emissions, more than 450000 cars), and the activity of large enterprises polluters: Ltd “Lukoil-Volgogradneftepererabotka”, Public Company “Volgograd Aluminum Smelter”, “Volgograd hydroelectric dam (Volgogres)”, Public Company “Khimprom”, Ltd “Volgograd tractor plant (VGTZ)” and others.

The largest part of the pollution is made by metallurgical plants, oil and gas enterprises, petrol and chemical enterprises emitting into the atmosphere sulfur compositions, nitrogen oxides, metallic oxides, hydrocarbon oxides and other harmful substances that are production wastes.

One of the main polluters of the northern industrial area of Volgograd is the metallurgical plant “Public Company Krasny Oktyabr”. Next to the plant there exists the dwelling area, adjoining the territory of the enterprise and entering its sanitary and protective zone. The main sources of pollution are electric furnace melting shop and open hearth plants, continuous steel casting plant, etching room, cast iron furnaces.

The old fashioned technologies and worn out equipment sharply aggravate the considerable negative impact on the environment implied by the character of the metallurgical industry. “Iron red” clouds above the “Krasny Oktyabr” plant is quite a typical picture. Only in 2017 the plant exhausted into the air 2.7 thousand tons of polluting substances. Traditional technologies do not give the opportunity to get rid completely of harmful emissions into the air during the steel making process. The plant is planning to reconstruct the second furnace and to install a special “umbrella” above furnaces and the place of the steel making. The program of the resurrection of the enterprise there are funds (7 million US dollars) for the natural protection [Mitrofanova, Pashkova, 2016].

Another source of the air pollution is the net of motor petrol fuelling stations of Volgograd which have been emitting into the air hydrosulfide, pentylenes, xylene, ethylbenzene for decades.

Economic instruments of the ecological regulation include ecological payments: payment for the right to use natural resources; deficiency payments (reparation of damages) for the decrease of natural resources from the target use or the degradation of their quality caused by the economic activity; payments for the negative impact on the natural environment [Yumaev, 2015; Starokozheva, Mitrofanova, 2015]. These economic tools help adhering ecological standards in the most efficient way. In the natural protection activity it is the payments for the negative impact on the natural environment that are the basis for the economic tools of the regulation are the payments

From 2009 to 2017 the tendency of the growths of payments by 9% is observed. This fact is determined by the growth of the anthropogenic impact as a result of the economic activity.

The program of the development of territorial control of the air quality was implemented in the Volgograd region. It implied the obtaining the latest update about the air condition, increase of the maximum allowable concentration of the polluting substances. This information is taken into consideration at the development of target programs and by a number of enterprises in the sphere of the air protection.

Volgograd region has already organized work of 15 stations whose task is to control the condition of the air in the region. In the region there are special mobile laboratories that are busy with the study of the gas contamination of the air [Grigoriev, 2014; Mitrofanova, Pashkova, 2016].

Water resources of the region are in a deplorable condition. Rivers, ponds and lakes suffer from unpurified waste waters. The main polluters are the enterprises of the communal sphere, industrial enterprises, agricultural enterprises, discharging waste waters. The largest part falls due to the communal service enterprises (up to 70%). It is the communal enterprises pollute two main water sources of the region: Volga and Don. Yearly more than 200 million cubic meters of waste waters are discharged into the rivers of the Volga and Don basin [Mitrofanova, Starokozheva, Mitrofanova, Shkarupa, Batmanova, 2015].

The quality of surface waters and specifically the considerable excess of harmful substances in them (phenols, metallic compounds, ammonium and nitrite nitrogen, oil products, chlorides) raise special fears.

The problem of water protection can be partially solved due to the regulation of water relations, modernization of mechanisms of rational use of water for the needs of the population and regional economy. Among the priorities are: introduction of innovative technologies of protection of waters from pollution, contaminants and exhaustions; use of effective methods of the prevention and elimination of harmful effects; protection of the rights of the enterprises, organizations, establishments and citizens, strengthening of the legislation in the field of the water relations. The largest volume of waste waters is discharged yearly into the basin of the river Volga.

Another important problem of the region is the condition of the Volga and Akhtuba flood plain. The change of the hydrological mode of the drain of the Volga River has led to an exhaustion and a shallowing of water reservoirs of the Volga-Akhtubinsky flood plain, reduction of the period of its flooding. Today the Volgograd water reservoir during the flood is not capable of providing a sufficient water capacity of the flood plain due to its spillage volumes. This leads to the reduction of the reproduction of biological resources including the food reserve and the degradation of the wetlands and flood forests.

The most widely spread manifestation of such a negative impact on the nature is the flooding and saturation of areas intended for building, arable lands. When the level of water in headwaters and shallow waters increases sharply during the spring flood the inhabited localities suffer that are subject to flooding and saturation.

Among the negative factors of the influence on the surface water objects is wear and tear of the net of waterworks whose largest part is either in a disabled state or a critical condition what creates a potential threat to the environment, population and economic infrastructure [Vladimirov, 2014; Girusov, 2014].

Inappropriate economic activity in watersheds has a negative impact on the ecological condition of the basin and river system, on the water body buffer zone and coastal protective belts that in its turn leads to stoppage, occlusion, mud accumulation and depletion of the corridors of headwaters and shallow waters.

Today in the region the state regional program “Use and Protection of Water Bodies, Prevention of a Negative Impact on the Territory of the Volgograd Region for 2014–2020” that determines the

most important directions of the activity concerning the solution of the largest part of the mentioned problems is being implemented. In order to improve the hydrosphere of the region it is necessary to discover immediately and to decontaminate the polluted water reservoirs, to construct new purification facilities and to reconstruct old ones, to modernize and to bring the riverside areas to sanitary norms.

In the region the problem of the pollution of soils and arable lands is very acute. The contribution to the soil pollution is made by industrial enterprises, car transport, illegal dumps with communal wastes and industrial refuse [Mitrofanova, Pashkova, 2016].

In the soils of city the concentration of the phenol and formaldehydes is considerably exceeded. The most polluted soils are the territories of industrial enterprises. Even within “green areas” of city districts the excess of the maximum permissible concentration of a number of heavy density metals is observed [Radzevich, Pashkang, 2015].

The decrease of the general level of farming standards and failure to implement the necessary soil protective and other environment oriented measures due to financial problems, poor state support of agricultural producers present a special danger for arable lands of the region. However it is worth mentioning that in the last years biological means that do not damage the ecosystem so much are widely used in the agriculture of the region. This provides a more favourable ecological situation in the agricultural and ecological system and the content of the ecologically toxic substances is close to the norms and today is assessed as an allowable one.

The land is the main chain of all land biological communities and the biosphere in the whole, its fertility ensures the growth and the development of plants, preserves the water and purifies it in a natural way. It is necessary to introduce new technologies preventing the depletion and pollution of the land surface and to encourage its sound use.

Thus, for instance, in 2017 80,8% of the total land resources of the region were the agricultural lands, 2,9% were the lands of communities, 6,4% – lands under the industrial equipment, transport, communication, power energy production, military infrastructure and so on. 6,0% are forests, 3,2% of lands are occupied by water reservoirs. During the latest years the surface of agricultural lands kept reducing. The lands vulnerable to erosion occupy 43% of lands, eroded lands make up 25,9%, salinized soils make up 16,7%, alkaline soils make up 40,6%. The fertility of lands (content of humus) keeps decreasing.

Due to frequent drought seasons the agricultural producers do not have enough funds to buy the fertilizers (they need 10 000 rubles (166 US dollars) per hectare and the subsidy is 300 rubles (5 dollars) per hectare). The regional law «About the fertility of agricultural land provision in the Volgograd » passed in 2012 does not work fully due to absence of corresponding funding.

One of the important ecological problems are the slop landslides, reprocessing of the river banks (use of sand for construction) and river erosion caused by the creation of the Tsimlianskoye and Volgogradskoye water reservoirs. In the area of the washaway all the riverside boroughs, pump stations, fish breeding enterprises, valuable agricultural lands are located. The processes of erosion of the rivers of Volga and Akhtuba are actively developed along both rivers. The average speed of the right bank retreat as a result of erosion is 0,3–0,5 meters per year being in some areas 2,5 meters per year. In the left riverbank the erosion makes up 50–60 meters per year in places.

The efficiency of lithosphere use is influenced by measures directed on the increase of the land fertility including organizational and economic, agronomical, forest improvement and hydrotechnic measures preventing air and water erosion of lands, salting of soils, genesis of bog soils, pollution of soils, occlusion of lands with weed plants and other processes deteriorating the condition of soils in the region.

There exists another problem of the unorganized and irrational waste recycling whose largest part was dangerous not only for an individual and for the nature as a whole. For the beginning of 2017 in

the territory of the Volgograd region 50 million tons of wastes were piled up and the yearly increase made up 1–1,5 tons per year. For the solution of this problem in the region it was planned to build 8 polygons for solid household waste, about 10 stations of the waste transshipment and 5 waste sorting stations [Information system of territorial planning ..., 2017].

The role of specially protected natural areas in the protection of the ecological frame of the Volgograd region

When studying ecological problems it is necessary to pay a special attention to the creation, functioning and management of the specially protected natural territories. In the regions of the Southern federal district of Russia there are 650 specially protected natural areas, that occupy more than 5100 thousand hectares.

When solving the environmental problems a special attention should be paid to the problems of creation, functioning and management of specially protected natural areas. In the regions of the Southern Federal District of Russia 650 specially protected natural areas are found which are located on more than 5100 thousand hectares.

The reproductive and assimilatory opportunities of natural environment can be ensured only in relatively vast spaces (no less than 400-1000 km²). At the same time the relationship of specially protected natural or naturally anthropogenic areas with the total surface of territorial and administrative entities should correspond to the requirements of the minimal level (no less than 10%) for the beginning of basic activities devoted to the creation of a sustainable ecological frame of the regions. The functions of key natural territories at the special planning can be fulfilled by the natural parks as they are the largest areas having the protection regime and regional status. According to documents of entitlement in the Volgograd region seven natural parks with the total surface of 713307,44 hectares are chartered which are located within the boundaries of eleven municipal regions [Svodnaya informatsiya, 2017]. The parks have an internal zoning in general into four functional segments: natural protective, recreational, buffer and economic ones. The forbidden and admissible types of activity are set for all the territory of the parks. For every segment in addition to general restrictions the individual limitations and allowed types of activity are set. If we analyze the areas within the identified segments as a set of interrelated elements of natural environment with the center or nucleus or the form of clusters of specially protected natural area, so we can speak about the presence of one of the indices allowing to speak about the opportunity of the creation of an ecological frame at the level under analysis [Osobo okhranyaemye ..., 2019].

Another indicator of ecological frame is the opportunity of the creation of ecological corridors which implement an important communicative role in its support. In steppes and half desert areas these corridors can be presented by both natural complexes, special areas and also natural and anthropogenic elements (irrigating channel, shelterbelt forests). Besides it is important not to lose sight of the importance of territories of restoration ecology in the provision of ecological frame integrity. These are the lands which were subject to an intensive use in the past or which are being intensively used and which need the improvement of the condition or restoration. The historic and cultural conservation areas and constructions which harmonically match the landscape and socio-natural landscapes and have a considerably important scientific and cognitive meaning and they can be included into the ecological frame of the region. The provision of their protection can be implemented through the creation of museums (conservation areas) and reconstructions of the most important of historical and cultural conservation areas and constructions. Thus, the analysis of the empirical material allowed justifying minimally five basic structural and economic groups for the

development of the ecological frame of the region. These are: key natural areas or nuclei of ecological frame, ecological corridors, buffer areas, areas of ecological restoration, historical and cultural conservation areas and constructions [Kadastrovye dela, 2019; Prirodnye parki, 2019; Doklad «O sostoyanii»..., 2017, 2018].

The Volgograd region has a sufficient natural potential so that the region could become a real ground for the construction of an ecological frame. In order to do this it is necessary to ensure the integration of the ecological frame creation into the territorial planning at the municipal level of administration what will allow creating an optimal spatial model taking into account the key value of the already existing specially protected natural areas that can be seen as the nuclei of the constructed ecological frame [Prikaz Ministerstva prirodnikh., 2014]. Such an approach will allow “finish constructing” the environment creating systems till the self sustaining level on the basis of its main natural peculiarities of development of regional areas but the character of division into zones of the administrative region should be taken into account where the natural parks are located today. It is determined by the relationship of three main structural and functional parts of the ecological frame reflecting the natural and economic specificity of areas: natural and resource nuclei of specially protected natural areas; disseminated nuclei of the concentration of biodiversity and ecological corridors providing the relationship between them; areas of communicative and engineering, service and communal servicing; territories of traditional agricultural and anthropogenic development [Starokozheva, Mitrofanova, 2018].

Conclusion

Thus permanent ecological problems of the Volgograd region are solid household wastes, low quality of the drinking water and the accumulated in the soviet times damage from the industrial activity (sludge reservoirs and sediment bowls of chemical and metallurgical enterprises). The result of constant violations in the work of official household waste polygons is a severe pollution of groundwater aquifers and of the atmosphere. Several hundreds of illegal dumps, two large unofficial commercial polygons exist illegally. The works for the renovation are extremely inefficient. Even in epy specially protected areas of the Volga and Akhtuba flood plain in the natural park “Donskoy” almost all the residents have the places of the so called “temporary dumping” of the household waste. This waste is not removed by decades. There are no waste transfer stations and polygons of household waste. This fact has lead to a “waste collapse”.

Due to shortage of water the situation in the territory of the Volga and Akhtuba flood plain is close to a catastrophe. Even in peak times of the flood the northern end of the Volga and Akhtuba flood plain was practically empty and due to this fact the massive plague of fish took place in Volga close to Astrakhan. River meadows and shallow rivers dry out. The result of the nonfeasance of the authorities responsible for the regulation of water resources, executive authorities of the region could be the destruction of this natural park of the international importance.

At the same time it is worth mentioning that in 2015-2018 within the frames of the basic nature protective activity in the Volgograd region a special attention is being paid to the removal of the forbidden chemical pesticides, grubbing of shallow rivers, creation of nine protected territories. In the territory of Volgograd two large water courses that used to pollute the river Volga were eliminated. For a more efficient recycling of the solid household waste the concession contract concerning the construction of polygons with the participants of the waste recycling and waster sorting business was signed. These and other measures allow reducing the degree of the acuteness of ecological problems in the Volgograd region.

The development of the conception of the rational use of water resources of the lower Volga and the conservation of the system of the Volga and Akhtuba flood plain comes to an end. In the Volgograd region an integrated strategy of the encouragement of the practice of dealing with solid household wastes for 2014–2020 was developed. It is directed on the efficient management in the regional sphere of the household waste handling and the solution of its basic problems. A new modern polygon in the town Kamyshin (Volgograd region) started to work. The funding of such measures is carried out using the funds of investors. The elimination of the dump in the town Uriupinsk (Volgograd region) has already started. This project became the first that is planned for the implementation using the funds (329 million rubles or 5,5 million US dollars) of the federal budget. The interaction with the scientific community in the sphere of the development of efficient resource saving technologies has been organized. Volgograd has good prospects of the development as a sanitary and cultural center or a socially oriented mega polis. All these and other measures as the authors suppose will allow reducing the degree of the acuteness of the accumulated problems in the sphere of ecology and nature and resource use, to strengthen the “ecological carcass” of the region.

The Volgograd region has a sufficient number of natural and anthropogenic elements, the spatial location of which allows increasing the surface of specially protected natural areas, creating the ecological corridors, buffer areas, zones of the ecological restoration, historical and cultural conservation areas of the ecological frame without the damage to traditional industries of economic specialization of a region. At the expense of inclusion into the territory of all interacting elements of ecological frame, its surface becomes sufficient enough for the support of ecological balance and conservation of natural diversity under the condition that a high share of regional landscapes should be taken into account in the plans of territorial organization of environment forming facilities within the limits of administrative entities (planning of protected landscape elements). The existing spatial “separatedness” of the nuclei of the concentration of biological diversity and areas of economic development in the municipal districts of the regions also contributes to the conservation of the most valuable natural, historical and cultural conservation areas and elements by means of the determination of the prospects for their sustainable development.

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Тенденции и перспективы укрепления «экологического каркаса» региона

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Аннотация

Выбросы вредных веществ, большую часть которых производят металлургические заводы, предприятия топливной, нефтехимической и химической промышленности, растущий автомобильный парк, недостаточный уровень озеленения, нерациональное, неорганизованное размещение отходов и др., оказывают негативное влияние на экологию крупного российского города Волгограда и Волгоградской области в целом.

Основные загрязнители водоёмов: жилищно-коммунальное хозяйство, промышленные предприятия, сельскохозяйственные предприятия, активно сбрасывающие в водоемы сточные воды. Особые опасения вызывает качество поверхностных вод, не соответствующих нормативам. Изменение гидрологического режима стока реки Волги привело к истощению и обмелению водных объектов Волго-Ахтубинской поймы, сокращению периода ее затопляемости. В числе первоочередных задач: внедрение инновационных технологий охраны вод от загрязнений, засорений и истощений; использование эффективных методов предупреждения и ликвидации вредных воздействий; охрана прав предприятий, организаций, учреждений и граждан, укрепление законности в области водных отношений.

В статье отмечено, что существующие подходы к сохранению экологического равновесия в регионе не обеспечивают необходимого уровня защищенности экосистем, имеют низкую эффективность восстановительной функции; рассматриваются возможности формирования эффективной пространственной модели с учетом ключевого значения уже существующих особо охраняемых природных территорий.

Авторами дана оценка тому комплексу мер, которые сегодня реализуются в Волгоградской области для улучшения экологии на программно-целевой основе, выявлены основные реперные точки коррекции региональной экологической политики.

Для цитирования в научных исследованиях

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Ключевые слова

Экология региона, атмосфера, гидросфера, литосфера, токсичные отходы, загрязнение водоемов, эрозия почв, особо охраняемые природные территории, целевые программы, утилизация, инновации, эффективность.

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