Supplementary Notebook (RTEP - Brazilian academic journal, ISSN 2316-1493)

TERRITORIES IN URBANIZED INDUSTRIAL ZONES: ENVIRONMENTAL AND ECONOMIC ASSESSMENTS

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Abstract: At present, an increase in production and polluting emissions adversely affects the environment of any administrative-territorial formation. A comprehensive interdisciplinary analysis of environmental factors is necessary, since when studying environmental and economic factors, it is necessary to consider the state of the territory in all its complexity. Environmental and economic assessments of territories in urbanized industrial areas show that population congestion in growing urban agglomerations exceeds the permissible technogenic level of impact on natural systems, as well as depletion of local water, fuel and the ability of the environment to store and process the entire set of various wastes, exceeding thresholds of permissible exposure. This research topic seems extremely relevant and promising.

Keywords: Environmental Impact, Economic Impact, Environmental Factors, Water Supply, Water Resources, Zoning, Human Activities.

INTRODUCTION

The history of the interaction between society and nature shows that mankind most often developed its economy through the predatory use of natural resources. The spontaneous development of productive forces already in ancient societies inflicted irreparable damage to nature. Changing landscapes in large areas as a result of forest destruction to create agricultural land, uncontrolled cattle grazing, soil depletion due to extreme intensification of agriculture, salinization of irrigated lands led to the degradation of vast areas and the decline of entire civilizations of the ancient world. However, in ancient times, anthropogenic environmental impacts were still relatively insignificant, they could not lead to radical environmental changes in nature. And only the 20th century with the colossal development of productive forces became a critical point of reference, beyond which the fate of mankind began to depend on the nature of the interaction of nature and society. The economic system is a system of production, distribution and consumption of goods and services. Within the framework of these processes, the interaction of society and nature is constantly happening. Any production and consumption are associated with the use of natural resources and environmental impact. Any economic decision also affects the environment in the broadest sense of the term. As the functioning of economic systems becomes more complicated, production and consumption increase, the role of the natural (environmental) factor is constantly increasing. The study of its importance, role and place in the economy is the subject of environmental economics.

METHODOLOGY

The work proposes a methodological approach that uses various, primarily general scientific methods developed by natural, social and other branches of knowledge. At the same time, the range of its specific methods is expanding, allowing a deeper study of the synthesis of ecology and economy. It is fashionable to attribute the following to the main research methods:

1. The dialectical method involves the study of environmental and economic processes in unity, difference and historical development. The fundamental position of the dialectical method is the inclusion of practice in the theory of knowledge.
2. The historical method allows us to trace the dynamics of the relationship between nature and society. Studying the history of these interactions is necessary both for a better understanding of the current state of ecological and economic systems, and for scientifically based forecasts of the features of their development.
3. The systemic method, which consists in determining the components of ecological and economic systems and external objects interacting with them, establishing the structure of the system, i.e. totality of internal connections and relations.
4. Normative method. A special role belongs to such environmental standards as maximum permissible concentration (MPC), maximum permissible emissions (MPE), norms of green zones, etc. Their purpose is to establish objective boundaries of permissible anthropogenic loads on nature.

DISCUSSION

The topic is the subject of analysis by a fairly limited number of scientists. Bespamyatov G.T., Krotov Yu.A. investigated the maximum permissible concentration of chemicals in the environment, Budyko MI, Drozdov OA, Yudin MI talked about the impact of human activities on the climate. Dolgov S.V. investigated the hydrological consequences of changes in economic activity in the Kursk region, Yu.V. Medvedkov - human and urban environment. Studies of this publication are based on the works of the following scientists: A.A. Dubyansky, V.M. Smolyaninova, N.A. Kravchenko, Yu.V. Mukhina, L.A. Ostrovsky, L.A. Vasilevskaya and others.

RESULTS

The Kursk region is characterized by an unfavorable, from an environmental point of view, structure of agricultural land. The land fund of the region amounted to 3 million hectares. 2.3 ha of land are per capita, including 1.9 ha of agricultural land, of which 1.5 ha are arable land (Vasilevskaya & Rubekina, 2013). In the structure of cultivated areas of the territory under consideration, «soil-violating» crops dominate - grain and row crops (about 70% of crops). The proportion of «soil-improving» crops - legumes and perennial grasses - is about 10% of the crops. This structure of agricultural land enhances linear erosion, deflation, and planar flushing. A significant impact on the quality of the environment, including groundwater, is exerted by agricultural production and soil pollution (Vasilevskaya, 2012; Antipov & Korytny, 1981). Soil pollution by heavy metals is one of the most dangerous types of soil degradation, which creates serious environmental problems with the active agricultural use of land.

To a lesser extent, the soils of Glushkovsky, Korenevsky, Bolshesoldatsky, Fatezhsky, Oktyabrsky and Solntsevsky regions are contaminated with heavy metals (Zc = 4); with an average degree of pollution – Manturovsky and Kastorensky (Zc = 4-8); and with the highest total pollution – in the Gorshechensky and Sovetsky districts (Zc = 8-12). Pollutants are both local enterprises and industrial facilities of neighboring regions: Voronezh, Lipetsk and Belgorod, because contaminated soils stretch in a winding strip about 5 km wide in the central part, increasing to 20 km to the southeast and 35 km to the north of the region. Near the regional centers, small areas were identified with higher total soil pollution (Zc): Tim (Zc = 9.88), Oboyan (Zc = 9.79), Rylsk (Zc = 10.16), Sudzha (Zc = 8, 99), Konyshevka (Zs = 8.05). The main pollutants are cobalt, lead, zinc, chromium, and molybdenum. The depth of distribution of heavy metals can reach up to 1 m. A kind of technogenic anomalies are formed along the highways, where soil is heavily contaminated with lead, to a lesser extent, with cadmium and zinc. The most polluted lead strip is usually located near the road, 20 m from it. Some lead compounds disrupt the metabolism and act as inhibitors of enzymes, which can replace calcium in the bones of animals and humans. The intake of lead by the respiratory route is very harmful, because it is worse excreted from the body (Babkin & Vuglinsky, 1982; Glushkov, 1933; Vasilevskaya & Kosinova, 2014).

Urban waste, in particular fragments of bricks, causes an increase in the content of copper, lead, zinc in the soil. Mineral-rich sediments become sources of pollution of groundwater and vegetation. In the Kursk region, 11.3 thousand hectares of agricultural land contaminated with pesticides were identified, including 10.0 thousand hectares of arable land and 1.3 thousand hectares of perennial plantations, of which 0.9 thousand hectares of arable land belong to the moderately hazardous category and 0.2 thousand ha of perennial plantings. Pesticides are currently widely used as a means of controlling pests of cultivated plants and therefore can be found in soil in significant quantities. In their danger to animals and humans, they are very high. It is for this reason that DDT (dichloro-diphenyl-trichloromethylmethane) was banned for use, which is not only a highly toxic compound, but also has significant chemical resistance without decomposition for decades. Pesticides are detrimental to soil microflora: bacteria, fungi, algae (Vasilevskaya & Smolyaninov, 2010; Holberg, 1985; Vasilevskaya, 2009; Kosinova & Lomova, 2016).

Over the years, a hotbed of pollution has been formed in the Volkova Dubrava tract of Fatezhsky District, associated with the burial of unsuitable and prohibited for use pesticides. Obtaining high yields at present is impossible without the use of various pesticides for plant protection - pesticides. However, their use is now reduced due to the death of soil microorganisms, adaptation of many pests to them, infection of vegetable crops and the accumulation of toxic substances in surface waters, bottom sediments of water bodies, animal and human organisms. The low culture of livestock farming leads to the accumulation of large quantities of manure near livestock farms, which is a dangerous factor in soil and water pollution. A huge number of harmful microorganisms accumulate in them, among which there may be causative agents of dangerous diseases (Kosinova & Lomova, 2015; Vasilevskaya & Kosinova, 2015).

Some crops receive nitrites from the soil, others, such as peas, as well as beans, emit them. Without harming nature, you can increase crop yields, changing them considering the cycles of substances in nature. Raw sewage from agricultural production is one of the sources of water pollution. Wastewater carries dangerous chemical compounds, pathogens, herbicides, nutrients that make up fertilizers. Pesticides and fertilizers used in agriculture are washed off into rivers, lakes and become food for bacteria. At the same time, bacteria consume oxygen dissolved in water, as a result, aquatic animals begin to suffocate. In several places, untreated wastewater is washed off into rivers and causes diseases, and sometimes death, both animals and people (Lomova & Kosinova, 2015; Vasilevskaya & Kosinova, 2015; Vasilevskaya, 2014; Dolgov, 2002).

Fertilizers compensate for the removal of nitrogen, phosphorus and potassium from the soil, and may also be excessive, infect groundwater and surface water. Phosphate fertilizers are less hazardous. The phosphate ion is mobile, firmly fixed in the soil and practically non-toxic to humans and animals. A specific danger lies in the fact that their use in large doses leads to the accumulation in the soil of other undesirable elements: fluorine, natural radioactive compounds of uranium, radium, and thorium. Fluorine and its compounds are widely used in the nuclear, oil, chemical and other industries, and it enters the soil in the process of agricultural production. Contaminating the soil, fluorine causes a decrease in yield not only due to direct toxic effects, but also as a result of changes in the ratio of nutrients in the soil. The highest fluorine adsorption occurs in soils with a well-developed soil absorbing complex. Soluble fluoride compounds move along the soil profile with a downward flow of soil solutions and can fall into groundwater (Klindukhova, 2007).

The chemical compounds polluting the soil and natural waters also include carcinogens, which are found everywhere in the soil, but the intensity of their pollution varies significantly (Klindukhova, 2007; Voronkova et al., 2018; Smolyaninov, 1976; Kabanova et al., 1997). In areas of oil depots, soil pollution occurs with oil products. It leads to a deterioration of the ecological state of the soil cover and the loss by the soil of its natural buffering properties. There is a risk of penetration of oil products to the depth of the soil profile, pollution of surface and ground waters, the surface air layer. Maximum MPC excess is noted in the territories of Sudzhanskaya and Kastorenskaya oil depots; high pollution rates were observed at Korenevskaya, Medvenskaya, Dyakonovskaya, Timskaya and Cheremisinovskaya oil depots (Table 1).

Table 1 - Soil pollution by oil products at oil depots in the Kursk region

Tank farm	Area, m^2	Polluted area, m^2		Maximum permissible concentration MPC (g/kg)
		m^2	% of the total area	
Dyakonovskaya	574	430	74,9	25
Zheleznogorskaya	765	2000	26,1	2
Kastorenskaya	3360	3360	100	39
Korenevskaya	7200	1350	18,8	19
Marmyzhanskaya	12650	2650	20,9	6
Krupskaya	3900	900	23	8,5
Medvenskaya	4825	2825	58,5	33
Otreshkovskaya	2250	–	–	–
Pristenskaya	4525	675	14,9	22
Pselskaya	8125	–	–	–
Timskaya	8400	7175	85,4	14
Solntsevskaya	5100	–	–	–
Sudzhanskaya	7075	7075	100	108
Cheremisinovskaya	10600	4000	37,7	26

In 2001, an emergency fuel leak occurred in the Zheleznogorsk oil depot, as a result of which about 500 hectares of land were contaminated with oil products. On the territory of the fuel and oil storage facility of the Lgovsk sugar plant, soil pollution was detected at a depth of 1 m and amounted to 105 maximum permissible concentrations; at the filling stations of the ATX of the Kursk NPP - it exceeds surface pollution by more than 10 times and amounts to 39 maximum concentration limits; in the territory of the fuel and lubricants warehouse of Kurskmedsteklo OJSC – 97 maximum concentration limits, bitumen storage DRSU-1 of the city of Kursk – 44 maximum concentration limits. The highest levels of pollution were found on the territory of fuel oil storages (up to 400 MPC - Kommunar sugar factory), fuel and lubricant warehouses (up to 200 MPC – DRSU-4 in Rylsk), bitumen storages (up to 90 MPC – DRSU-1 in Kursk) [22 -24]. To the greatest extent, water resources in the Kursk region are affected by: industry, which discharges pollution into the local hydrographic network; transport; utilities that produce groundwater. These effects lead to a change in the state of water resources [25]. The greatest number of industrial and utility enterprises is concentrated in the cities. Kursk, Zheleznogorsk and Kurchatov. So, only in the city of Kurchatov 89% of the land is occupied by industrial enterprises. Industrial enterprises have a strong impact on the pollution of landscape components. The greatest pollution of the environment and groundwater was noted in the cities. Kursk, Zheleznogorsk, Kurchatov. In the city of Kursk – Kurskrezinotekhnika CJSC, Energosbyt OJSC, Khimvolokno CJSC, Kursk Leather Plant OJSC, Pribor OJSC, Kursk Knitwear Combine CJSC, Kurskvodokanal MUE, APZ-20 OJSC, TPP- 1, JSC «Accounts», CJSC «Kursk Machine Tool Plant», FSUE «Kursk Biofactory, JSC Household chemicals» and others [26]. In the city of Zheleznogorsk – OJSC Mikhailovsky GOK, CJSC Golubaya Niva, MUP Transport Lines, MUP Gorvodokanal, etc.

A feature of the city of Kurchatov is the presence of a nuclear power plant. Kursk NPP (one of the largest NPPs in Russia) is located about 30 kilometers west of Kursk. Of the total emissions, NPP emissions account for 38.4%. The main enterprises to produce building materials are: KSSK JSC Kurskatomenergostroy, a branch of JSC Energozhilstroy, State Unitary Enterprise Brick Plant of Kursk NPP. The road transport complex in the city is represented by the following enterprises: OGUP Kurchatovskoye PATP, ATP OJSC KAES [27].

In other cities, the following largest industrial enterprises that contribute to environmental change can be noted: in the city of Dmitriev – LLC Dmitrievskiy combine of bakery products, UMP Vodokanal, UMP Dmitriyevsky KETS, OGUP Dmitrievsky DEP; in Lgov – OJSC «Lgovsky Milk and Canning Plant», Lgovsky Forestry, Plant «Electroshield», OJSC «Kurskenergo», Establishment OX – 3O/3, OJSC «Avtokolonna 1779», FSUE «Kursktopprom» – Lgovsky Branch, Lgovsky Branch of OJSC Kurskgaz, Lgovskaya Zarya LLC, Lgovskaya distance, PMS – 308 directorate for repairing the Moscow Railway track – a branch of Russian Railways OJSC, Russian Railways branch Moscow railway Orel-Kursk branch Car depot, PMS – 105 repair directorate Railways of the Moscow Railway – a branch of Russian Railways Kursk MZ – branch of JSC «Russian Railways» Consumer society «Lgovskiy» MUP «Housing-operational site» MUP «Gorseti», JSC «Lgovskii winery», JSC «KHP Lgovskii» Lgovskii plant «Aviospetsoborudovanie» them. Kuropyatnikova D.P., OGUP «Lgovskoye» DEP, OJSC «Lgovsky bakery», OJSC Sugar factory Lgovsky, MUE «Gorvodokanal»; in Oboyan – Isaplit CJSC, Oboyansk Elevator OJSC, Oboyansk and Utility Electric and Heating Networks Municipal Unitary Enterprise, Oboyansk Municipal Electric Utility Vodokanal Housing and Public Utilities; in Rylsk – OJSC «Rylsky Bakery», OJSC «Globus», OJSC «Rylsky Automobile Plant», UMP «Rylsky KETS»; in Sudzha – Municipal Unitary Enterprise «KETS», OGUP Sudzhanskoye DRSU-2, OAO «Sudzhansky Butter Plant», OJSC «Sudzhansky Bakery», a branch of LLC Mostransgaz, CJSC «Sudzhansky Meat Processing Plant»; in Fatezh – Kurskpromstroy OJSC «Fatezhskaya MSO», Fatezhsky DRSU – 6, Fatezhsky branch of OJSC «Kurskgaz»; in Shchigry – Kursk distance of the route of the Oryol-Kursk branch. Moscow Railways Russian Railways OJSC, Som OJSC, Shchigrovsky KHI OJSC, Shchigrovsky Brick Plant LLC, Shchigrovsky DEP, Geomash OJSC, Municipal Shchigrovsky KETS, Shchigrovsky Repair and Construction Management PC.

In Fatezh, a problematic ecological area has been formed, which is associated with the burial of unsuitable and prohibited for use pesticides [28]. Thus, according to the industrial potential, cities are distributed in descending order as follows: Kursk, Zheleznogorsk, Kurchatov, Shchigry, Sudzha, Lgov, Rylsk, Oboyan, Dmitriev, Fatezh. Road transport is one of the main sources of environmental pollution while reducing industrial production. The largest amount (more than 200) of air polluting substances is given by gasoline carburetor engines: carbon monoxide, nitric oxide, unburned hydrocarbons. Diesel engines pollute the atmosphere with soot, sulfur compounds, benzopyrene [29-30]. Moving vehicles have a huge impact on environmental pollution, including water resources. Every year there is an increase in the number of vehicles, which does not comply with its environmental standards, which leads to increased pollution of the atmosphere, soil and water. The most intense traffic was noted in the cities of Kursk, Zheleznogorsk, Oboyan. Further, the places were distributed as follows: Kurchatov, Shchigry, Fatezh, Sudzha, Rylsk, Lgov, Dmitriev. In Dmitriev, the traffic intensity is almost 5 times less and amounts to about 5% of the total indicator (Table 2). Despite a slight decrease in the number of vehicles in the winter, compared with the summer, the traffic intensity remains in the same order. We calculated the number of moving vehicles on the main streets of the cities of the Kursk region and obtained the following results. The largest contribution to pollution is made by passenger cars than by trucks. The most intensive movement of passenger cars in the cities. Kursk, Zheleznogorsk and Oboyan, then in the cities. Kurchatov, Shchigry, Fatezh, Sudzhe, Rylsk, Lgov and Dmitriev. Whereas freight transport prevails in Oboyan, Kurchatov and Lgov [31].

Table 2 – The intensity of traffic in the cities of the Kursk region

	City	Passenger car, quantity/hour	Freight vehicles, quantity/hour	Total number of vehicles quantity/hour
1.	Kursk	700	150	850
2.	Sudzha	288	96	384
3.	Oboyan	510	97	607
4.	Rylsk	252	96	348
5.	Lgov	216	108	324
6.	Kurchatov	516	132	648
7.	Shchigry	360	60	420
8.	Fatezh	327	98	425
9.	Zheleznogorsk	520	95	615
10.	Dmitriev	144	24	168

Moving vehicles have a huge impact on dusty air. The degree of dustiness of the air depends on the season, type of soil, type of road surface, traffic intensity, wind direction. Asphalt dust and rubber dust contain harmful substances that enter the soil and atmosphere. In addition, moving vehicles pollute air of various kinds with emissions (Table 3). The table shows that the largest contribution to pollution in the atmosphere in the content of carbon monoxide, nitric oxide and hydrocarbon makes moving vehicles in the cities. Oboyan, Kursk, Zheleznogorsk. Here, along with local vehicles, a large proportion is allocated to transit, since the city of Oboyan is located on the Moscow – Simferopol highway, and the city of Zheleznogorsk on the Moscow – Kiev highway [32]. Least of all the load is Mr. Dmitriev. All these impurities ultimately settle on the soil, then, together with sediments, they enter groundwater or surface water that feed plants and animals, as well as humans.

Table 3 – Emissions of pollutants into the atmosphere from vehicles

City	Carbon monoxide, thousand tons / year	Nitric oxide, thousand tons / year	Hydrocarbon, thousand tons / year
Kursk	3,20	0,98	0,97
Kurchatov	2,16	0,30	0,42
Sudzha	1,12	0,14	0,19
Rylsk	1,29	0,18	0,25
Lgov	1,20	0,17	0,24
Oboyan	2,92	0,87	0,82
Shchigry	1,59	0,38	0,42
Fatezh	2,45	0,41	0,49
Zheleznogorsk	2,54	0,64	0,76
Dmitriev	0,75	0,10	0,15

The technogenic impact also affects the quality of groundwater and its quantity. Water supply of the population is mainly based on groundwater. The largest population lives in the Kursk, Zheleznogorsk and Kurchatov districts, where the maximum selection of groundwater is performed [33]. Pollution of the upper horizon occurs when municipal and industrial effluents enter it, as well as water seepage in the areas of landfills [34–35]. The intensity of anthropogenic impact on groundwater in the Kursk region is distinguished.

1. **High technogenic impact area**, the area of high technogenic impact, which includes the following areas of the region: Kursk, Zheleznogorsk and Kurchatov (with an area of 1.61 thousand km^2). In these areas: Centralized groundwater abstraction is

applied; There are located energy and industrial enterprises; Civil-industrial construction is being carried out; The mining and processing plant and the Mikhailovsky iron ore quarry are operating; There are railways and highways of federal significance, oil depots and gas stations; The area is a zone of radiation pollution of the Chernobyl nuclear power plant, a zone of influence of the Kursk nuclear power plant.

Here, the main sources of air pollution, surface water, soil and groundwater are mining, thermal power plants, nuclear power plants, factories to produce building materials, road and rail transport [36; 38-46]

2. **The area of medium technogenic impact** (an area of 8.4 thousand km^2). The following are noted: In the cities of Rylsk, Lgov, Shchigry, Dmitriev - a centralized selection of groundwater; There is a development of urban and rural type; There are developed communal services; There are work quarries for the extraction of non-metallic raw materials, enterprises of the construction and food industries; There is developed agricultural production; There is a railway and roads; There is a zone of radiation pollution of the Chernobyl nuclear power plant, which included 273 settlements with a population of 140 thousand people.

3. **Area of low industrial impact** (area 19.79 thousand. km^2). It mainly includes the eastern and southern administrative regions, as well as the western outskirts of the region [44-59]. The following are noted: Dispersed groundwater abstraction; Development mainly of rural type; Small agricultural enterprises for the processing of agricultural products; Oil depots; Railway and motorway.

CONCLUSION

Ecological and economic environmental impact factors are becoming global. The anthropogenic factor becomes leading, and without taking it into account, it is impossible to understand and evaluate what else will happen to our common home. The level of human influence on the environment also determines how the changed nature affects the further development of our society. The more we act on nature, the more actively it responds to us. And in most cases, the answer is far from favorable: the environmental situation is deteriorating, natural disasters are increasingly occurring. The fate of the further development of mankind depends on how quickly ways to resolve the contradictions between the limited capabilities of our biosphere and the aggressive type of development of society in relation to it will be found. Anthropogenic environmental impacts are determined by the impact of agricultural production: the use of fertilizers, agrotechnical measures, etc., and industrial production: industry, which dumps pollution into the local hydrographic network; transport; municipal services producing groundwater. All this leads to a change in the state of water resources. In the area of several industrial enterprises, groundwater is polluted with oil products, heavy metals and other pollutants. Soils of the Gorshechensky and Sovetsky regions, pesticides – of Fatezhsky, oil products – of Medvensky, Korenevsky, Timsky and Cheremisinovsky are heavily polluted with heavy metals. As a result of anthropogenic impact on the natural environment, including water resources, there was a development of negative processes that affected the quality and quantity of groundwater. As a result of dewatering pumping and underground water intakes in the Kursk region, a violation of the natural hydrodynamic regime of groundwater occurred. Around the cities of Kursk and Zheleznogorsk depressed funnels formed.

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