

Impact of Environmental Factors on Health and Population Dynamics

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Abstract – The article presents the problems of environmental management and the quality of the environment to achieve the goals of sustainable development of the region. This study develops the idea of the need to conduct an environmental policy on the territory of the Russian Federation and RNO-Alania to improve the environmental situation and reduce the adverse impact on demography and public health. In the study, the authors proceeded from the assumption that the analysis of the state of the republic's environment makes it possible to identify some environmental problems typical for many regions of Russia: waste disposal, air pollution, water pollution, increased anthropogenic impact, high morbidity and natural population decline. The authors substantiate the idea that today it is impossible to separate the high quality of life and the health of the population. These positions are ensured only if the natural systems are preserved and the environment is in an appropriate quality. The main provisions of the article and the presented results can be used for further theoretical substantiation, research in the field of ecology, demography and public health. The results make possible to develop practical recommendations on the problems of forming and consistently implementing a unified policy, within the framework of which the most important measures are being taken to improve the ecological situation.

Key world – population, environmental factors, sustainable development, demography

I. INTRODUCTION

The study of the state of the ecosystems of the natural environment of orohydrographic conditions and other components of natural territorial complexes (NTC) is becoming increasingly relevant in the modern socio-economic

context. Analysis of human activities allows to adequately assess the negative impact of industrial and agricultural production on demographic and other processes on the formation of human capital. We have already written that the formation and manifestation of human potential can be facilitated by direct and indirect factors that are external to the individual environment, which can contribute to the manifestation and activation of certain characteristics of the individual [1]. It fully refers to the improvement of the ecological situation.

The economic use of the territory, the level of development of production in many respects predetermines the environmental characteristics of the mining industrial region. The questions of normalization of the state of ecology of mountain regions are devoted to the research of A. Skochinsky, V. Rzhovsky, K. Ushakova, I.D. Alborova, E.S. Kamenetsky and etc.

Many authors, for example, Ustyugova E.N., analyzing the prospects for the development of territories, and in particular, cities, indicate that today the tasks of human ecology come to the first place, for which the ecology of nature and the ecology of culture are beginning to work. Ecology of nature require a theoretically and practically thought out concept of development [2].

Protecting the environment from the effects of industrial growth is a field of action by both the public and governments, mentioned S.Yuriev [3]. On the dependence of children's health and the ecology of an industrial city mentioned Chernaya N. L., Shubina E.V., Fedotova G. Barinov A.A. and others. In the draft of Federal target program "Healthy Child" they indicate an increasing deterioration in the health of the

child population, and a decline in the quality of the human population [4, 5].

In the review of Glazachev O.S. “The annual session of the Russian section of the International Academy of Sciences (health and ecology)” the author mentions about deep scientific knowledge needed of the functioning of the biosphere as a reservoir of life, understanding of the limits within which co-evolutionary development of the “society-nature” system is possible. The theory of biotic regulation has fundamental basis, the embodiment of which allow optimizing human and nature activities [6]. V.N. Mangasaryan justifying the dialogical nature of the interaction of nature and society in the process of co-evolution, says that today, it is obvious that man, being a specific part of the earth's biota, cannot develop outside of certain socio-natural relations [7]. Kagirova G.V. in the article “Ecology and Health” recognizes that environmental problems are relevant for many regions of Russia and the world as a whole [8]. The influence of ecology on human and animal health and their reproduction is considered by Bakhtinov A.P. [9]. Along with anthropogenic, technological impact, yield problems, it is obvious the adverse effects of climatic and temperature factors, fluctuations in atmospheric pressure, the gas composition of the air.

II. PROBLEM STATEMENT

The state of the environment is becoming increasingly important in the physical development, health, reproductive function of man. According to Korsakov A.V. In the monograph “The Ecology of the Population of the Bryansk Region for a Twenty-Year Period (1990–2009)” and the 15th Congress of Pediatricians of the Russian Federation, 40 % of children in Russia are born sick or become ill during the neonatal period. Every year, 30% of boys aged 17 are exempted from military service for health reasons. An in-depth survey of students conducted by the Research Institute of Hygiene and Child Health suggests that the first group of health among them is 2–4 % [10].

According to the Information of the Ministry of Health of the Republic of North Ossetia-Alania, the infant mortality rate for 5 months of 2016 was 6.8 per 1,000 births (in 2015 - 10.4; in 2016, the North Caucasian Federal District indicator – 9.1; RF – 6, 1 per 1000 births). The target value of the infant mortality rate approved by the “road map” for 2016 is 9.6 per 1,000 births. With regard to mortality from diseases of the circulatory system, in January-May 2016, 1956 people died from circulatory system diseases (262 people less than in the same period of 2015). The indicator for 5 months of 2016 decreased from 759.8 in 2015 to 668.8 per 100 thousand of population (in the North Caucasus Federal District – 426.9; of the Russian Federation – 639.3 per 100 thousand of population). The target for the “road map” for 2016 is 677.5 per 100 thousand population. Acute coronary syndrome is one of the main causes of high mortality, both in the Russian Federation and in the Republic of North Ossetia-Alania. The mortality rate from malignant neoplasms in January-May 2016 increased in absolute terms compared to the same period in

2015 by 27 people. The indicator for 5 months of 2016 increased from 159.6 in the same period of 2015 to 168.6 per 100 thousand of population (the North Caucasus Federal District indicator –118.5; of the Russian Federation –200.8 per 100 thousand of population). The target mortality rate from malignant neoplasms according to the roadmap for 2016 is 168.0. The number of deaths from tuberculosis in January-May 2016 increased to 24 people, which is 5 more people than in 2015. The indicator for 5 months of 2016 was 8.5 against 6.5 in 2015 with the target indicator approved by the “road map” for 2016 –10.27 per 100 thousand population (North Caucasus Federal District – 4.6; Russia – 8.2 per 100 thousand population).

III. MATERIALS AND METHODS

Analysis of the state of the environment of the Republic of North Ossetia-Alania makes it possible to isolate some environmental problems that are typical for many regions: unresolved issues of recycling production and consumption waste, air pollution, especially in large settlements, water pollution with untreated and insufficiently treated wastewater, growth anthropogenic impact on biodiversity, high morbidity and natural population decline.

Monitoring the state of the environment in Vladikavkaz shows that the average annual concentrations of pollution in the atmosphere were below the maximum permissible, with the exception of nitrogen oxides, which is associated with vehicle emissions (Table 1).

According to the data of the North Ossetian Republican Center for Hydrometeorology and Environmental Monitoring in the city of Vladikavkaz, annual average concentrations of maximum permissible concentration (MPC) were recorded for sulfuric anhydride 2 times, carbon dioxide 70 times, nitrogen oxides 2 times, hydrogen chloride 1 time. The average annual concentration of benzo (a) pyrene was 1.4 MPC. The main industrial sources of pollution in Vladikavkaz are: OAO “Elektrotsink”, OAO “Pobedit”, OAO “Iristonsteklo”, Vladikavkaz heating network enterprise and some other enterprises.

TABLE I. EMISSIONS FROM STATIONARY SOURCES IN 2014, (THOUSAND TONS)

	Emitted into the atmosphere, total	From the stationary sources	Received on wastewater treatment plant	Rendered harmless
Total :	3.484	149.987	146.693	146.503
solid	0.337	85.729	85.469	85.392
gaseous and liquid:	3.147	64.258	61.224	61.111
sulfur dioxide	0.332	61.42	61.19	61.088
carbon monoxide	1.493	1.493	-	-
nitrogen oxides	0.269	0.269	-	-
hydrocarbons (without VOC)	0.854	0.854	-	-
volatile organic compounds (VOC)	0.098	98.045	0.556	0.365
other gaseous and liquid	0.102	0.125	0.034	0,023

The average annual concentrations of heavy metals: iron, copper, lead in the city were -1.7 MPC, 1.2 MPC, 2.3 MPC, respectively, and in chromium, manganese, nickel and zinc, were below the MPC level. Analysis of emissions shows a trend towards increased levels of carbon monoxide, nitrogen dioxide and dust. For all other harmful substances, there is a stable tendency towards a decrease in the level of pollution. Atmospheric pollution index by five major impurities is 4.2. The state of atmospheric air in rural areas is consistently satisfactory. Of particular concern is the state of the air basin, where a lot of emissions accumulate, primarily road transport. In the regions, annual emissions of pollutants into the atmosphere average about 7 % of the total emissions of stationary sources. This is due to the lack of large industrial enterprises in the rural areas of the republic, fewer vehicles and other pollution objects. However, the ecological situation in the capital and the republic can hardly be called prosperous. All these data are reflected in the 2015 State Report "On the state of sanitary and epidemiological well-being of the population in the Republic of North Ossetia Alania".

All of the above factors adversely affect the health and dynamics of the population (tab. 2). The population of the republic as of January 1, 2014 was 703977 people, of which 450386 people (64 %) live in urban areas, and 253591 people (36 %) in rural areas. The data as of October 14, 2015, the total population of the republic is 705270, of which the urban population is 451921 (64.1 %) and the rural population is 252304 people. (35.9 %). On the same date in 2016 – 703745, of which the urban population is 451441 people. (64.1), the rural population is 25, 2304 people. (35.9). This data indicate that the structural composition of the relatively urban and rural population remains virtually unchanged.

TABLE II. GENERAL RESULTS OF NATURAL MOVEMENT AND POPULATION DYNAMICS, (PEOPLE)^A

Year	Born	Dead	Natural increase (decrease)	Dead in under one year old	Population per (thousand)
2011	10398	7765	2633	98	712.5
2012	10801	7525	3276	125	709.0
2013	10760	7394	3366	109	706.1
2014	10798	7554	3244	116	704.0
2015	10261	7511	2750	92	705.3

^a. <http://osetstat.gks.ru/>

Speaking about the impact of the ecosystem on the demographic situation, the state of children's health should be especially noted. In this regard, the qualitative structure of newborns is of interest as a synthetic indicator accumulating the entire system of factors influencing the level of public health (Table 3). For example, in 1995 the number of children born unhealthy or sick was 1368; in 2005–2905; in 2009 – 338513. As a percentage of the number of live births, it was: in 1995 – 15.5 %; in 2005 – 40.2 %; in 2009 – 30.1% [11].

The level of birth rate (2011 – 14.6 and 2015 – 14.6), and mortality remains at the same level with small fluctuations (2011– 10.9 and 2015 – 10.9). The natural increase in the population in 2015 was + 3.9 (2014 +4.6. The natural increase in the rural population is 66.4 % higher than the urban population. The total fertility rate of the rural population is 0.8 % higher than the urban population, and the overall mortality rate down by 8%. The highest fertility rates in the republic are observed in the rural areas of the republic: in Digorsky (+20.9); in Alagirsky (+17.5) and in Right-bank (+17.2) districts [12].

TABLE III. GENERAL NATURAL OF MOVEMENT COEFFICIENTS , (PER 1000 PEOPLE)^A

	2011	2012	2013	2014	2015
Total fertility rate	14.6	15.3	15.3	15.3	14.6
General mortality rate	10.9	10.6	10.5	10.7	10.9
Of these, under the age of 1 year (per 1000 b.)	9.4	11.6	10.1	10.7	8.9
Natural increase of RNO-A, (decrease)	+3.7	+4.7	+4.8	+4.6	+5.1
Natural increase of the North Caucasus Federal District, (decrease)	+9.0	+9.1	+9.2	+9.3	+9.5
Natural increase of the Russian Federation, (decrease)	-0.9	0.0	+0.2	+0.3	+0.8

^b <http://osetstat.gks.ru/>

A convincing illustration of the effect of the ecological situation on public health is data relating to such diseases as atrophic rhinitis, which is a form of chronic rhinitis along with catarrhal, hypertrophic and vasomotor rhinitis. Atrophic rhinitis is a persistent disease that exists in two forms, primary and secondary. Under the first means atrophy of the mucous membrane, developing as an independent disease, under the secondary form – atrophic changes in the nasal cavity resulting from injury (after surgical interventions), infections and radiation injuries, granulomatous diseases of the body and other damaging agents and factors. [13].

Normal physiological changes during aging of the mucous membrane include the loss of support ability of the nasal structures and hyposmia. Atrophic rhinitis can be of age-related pathology, and some authors call it geriatric rhinitis, taking into account the features associated with the age-related involution of the structures of the nasal cavity [14]. Also one of the leading causes of chronic atrophic rhinitis is the long-term impact of adverse environmental factors in environmentally unfavorable territories and work in harmful production. Prolonged constant irritation of harmful agents and an unfavorable microclimate further lead to such deep damage to the nasal mucosa, up to perforation of the nasal septum. After 2-3 years of work in harmful production, workers begin to observe the appearance of the first typical symptoms of atrophic rhinitis. Atrophic changes of the nasal mucosa are rarely isolated and are usually with atrophic pharyngitis and laryngitis [15–17].

Under the supervision and treatment on the basis of the Republican Oncologic Dispensary in the period from 2014–2018, there were 130 patients with chronic atrophic rhinitis, 50 of them (39 %) were men, 80 (61 %) were women, the average age was 50 ± 3 years, the disease duration was from 7 to 10 years or more (Table 4).

TABLE IV. THE DISTRIBUTION OF PATIENTS WITH ATROPHIC RHINITIS BY AGE (ABSOLUTE NUMBER, %)

Year	30-40 years	40-50 years	50-60 years	60-70 years	70 years and more
2014	3 - 2.3	11 - 8.4	8 - 6.1	5 - 3.8	2 - 1.5
2015	2 - 1.5	9 - 6.9	9 - 6.9	5 - 3.8	3 - 2.3
2016	4 - 3.0	11 - 8.4	7 - 5.3	4 - 3.0	4 - 3.0
2017	2 - 1.5	8 - 6.1	5 - 3.8	3 - 2.3	3 - 2.3
2018	3 - 2.3	9 - 6.9	6 - 4.6	2 - 1.5	2 - 1.5

The etiological factors that led to the disease were as follows: occupational harmfulness 23 %, adverse environmental factors 11 %, and other factors 66 %. Subatrophy and atrophy of the nasal mucosa combined with atrophic laryngitis and pharyngitis are observed mainly in persons of mature and elderly age.

IV. CONCLUSION

In conclusion, the study note that the environmental situation in North Ossetia is determined by the strong pollution of land and water bodies, as a result of mining and processing of mineral resources, the activities of alcohol-producing enterprises, a car park and enterprises of the metallurgical industry. No less urgent problems are the waste of the mining industry, namely the tailings of the Fiagdonsky mine, the Mizur concentrator and enterprise "Elektrotsink", harmful emissions into the atmosphere discharges of liquid industrial and household waste into the rivers. Problems create spontaneous dumps in the vicinity of settlements, on roadsides, river banks, places of mass recreation for people.

To solve the above problems, the State program "Environmental protection, environmental safety and well-being of the Republic of North Ossetia-Alania for 2014–2020" has been developed and adopted. The total amount of funds provided for the implementation of the State Program is 16099.3851 million rubles. Expected outcomes of the program: reduction of pollutant emissions – 1 %; reduction of polluting wastewater discharges – 6–7 %; population, environmental conditions, whose residence will be improved as a result of the implementation of measures for the restoration and ecological rehabilitation of water bodies – 44070 people.

Environmental protection and environmental measures are currently considered from the standpoint of the process of reproduction of a set of national goods that meet universal needs [18]. High quality of life and health of the population as well as sustainable economic development can be achieved

only if natural systems are preserved and environmental quality is maintained. For this, it is necessary to formulate and consistently implement a unified policy in the field of ecology aimed at protecting the environment and rational use of natural resources. It is necessary to increase the level of public environmental awareness and educate the younger generation of respect for nature, a broader involvement of the population in solving environmental problems.

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