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**FACTORS OF QUALITY OF LIFE OF THE POPULATION:  
RESEARCH AND DISCUSSION**

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*Abstract*

In this article, the authors consider the factors of the quality of life of the population in the concept of sustainable development of the basin of a large river in the Russian Federation (the territory includes 6 republics, 1 kray and 17 regions). Within the framework of the concept of sustainable development, the assessment of the state of the socio-ecological-economic system is made through a set of relevant indices and indicators. The authors analyze the state of the socio-ecological-economic systems of the territory of the Volga basin with the help of the REGION expert information system developed at the Institute of Ecology of the Volga River Basin of Russian Academy of Sciences (EVRB RAS). The research assesses the quality of life of the population by the administrative units of the Volga basin from the standpoint of "ecological and moral potential" of the territory based on the available information on the ecological footprint and biological capacity on the subjects of the Russian Federation and the integral criterion on eight indices and indicators of sustainable development. These indices and indicators directly or indirectly reflect the state of the environment, quality of life, including the level of socio-economic development. As an integral assessment, we are developing methods of convolution, for example, taking into account weights, conversion into monetary terms, and others. As a result, we obtain an assessment of the state of the territories followed by ranking according to which a strategy for further development is developed.

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## 1. Introduction

The eco-economic paradigm which has a history of more than 100 years and has diverse methodological pluralism relies on studying the relationship between ecology and economics by analyzing the flow and reserves of energy and matter including their economic implications for social security and cultural development processes (Marco, 2018). The formulated concept of sustainable development (Our Common Future, 1987) actualizes the definition of criteria for assessing the state and forecasts the further development of a complex socio-ecological-economic system.

In the Russian Federation the ideology of sustainable development is consonant with the meaning and content of the concept of rational environmental management, formulated in our country during the time of the USSR; it is now perceived as a fundamental basis of public administration embodied in a historically very short time in the normative documents of national significance (Kasimov, Mazurov, & Tikunov, 2004). A comparative multi-criteria evaluation of 15 countries - the former Soviet republics over a 25-year period based on environmental, economic and social indicators (ecological footprint, environmental performance index, quality of life indicator, etc.) shows different development paths, whose differentiation is especially obvious when comparing the results obtained with nine European countries - Finland, Sweden, Norway, France, Germany, Italy, Spain, Great Britain, Russia and four Asian countries - China, India, Iraq, Iran (Kaklauskas et al., 2018).

Sustainable development is challenging as it depends on many different factors (Bobylev & Solovyeva, 2017). The development of indicator systems for assessing the state of social-ecological-economic systems at the international, state and regional levels continues. A social-ecological-economic system consists of 'a bio-geo-physical' unit and its associated social actors and institutions. Social-ecological systems are complex and adaptive and delimited by spatial or functional boundaries surrounding particular ecosystems and their problem context. Based on such systems and models, a comprehensive assessment of sustainable development, determination of critical and crisis "zones", analysis of the spatial distribution of socio-ecological and economic assessments, consideration of scientifically based scenarios for further development are carried out (Lazareva, Lifirenko, Popchenko, & Rozenberg, 2015). The analysis of the quality of life of the population is of fundamental importance.

From the point of view of sustainable development the main factors used to assess the quality of life of the population include: stable economic development at the state and regional levels; preservation of the quality of the environment (water, air, soil) and the biodiversity of natural ecosystems; social well-being, including a balanced, high-quality nutrition, employment opportunities and a decent income, comfortable housing, health and education, development and accumulation of cultural values, etc. Satisfaction with quality of life is assessed, for example, through population surveys (Yuana, Shinbc, & Managib, 2018).

## 2. Problem Statement

Within the framework of the concept of sustainable development, the assessment of the socio-ecological-economic system is made through a set of relevant indices and indicators. These indices and indicators directly or indirectly reflect the state of the environment, quality of life, including the level of socio-economic development. The currently proposed sets of indices and indicators take into account all

three components. As an integral assessment, convolution methods are being developed, for example, taking into account weights, translation into a cash equivalent, and others. As a result, we obtain an assessment of the state of the territories, followed by ranking, according to which a strategy for further development is developed.

### **3. Research Questions**

The territory of the Volga basin occupies a strategic place in the socio-ecological-economic potential of the development of the Russian Federation and is important for further progress in the framework of the country's sustainable development.

Analysis of the state of socio-ecological-economic systems of the territory of the Volga basin and modelling predictions of sustainable development using the REGION expert information system developed at the Institute of Ecology of the Volga River Basin of the Russian Academy of Sciences. This system includes unique information processing algorithms, including the construction of integral indices by several methods, correlation and regression analysis, etc.

### **4. Purpose of the Study**

The purpose of the research is to obtain an assessment of the development of the administrative units of the Volga river basin, which includes 6 republics, 1 territory and 17 regions, through a set of indicators of the quality of life of the population.

### **5. Research Methods**

Construction of integral indices and indicators using a number of statistical methods, correlation and regression analysis, etc.

### **6. Findings**

Dessein, Soini, & Fairclough (2015) classified culture and its relationship to sustainable development into three thematic clusters. Culture can do the following: have a supportive and self-promoting role; frame, contextualize, mediate, and balance the other three pillars (social, economic and environmental dimensions); integrate, coordinate and guide all aspects of sustainable action.

One of the leading aspects of achieving sustainable development of a large territory is the ecological-moral-ethical “renewal” of the human population, which is closely related with the potential of the intellectual development of the individual. Therefore, we have analyzed the spatial distribution of educational, health, culture (museums, theaters) and sports institutions in the Volga basin. That is, a generalized picture of the “ecological-moral potential” of the territory in the space of factors is given, which with varying degrees of conditionality can be attributed to the characteristics of the “ecology of culture”.

We considered two options: the distribution of institutions classified per 1000 population (generalized index of “culture”) and the distribution of institutions classified per 1000 km<sup>2</sup> (generalized density index of “culture”). When constructing integral indices, the selected indices were normalized by

the linear scaling method with respect to the specified minimum and maximum values of the scale and then summed.

The result obtained on the “cultural” index reflects insufficient development in Samara, Astrakhan regions and in the Republic of Mari El. An acceptable situation is typical for Kostroma, Tver, Yaroslavl regions and the Republic of Mordovia. The generalized density index of “culture” demonstrates the leading position of Moscow Region. The position of “outsiders” is occupied by Kirov, Astrakhan, Volgograd, Saratov regions and the Republic of Bashkortostan, which makes it possible to establish priorities in managing the achievement of sustainable development in the Volga basin.

It should also be noted that the values of the parameters of this index are closely related linearly. Such high linear correlation coefficients between the analyzed parameters (increasingly 0.62) allow us to use either one of them (for example, the number of cultural institutions per thousand km<sup>2</sup>), or use the resulting generalized “density of culture” index in the analysis.

The REGION system allowed us to determine the dependence of generalized indicators (indices of “culture” and “culture density”) on some factors that characterize the sustainable development of the territories of the Volga basin. The most significant for the “culture” index were purely ecological parameters (bio-productivity of ecosystems and forest cover of the territory - almost 19%) and anthropogenic pollution factor (the proportion of citizens living in conditions of high and very high air pollution - slightly more than 38%; inverse relationship). For the “density of culture” index, the main factors were the availability of cultural facilities, sports, etc. (the direct contribution of this factor to the overall impact is more than 78%) and investments in environmental protection facilities (more than 4%, also direct dependence).

Since the sustainable development of any region focuses on economic development balanced with the capabilities of the environment, the authors assessed the stability of the administrative units of the Volga basin based on the available information on the ecological footprint (EF) and biocapacity on the subjects of the Russian Federation (Shvarts et al., 2014; Bobylev & Solovyeva, 2017; Kostina, 2014).

Ecological footprint and biocapacity are considered the two main characteristics of any territory. The simplicity of comparing these values makes it possible to clearly formulate the distinction between sustainable and unsustainable development of a territory at a state, regional or local level.

The first academic publication about the ecological footprint was by William Rees in 1992. According to his definition, ecological footprint measures the consumption that requires estimation of natural capital requirements based on the interpretation of carrying capacity. It is a standardized measure of demand for natural capital that may be contrasted with the planet's ecological capacity to regenerate. It takes into account the impacts of technological development and trade. A key assumption of EF is that technology and trades do not expand the earth carrying capacity in the long run but only displace geographically the effects of increased consumption levels (Rees, 1992).

The EF indicator measures the area of arable land, pastures, forests and fishing areas that provide people with biological resources and absorb waste. The assessment of this indicator over the territory of the Volga basin was given earlier, where its relationship with other indices of sustainable development of the regional economy is shown (Kostina, Rozenberg, Rozenberg, & Khasaev, 2014). Biocapacity (BC) is the ability of ecosystems to produce valuable biological resources and absorb waste. BC measures the

area of available biologically productive areas capable of producing these ecological resources and services. The EF and BC values are expressed in global hectares (gga) per capita, which makes it possible to compare the results obtained. If the EF is greater than the available BC, then there is a situation that is interpreted as an “environmental deficit,” that is, human consumption exceeds ecological limits. When EF is less than the available BC, there is an “environmental surplus” or “environmental reserve”. The state of stability can be divided into three classes using the “traffic light” method (DEFRA, 2010; Liu et. al., 2016). This approach is used in analyzing the development of the situation in the long term.

The authors assessed the territories of the Volga basin using this approach. The first class, when there is an “ecological reserve”, includes Kirov, Kostroma and Tver regions, which makes up only 18.3% of the considered area of the Volga basin, as can be seen from the figure. The majority (62%) of the territory is characterized by “ecological deficiency”. The remaining subjects of the Russian Federation occupy an intermediate position in the Volga basin (19.7%), when EF slightly exceeds BC (the excess is less than 50%).

Within the framework of the concept of sustainable development, the assessment of the social-ecological-economic system of any territory is carried out through a set of relevant indices and indicators. These indices and indicators directly or indirectly reflect the state of the environment, quality of life, including the level of socio-economic development. As an integral assessment, convolution methods are being developed, for example, taking into account weights, conversion into monetary terms, and others. As a result, we obtain an assessment of the state of the territories followed by ranking, according to which a strategy for further development is developed. It should be noted that when choosing a large number of indicators, the expected effect of the “average temperature in the hospital” arises and that's a bit of a statistical Frankenstein. In addition, linking indicators to a class that worsens or improves is not always unequivocal and requires a compromise solution. Moreover, this approach does not take into account the relationship of individual components.

We have proposed a method for integral assessment of indices and indicators of sustainable development. The use of such an approach is considered on the example of the territories of the Volga basin (Kostina, Rozenberg, Kudinova, Rozenberg, & Pырsheva, 2016). The selected subset does not claim a comprehensive coverage of all the characteristics and parameters of the social-ecological-economic system, however, it satisfies the requirement of representation in three components: the share of specially protected natural areas as an indicator of the preservation of the main components of natural ecosystems and their biodiversity; infant mortality rate, the general morbidity of the population, indirectly characterizing the “quality” of the life of the human population; environmental footprint indicator; environmental assessment using the function of desirability; the index of anthropogenic transformation of the territory and its modification; Human Development Index (HDI) reflecting socio-economic development; the index of “density of culture”, which characterizes the “ecological and moral potential” of the territory, discussed above.

For the integral assessment of the social-ecological-economic state of the territories, we introduced two more variables — the “critical” (C) and some “reference” (R) states; we then adjusted the values for each index and indicator under consideration. Taking into account the introduced objects (R and C), the values of correlation of indices and indicators were determined. Positive and negative relationships

(reliable correlation coefficients) of indices and indicators show the “internal” interdependence of the considered population. The indicator “general morbidity of the population” and the HDI, which are associated (statistically significant links) with all analyzed indices and indicators can be considered as the key ones. In the space of the two main components explaining 73% of the variance, factor 1 can be conditionally interpreted as the “positive” component of sustainable development, and factor 2 as the “negative”.

According to the “location” in the factor space of administrative units of the Volga river basin, different management strategies are viewed. One group includes the Republic of Tatarstan and Chuvashia, Moscow and Samara regions. These regions should pay special attention to financial investments in improving the “quality of life” by stabilizing and reducing the anthropogenic load on the territory. For example, we suggest improving the protection regime of existing specially protected natural areas and increasing the number of reserves, nature monuments, etc. For the the second group (Astrakhan, Volgograd, Kirov, Tver and Kostroma regions and Perm Krai) it is advisable to make investments of funds and resources in the education of the population, to increase the average life duration, increase the incomes of the population.

As a result of the use of the Euclidean metric (distance to objects R and C) in the resulting space of the two main components, we demonstrated a weakly pronounced differentiation of regions. However, there are three categories. The calculation of the generalized desirability function for a set of indices and indicators showed that all regional units belong to the group of "satisfactory" state. Thus, the integral assessment of the indices and indicators of the sustainable development taken into consideration showed a similarity in the assessment of the state of the administrative units of the Volga basin. This in the first place reflects approximately the same social-ecological-economic development, given by common political and economic decisions. Scenario development of the social-ecological-economic system of Samara region on the basis of the model obtained shows that when implementing a strategy that includes, for example, increasing the territory of natural protected areas to 30%, leads to a change in the “location” of the specified region. At the same time, there should be a decrease in incidence by 10%, and the infant mortality rate - by 9%. The value of the “ecological footprint” will also decrease (by 19%), and the HDI will slightly increase.

## **7. Conclusion**

On the basis of the estimates obtained, one can conclude that the subjects of the Russian Federation have every chance to preserve biological resources, while maintaining a high level of well-being of its inhabitants and the development of human capital. Consequently, the sustainable development of the Volga basin region as a priority strategy for the development of society will ensure the preservation of the environment for both current and future generations while guaranteeing a high economic standard of living and social protection of citizens.

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