

Zoning Based on Comfort of Living Using The Example of Yakutia

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Abstract—The article explores the comfort of the region and its zoning based on natural and climatic, social and economic conditions for human living. We completed this study by solving the following tasks:

– Selection of statistical indicators characterizing the comfort of living;

– Calculation of synthetic indicators by bringing them to dimensionless normalized values;

– Retrospective integral assessment of the comfort of living in different areas and economic zones of the region.

Selection and analysis of a large array of indicators of economic, housing and utility, environmental and social comfort of living for different areas and economic zones of the region in a quite profound retrospective allows you to approach to their objective assessment as close as possible.

The presented method to assess comfort of living quantitatively and the region territory zoning can be applied by the municipal and regional authorities in order to equalize the development of the areas and economic zones in terms of social and economic conditions.

Keywords— *Economic, Social, Housing and Utility Comfort, Environment, Zoning*

I. INTRODUCTION

The entire territory of Yakutia lies in the zone I with very harsh natural and climatic conditions, where the long-term living of people from moderate climate areas is excluded, and in the zone II, where the long-term living of people from moderate climate areas causes health damage which is not recovered by adaptation [28] (see Fig. 1).

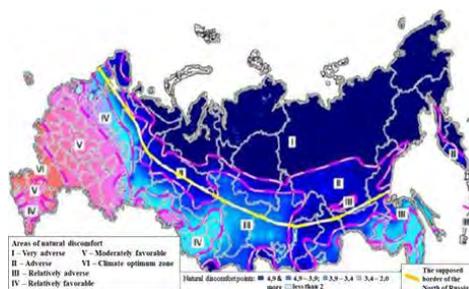


Fig. 1. Zoning of Russia's territory based on natural and climatic conditions by the Luzin Institute for Economic Studies of the Kola Science Centre of the Russian Academy of Sciences.

The article presents the methodology to zone the territory of Yakutia based on comfort of living, taking into account not only natural conditions but also economic and social environment, as well as housing and utility conditions..

II. THEORETICAL AND METHODOLOGICAL ASPECTS

Creation of the most favourable and comfortable living environment for people is one of the priority directions for any state development. The modern scientific and public literature still lacks a common definition for the concept of “quality of life” and proposes different approaches to interpret the term.

Thus, the main difficulties in the study arose when reasoning the conceptual framework of the quality of life (comfort) category [1, 25]. Works of domestic and foreign scientists have reflected various aspects of the theory and practice of living standards and quality of life. The welfare theory was fleshed out and examined in A. Pigou's works [2] and further developed by V. Bobkov, S. Glaziev, T. Zaslavskaya, V. Kavaliauskane, M. Mozhina, L. Rzhanicyna, N. Titova, A. Fedorenko, Ya. Drevnosky, V. Scott, Foster-Greer-Thorbeck, P. Mstislavsky, N. Golub, etc. However, this is highlighted the most, in terms of both reasoning of regional particularities and outlining of the natural factor determining its significance in the life support system, in the studies on sustainable development of northern settlements of E. G. Egorov [3] and I. I. Poiseev [4].

Unit recently, the term “comfort of the environment” was used only by the few number of researchers (Milkov, Reich, Khrustalev, etc.) [5], [6], [7]. The term “comfort” (of English origin) means “a combination of conveniences”, i. e. favourable conditions for existence and activities of any object [8, 9]. N. V. Maslov defines comfort as “the most favourable conditions for human life and activities, a combination of household utilities, well-being and ecological safety” [10]. There are other opinions. We should note that there is neither adequate interpretation of the concept of “comfort of human living in a territory” nor clear criteria for ranking the indicators. Usually, climatic, social, or ecological comfort is identified. The theoretical and methodological basis of such studies is formed by the works in medical and social geography, ecology, bioclimatology, sociology, etc. [11, 12, 13, 14, 15].

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Moreover, it is difficult to calculate a specific comfort indicator for a large area, where there are significant differences in natural and climatic or social and economic conditions, therefore, the comfort of living is normally considered for comparatively small areas. A number of regional studies focus on identifying environmental comfort for cadastral valuation relating to urban and recreational areas, housing and industrial conditions, usually taking into account separate factors or parameters of the environment [16, 17, 18, 6]. The “natural” factor is of importance, and sometimes even of critical importance, for regions with harsh and very harsh climatic conditions. In this regard, scientific disputes on determination of a fundamental approach to cover the studied topic required the authors to consider the existing theoretical developments from the classical to modern ones comprehensively.

The scientific literature contains a number of definitions; one of the most famous definitions is the description of the concept of “quality of life” given by the World Health Organization (WHO): “an individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns”. The All-Russian Centre of Living Standards proposed to define quality of life as “a variety of abilities and satisfied needs of individuals, social groups and society as a whole, predetermining their development and well-being” [11]. Considering quality of life as a system, its elements can include goods (materials), services, social and spiritual needs, safety and other parameters of comfort.

The study results are based on their unification, integral evaluation and visual representation that makes the interpretation and practical application easier.

III. METHOD

The main hypothesis of this study is that the quality of life is largely predetermined by the conditions existing in the region – comfort of living both in rural and urban areas, regardless of underdevelopment or periphery. These conditions should be equalized and fit the modern physiological and spiritual needs.

We have solved a specific task, i. e. how to assess the comfort of living in different areas quantitatively and how to zone the region territory based on the comfort level. In order to ensure the comprehensiveness of our study, we used nearly all existing official comfort estimates based on which the annual statistical monitoring is carried out.

The database formed by the author to assess the comfort of living in different economic zones and areas of the Republic of Sakha (Yakutia) includes 60 synthetic (calculated) and direct (primary) statistical indicators, divided into 4 groups.

The first group consists of 12 synthetic indicators based on which the normalized index of economic comfort is calculated:

The second group is formed of 30 indicators evaluating the normalized index of housing comfort and consists of three subgroups.

The first subgroup to assess the comfort level of an area’s housing stock includes 11 indicators.

The second subgroup to assess the technical condition and renovation of an area’s housing stock includes 14 indicators.

The third subgroup to assess the social protection in terms of public services includes 5 indicators.

The third group consists of 10 indicators based on which the normalized index of environmental comfort is calculated.

The fourth group is an assessment of the integral indicator of social comfort and consists of 8 indicators.

The normalization is done in order to bring incommensurable indicators into a dimensionless form using formula 1 or 2 [26].

$$c_{ni} = \frac{c_i}{c_{max}} \quad (1)$$

$$c_{ni} = 1 - \frac{c_i}{c_{max}} + \frac{c_{min}}{c_{max}}, \quad (2)$$

where c_{ni} is the normalized value (rating) of the n th indicator of the i th municipal area;

c_i is the value of the i th municipal area indicator;

c_{max} is the maximum indicator value for all municipal areas;

c_{min} is the minimum indicator value for all municipal areas.

If an indicator value reflects the favourable influence on the municipal area rating directly or proportionally, then formula 1 will be applied – the more the better. If it is inversely proportional, then formula 2 will be applied – the more the worse. If a municipal area does not have any indicator value, it is assigned a zero rating.

The result is an aggregate index of the comfort of living in the area, obtained by summing up the integrated indicators of the four groups.

IV. ANALYSIS AND ZONING OF THE REGION TERRITORY BASED ON THE COMFORT OF LIVING

Zoning, accepted by the author in this study, proceeded from the weight equivalence of the indicators to assess the comfort. The limit values of comfort based on the factor groups should be equal to the number of the indicators: 12 – for economy; 30 – for housing and utilities; 10 – for environment; 8 – for social comfort (see the “Method” Section). The comfort of living in the areas based on these factors should aspire to these points, and the aggregate index should aspire to the limit value of 60.

As the diagram in Figure 2 shows, the aggregate comfort index is the lowest in the Central Agricultural Zone (32.5 points), while it is equal to 34.6 points in the Arctic Zone and reaches 37.1 points in the Central Industrial Zone. The difference between these values and the limit index of 60 points shows the comfort of living in these areas and zones of

the region. The average comfort of living is 61.8% for the central industrial areas, 54.2%, and 57.7% for the agricultural and Arctic areas, re-spectively. The predominance of the Arctic areas over the agricultural central ones in terms of comfort is the legacy of the Soviet Union, when many people from moder-ate climate areas were attracted to the Arctic areas thanks to the regional coefficients and northern supplements to wages and salaries. With the economy of scarcity, peo-ple living in the far north were supported much better than people living in the central regions of Yakutia. There were built comfortable houses at the expense of public funds. At the same time, people living in the central agricultural areas has been solv-ing their housing problems by individual housing construction at their own expense. This housing stock does not fall in the federal programs on the elimination of old and failing housing stock even today, because the residential houses are individual rather than multi-family. As you can see in Figure 2, the central agricultural areas have the lowest values of the integral indexes of economic comfort among the three zones. 20% of people with income below the minimum subsistence level for the republic live mainly in the central agricultural areas. They cannot afford mortgage loans of commercial banks and have no prospects to improve their living conditions.

As Fig. 2 shows, the integral indexes of environmental comfort in the central industrial zone areas are much lower than those in the Arctic areas are and almost on a par with the agricultural ones, that was quite expected taking into account the vul-nerable northern nature.

The integral index of social comfort in Fig. 2 is of interest. The most hard-to-reach and underpopulated Eveno-Bytantaisky area has the highest value of 6.3, while Yakutsk has the lowest value of 3.3, and all the industrial areas have lower values than the Arctic and agricultural ones.

Fig. 3 shows the capabilities of the presented method for detailed analysis of “bottlenecks” in arranging life activities in the area. The CM6 cell contains the nor-malized index of heat loss in the Aldansky area; it is 0.152 and is calculated according to formula 2 (see the formula line in Fig. 3). The BY6 cell shows the loss percent-age of the heat supplied to the network; it is 34% and is the highest in the BY column. The Anabarsky area has the lowest heat loss in the Republic (3.4%), where the nor-malized index in the CM9 cell is 1. The reader can verify the calculation of the tech-nical condition integral index for the housing stock, shown in Figure 3 based on the CN column, using the sum of the 14 normalized indexes for each area. The loss of one third of the heat supplied to the network suggests not only wastefulness but also capture of the regulator by those to be regulated.

Unfortunately, we cannot give the list and detailed analysis of the indicators applied in the comfort calculations on the pages provided for this article.

Zoning based on the comfort of living, as Fig. 4 shows, rests on the natural and climatic zoning (see Fig. 1), as well as the similarity of social and economic, hous-ing and utility conditions for human living. The traditionally agricultural Olekminsky area was attributed to industrial areas, as in recent years its gold extraction is up to 3 tons per year.

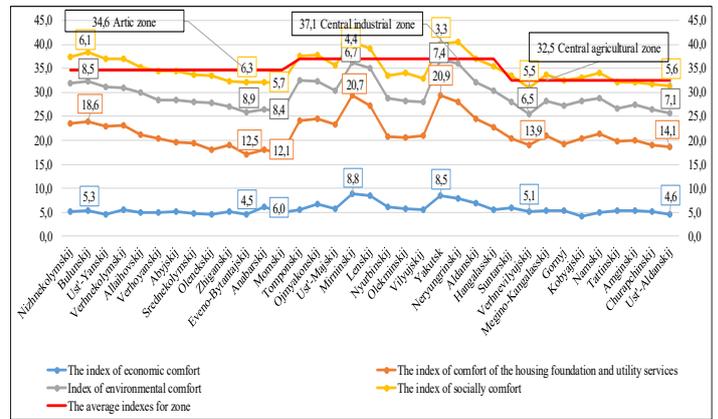


Fig. 2. Aggregated integrated indices of living comfort in industrial, agricultural districts of the Central zone and in the Arctic zone Republic of Sakha (Yakutia).

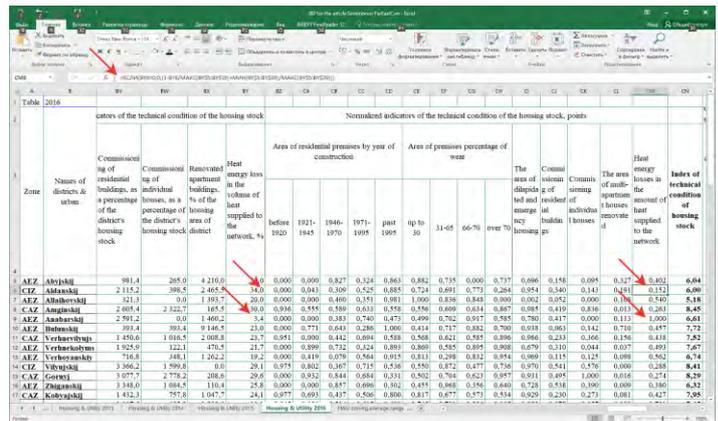


Fig. 3. Screenshot of the calculation of the index of the technical condition of the housing.

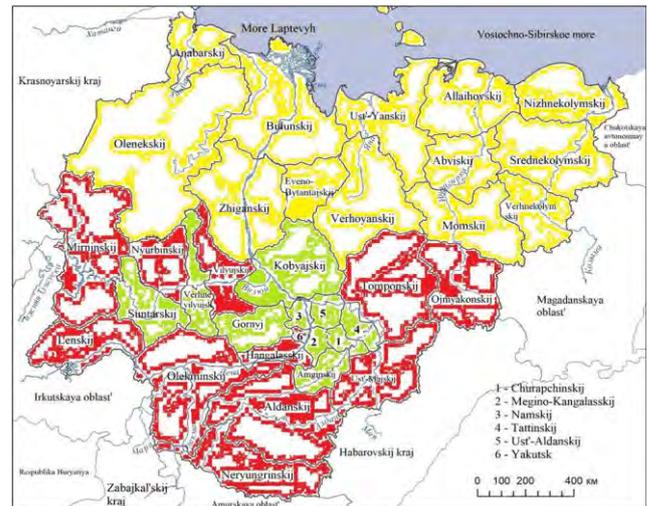


Fig. 4. Zoning map of the Republic of Sakha (Yakutia) in the Central agricultural, industrial, and Arctic zones for the comfort of living.

You can find the arguments for attribution of the 13 areas to Arctic ones in the specified author's article [29]. The Verkhoyansky, Ust-Yansky, Verhnekolymsky areas of the Arctic zone, which were previously considered to be traditionally indus-trial, cannot be attributed to industrial due

to closure of plants and decline in extraction volume. The extraction industry emerging in the Anabarsky, Oleneksky, Bulunsky, Zhigansky areas has not caused tangible social and economic transformations for the people living in these areas, as all production is organized on a rotational basis and, according to the federal legislation, the companies are absolutely independent from the local government and regional authorities.

V. CONCLUSION

The database created with this methodology to assess the comfort of living is a ready-to-use tool for equalizing the spatial difference in the comfort of living in the Republic of Sakha (Yakutia). The database can be updated and applied by the administrative and regulatory authorities to assess the effectiveness of the municipal and state authorities.

The proposed zoning of the region territory based on the comfort of living can be further detailed in future research. The detailing can address sensitive comfort zones such as agglomeration factors: remoteness/availability of regional centres, reliability of energy supply, stability and speed of communication, etc.

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