RUSSIAN NORTHWEST: AN INTEGRAL ASSESSMENT OF THE CONDITIONS OF REGIONAL SOCIAL, ENVIRONMENTAL AND ECONOMIC SYSTEMS AND QUALITY OF LIFE

V. Dmitriev[*]
N. Kaledin[*]

The article describes the results of an integral assessment of the regional social, environmental and economic systems (SEES) and the quality of life (QOL) in the regions of Russia's Northwestern Federal District (NWFD). This work aims to give an integrated assessment of SEES in the Arkhangelsk and Murmansk regions in comparison to the Moscow region. The authors examine the QOL in 10 NWFD regions, including the Baltic ones. The significance of the research work lies in an integrated and comprehensive assessment of the regional SEES and QOL in 2006, 2009, 2012, and 2013 in view of the effect of priorities within and between groups of assessment parameters. Another important result is the identification of 'stability limits', when regions retain their QOL whereas their regional environmental characteristics change. The proposed methodology is based on multi-criteria and integrated approaches, the composite indicator method, and the method of parameter analysis and synthesis in the conditions of information deficit (IASID).

The assessment of SEES and QOL was performed for five classes (from '1 — high' to '5 — poor') based on calculating statistics for 3—6 groups of assessment criteria at two levels of convolution. The analysis of the data obtained shows an upward trend in QOL in the regions. The authors suggest assessing stability of SEES on the basis of critical values of aggregate indices, at which a given SEES maintains its characteristics and regime properties within a certain QOL class.

Key words: regional social, environmental and economic system, quality of life, integrated assessment, aggregate index method, regions of Russian Federation

In the recent years, Earth and social sciences have been actively developing methods for analysing, evaluating, and forecasting changes in natural and so-

[*] Saint Petersburg State University
7—9 Universitetskaya nab.,
Saint Petersburg, 199034, Russia.

Submitted on February 10, 2016.
doi: 10.5922/2079-8555-2016-2-7

cial systems and their emergent properties and transformations in natural conditions and under external impacts. Studies in this area suffer from the incompleteness and inaccuracy of current knowledge — a result of the complexity of the structure and functioning of natural and social systems and a combination of determinacy, stochasticity, holism, and elementarism in their development. Therefore, most evaluation studies are carried out using component-based evaluation, rating/index, or comprehensive approaches. The indicator approach, indexology, axiometry, and environmental qualimetry of system studies are developing as a basis for multi-criterion and integrated assessments.

The notion of 'quality of life' (QOL) has gained wide currency in the academic community. It describes manifold aspects of lives of different social groups. Definitions given by different authors emphasise economic, social, political, and cultural components of social systems and the condition of natural and human-transformed environment, which interacts with the human community, being often identified with the ecological condition of a territory or its ecological situation. Quality of life pertains to both actual objects and phenomena surrounding human beings and individuals' and societies' ideas of anticipated and desired future (objective and subjective approaches). Such ideas are rarely referred to as 'models'. More often, they are designated by vaguer terms akin to 'ideal image'. Such terms impart an incongruous set of conditions, circumstances, and factors, which define a certain current condition of the system, to a virtual system. This gives rise to an idealised idea of quality of life, where all living conditions — from nutrition and environmental conditions to political freedoms and opportunities to utilize achievements of science and culture — can and should meet the desires and needs of modern human beings and their concept of a high living standard. A refusal to use social/environmental/economic models to trace the influence of social, economic, and political factors on the functioning of the system leaves few possibilities for studying such systems, namely, a component-wise assessment of elements and their temporal changes or a multi-criterion evaluation based on economic, social, and environmental indices. However, this undermines basic principles of studying complex systems (for instance, the principle of emergence), according to which a composition analysis does not replace studying integrative properties immanent in the system as a whole (stability, independence, cohesions, integrity, well-being, transformation stage, etc.).

Further, the essential and sufficient indices are identified. From the perspective of a researcher, they should describe the condition of a social system and quality of life. These indices are often referred to as 'target indicators', 'sustainable development indices', etc. The concept of indicator-based management is widely used by administrative institutions and it suggests taking into consideration the indicators of the state and quality of an evaluated system or those of quality of life, which are often called indicators of sustainable (balanced, crisis-free) development [12; 16; 20]. The process of evaluation consists in identifying a system's positive or negative value based on a comparison of its performance with target indicators. This suggests a comparison of actual values calculated on the basis of statistical data with a certain standard identified for each index. However, it might happen that, according to one index (or criterion), a system would fall into one category and, according to another, into another. Setting a trajectory of changes in the index describing, for instance, a country's 'economic welfare' makes it possible to obtain a more or less balanced index growth rate [21].

The management process is based on monitoring several factor indicators and analysing these indicators in view of their effect on the target indicator set using various approaches. Other important elements are a qualitative forecast of possible changes in the indicators, a priori parametric changes in the conditions of management object development, and an assessment of alternative decisions when choosing the most efficient variant. However, today, there is no unanimity in views on either the development of a theoretical and methodological framework for a unified system of assessing the condition of a social/environments/economic system and quality of life or methodological preferences in devising algorithms and assessment methodologies [5]. This situation is brought about by the uniqueness of Russian reality — a wide range of natural conditions, social and economic potential of regions, and ethnic diversity. Therefore, a region's system of indicators can correspond to that of another region but they will not be interchangeable due to objective reasons [14]. All the above reduces the possibility of unification and decreases the efficiency of authorities in planning sustainable regional development [2; 6; 9—11].

'Quality of life', a term widely used in human ecology and social ecology, describes the quality of satisfying the material and cultural needs of people — quality of nutrition, housing standards, quality of education, healthcare, services, environment, recreation, fashionability of clothes, the need for objective information, level of stress, etc. Moreover, quality of life can be interpreted as the correspondence of living environment to the social and psychological attitudes of an individual. Building on these definitions of quality of life, a major objective is to identify a combination of natural, social, and economic conditions of human health, i. e. the correspondence of the living environment of healthy human beings to their needs [2, p. 92]. The WHO defines quality of life as 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' [2].

The existing interpretations of 'quality of life' are numerous and rather ambiguous. Therefore, different researchers propose disparate approaches to measuring QOL [1].

Among recent works on regional social, environmental and economic systems (SEES), it is worth mentioning the contribution of the commission headed by J. Stiglitz, A. Sen, and J.-P. Fitoussi — 'Report on the Measurement of Economic Performance and Social Progress' proposing recommendations for developing statistical tools for assessing quality of life and social sustainability [13]. The ideas and conclusions presented in the report stirred an animated discussion. Later, a communication from the European Commission entitled 'GDP and beyond' (2009) proposed recommendations for improving social progress indicators. The OECD prepared a compendium of well-being indicators based on the findings presented in Stiglitz, Sen, and Fitoussi's report. The governments of France, Japan, China, the US, Germany, and Norway have shown interest in developing a full and objective system of well-being and sustainable development indicators. Thus, one can conclude that international interest in evaluating sustainable development is rather high and that relevant methodologies are still emerging [13].

Differences in existing methodologies for measuring quality of life manifest themselves when solving such problems as selecting a nomenclature of QOL indicators, measuring indicators, and choosing measurement methods and procedures for formulating a general conclusion about the QOL of an individual, a group of individuals, a region, or a country. Most QOL methodologies and models are developed within either the subjective or objective dimension [2; 4; 9; 11; 23].

Sources and methods

Let us consider the general idea behind integrated indicators of regional SEES and QOL. In our studies, integrated indicators (II) are obtained using the composite indicator method, the randomised composite indicator method (RCIM), and the method of indicator analysis and synthesis in the conditions of information deficit (IASID) [22]. For the purpose of simplification, we will use the RCIM method, whose stages will be considered below.

Stage one consists in choosing a relevant system of criteria for evaluating the condition of regional SEES and QOL. These criteria reflect the condition of social, economic, and political subsystems and the quality of environment (ecological state of a system). All criteria are divided into several thematic groups. Each parameter should be essential and all parameters taken together sufficient for describing SEES and QOL. However, an increase in the value of some parameters results in the growth of QOL (type I) and an increase in others in its decrease (type II). Moreover, there are characteristics, whose critical values divide the scale of parameter changes into two intervals with opposite properties defining its effect on the state of a system. At this stage, it is reasonable to set the minimum (*min*) and maximum (*max*) values of characteristics based on a preliminary analysis of their regional temporal changes. Further, a continuous scale of changes by quality classes is introduced for chosen criteria. In most cases, these criteria serve as key properties characterising the condition of SEES or they are results of convoluting information on the system condition, which is assigned a certain QOL class. These criteria can be presented by certain indices. A crucial element is a scale for evaluating changes in indices by classes of system conditions. It is possible to use classifications proposed by different authors. It is also important to specify the type of connection (type I — direct and type II — inverse) and the degree of connection nonlinearity.

Simultaneously with the properties (criteria) of measurement, classes of regional SEES or QOL are introduced. At this stage, it is reasonable to employ classifications and axiometric scales described in research literature. It is more apt to refer to classifications developed for all groups of criteria classification as models.

The integrated approach considered in this article rectifies the deficiencies of multi-criterion evaluation through simultaneously considering multi-criterion and multi-level (hierarchical) features in the cases of indicator convolution, diversity of connections, and modelling measurement priorities.

At this stage, it is always important to analyse measurement scales of parameter changes by quality classes. It is preferable but not obligatory that all scales have both left and right boundaries within classes, be continuous, and take into account regional extremes of measures indicators.

At *stage two*, simple transformations (minimax functions taking into account the non-linearity and 'direct/inverse' type of connection) are performed and one gets rid of dimensionality of initial characteristics so that the value of 0 would correspond to the best conditions for each criteria and the value of 1 to the worst (or vice versa).

The minimum (min_i) and maximum (max_i) values of each scale of initial characteristics are used to this end. It is also possible to use regional minimums and maximums. In the latter case, it is important to understand that a classification based on minimum and maximum values will also have regional characteristics.

It does not seem appropriate to demonstrate necessary mathematical transformations in this article. However, they are considered in detail in earlier publications [8; 9; 11; 15].

It is recommended to present the results of parameter standardising in a table. Further, it is reasonable to find the width of measurement scale intervals for each class. Deficiencies of measurement scales are identified at this stage. If one class comprises 50—70 % of all scale values, this scale is not satisfactory. Uniform or rectilinear (direct and inverse) scales are of similarly little interest, since resulting composite indicator scales will also be uniform and rectilinear with class boundary values of 0.2, 0.4, 0.6, 0.8, and 1.0. A variety of such scales is the Harrington scale, which also has a priori known boundary values of characteristics between classes.

At *stage three,* the form of the integrated indicator $Q\ (q,p)$ is chosen. The indicator depends on not only standardised values of q_i indicators but also their significance defined by weighting coefficients p_i whose sum should equal 1.0 ($0 \leq p_i \leq 1$).

At *stage four,* estimates of the weighting factors p_i are introduced. As a rule, the development of a programme for evaluation studies is the preliminary 'weighting' of parameters, components, and their properties. However, such 'weighting' is often insufficient, since the effect of selected factors is unequal, which necessitates assigning different priority, weight, or significance to different criteria. However, weight is often introduced rather randomly. There are several methods to identify the 'weight' of individual criteria of natural environment quality. It is possible to assume that the weight of each selected parameter is equal, that the weight of the most significant parameters is increased or the weight of less significant parameters is decreased by a certain factor, that the weight is identified based on expert evaluations, or that the weight of each parameter is identified through additional calculations.

This study uses a multiple-parameter integrated evaluation performed using the composite indicator method (CIM). When introducing the so-called ‘weighting coefficients’ or ‘weights’ representing individual criteria’s significance for an integrated evaluation, a researcher is faced with a deficit of numerical information on these weighting coefficients. In social, economic, and environmental evaluations, the significance of individual criteria is often assessed using comparative judgements, for instance, ‘this criterion is more important for the general evaluation that the other criterion is’ or ‘these criteria are equally important for the integrated evaluation’, etc. Therefore, the significance of individual criteria is often measured using a non-numeric scale or all criteria are assumed to be equally significant. In other cases, a researcher would set intervals of possible variations of weighting coefficients. Therefore, it is important to work with *non-numeric inaccurate* information, which is often *incomplete* (nontrivial equations and inequations corresponding to interval and ordinal information are not assigned to all weighting coefficients). Non-numeric, inaccurate, and incomplete information induces a set of accessible combinations of weighting coefficients, which complicates the application of the CIM [22]. According to N. V. Khovanov [22], overcoming this complication requires using the *Bayesian model of uncertainty randomisation*. The model suggests a transition from uncertain selection of weighting coefficients to random selection from a set of all possible combinations of weighting coefficients. Thus, a researcher obtains random weighting coefficients and randomised composite indicators [22]. This technique is termed the randomised composite indicators method (RCIM) and the methodology of *indicator analysis and synthesis in conditions of a deficit of information* on evaluation parameters is referred to as the IASID methodology [22].

At *stage five,* the value of $Q_{i.}$ is calculated for the left and right boundary of the initial classification model.

As a result, one obtains a scale of changes in the integrated (composite) indicator by class regardless of whether all evaluation parameters are considered as equal or unequal. After completing this stage, it is also reasonable to analyse the obtained scale for uniformity and rectilinearity. If a single class comprises 40—50 % of the interval, it is necessary to go back to the previous stages and rectify the identified deficiency.

At *stage six*, accumulated statistical data are used to calculate the integrated indicators of the first and later convolution stages following the rules of building the initial classification models. At the same time, the procedure of value standardisation is not performed at the second and following stages. However, the problem of choosing weights (evaluating priorities) is carried out at all stages.

Changes in the integrated indicator are calculated similarly for different years or territories based on spatially distributed information. In complicated cases of handling incomplete, inaccurate, and non-numeric information, multi-level convolutions of information on the conditions of measured systems are introduced [22]. A comparison of system conditions on an integrated basis makes it possible to evaluate the spatial and temporal features of changes and the degree of their transformation. The value obtained through convoluting admissible (critical) values of initial parameters can be used as the 'critical' value of the integrated indicator.

Research results and discussion

1. An assessment of the condition of regional SEES and QOL in Russia's Northwest. The integrated assessment was carried out based on 2006, 2009, and 2012 data for the Arkhangelsk and Murmansk regions in comparison to the Moscow region.

At the first stage, a system of criteria for regional statistics was selected to assess quality of life [3; 6; 7; 17]. All criteria were divided into three modules (six groups, seventeen criteria) — social, economic, and environmental. At the same time, QOL classes were identified. Five classes were used, with the first one representing the 'highest', the second 'above average', the third 'medium', the fourth 'below average', and the fifth 'the lowest' quality [2; 8; 11; 15; 23].

Initial criteria were selected at this stage to measure quality of life. They comprised six groups of indicators:

1. level of income (per capita income, roubles; proportion of population with an income below a living wage,%);
2. culture and recreation (number of sport facilities, units; number of theatre-goers per 1,000 population, people);
3. personal security (number of registered murders and attempted murders, cases);
4. population health (number of hospital beds, 1,000 units; incidence of infectious and parasitic diseases per 1,000 population, people; population per one doctor, people; life expectancy, years);
5. level of education (number of pre-school institutions, units; number of higher professional education institutions (public, units));
6. quality of the environment (stationary source atmospheric emissions, 1,000 tons; fresh water usage, million tons; recirculating water volume, million m^3; wastewater discharge into surface water bodies, million m^3; forest area burned by wildfire, ha).

2006, 2009, and 2012 data for Russian regions are available in [6; 7; 17—19].

For all criteria, measurement scales for the left and right boundary of each class were developed. At stage two, all initial data and measurement scales were standardised.

Linear convolution of standardised indicators in view of their weight was used to express the integrated QOL indicator in the basic variant.

Three classification models for assessing QOL are proposed. These models differ in weights (priorities) assigned at stage two. In model 1, weights are equal. In model 2, priority is given to income. In model 3, the priority is the environment. All three models were built for each region. QOL values were compared based on the results of composite indicator calculations (table 1). Evaluative scales of composite indicators for these models are shown in table 2.

Table 1

Integrated indicators by groups at the first and second levels of convolution for the Arkhangelsk (Arkh), Murmansk (Murm), and Moscow (Mos) regions

Group	2006			2009			2012		
	Arkh	Murm	Mos	Arkh	Murm	Mos	Arkh	Murm	Mos
First level of indicator convolution (model 1)									
1. Income	V	V	IV	III	III	III	III	III	III
2. Health	IV	IV	IV	IV	II	IV	III	II	IV
3. Environment	IV	III	III	III	III	III	III	III	III
4. Culture and recreation	IV	IV	IV	IV	IV	III	IV	IV	III
5. Personal security	I	I	V	I	I	IV	I	I	III
6. Level of education	IV	IV	II	IV	IV	II	IV	IV	II
Second level of convolution									
Model-1	IV (0.70)	III (0.66)	IV (0.69)	III (0.64)	III (0.60)	III (0.60)	III (0.59)	III (0.53)	III (0.52)
Model-2	IV (0.78)	IV (0.77)	IV (0.74)	IV (0.70)	III (0.67)	III (0.63)	III (0.61)	III (0.56)	III (0.53)
Model-3	III (0.59)	IV (0.77)	IV (0.65)	III (0.55)	III (0.67)	III (0.56)	III (0.49)	III (0.56)	III (0.51)

Comment. Model-1: equal priorities; Model-2 (income > culture and recreation = = health > level of education = personal security > environment); Model-3 (environment > health = level of education = personal security > culture and recreation > > income).

Table 2

SEES and QOL composite indicator scales (second level of convolution)

Model	Class				
	I	II	III	IV	V
Q model-1	0.00—0.21	0.21—0.43	0.43—0.66	0.66—0.84	0.84—1.00
Q model-2	0.00—0.21	0.21—0.45	0.45—0.69	0.69—0.85	0.85—1.00
Q model-3	0.00—0.20	0.20—0.42	0.42—0.64	0.64—0.82	0.82—1.00

An analysis of the data obtained shows a trend towards an increase in QOL in the regions. In 2006, in 13 out of 18 cases, regions fell into classes IV—V. In

2012, QOL corresponded to class III and above in 13 out of 18 cases. In general, quality of life in the regions of Northwestern (two regions) and Central Russia (Moscow region) does not differ dramatically. The obtained QOL values suggested a shift from class IV to class III (the Arkhangelsk region closer to the right and the Murmansk and Moscow regions closer to the left boundary). There is a chance of the regions moving up to class II (above average).

2. An assessment of the condition of regional SEES and QOL in Russia's Northwest.

Three modules — social, economic, and environmental — were used to obtain an integrated assessment. The official report 'On the state and protection of environment in the Russian Federation' and the 'Regions of Russia' 2013 annual statistical compilation [19] were used as data sources.

The environmental module included the following nine criteria: wastewater discharge into surface water bodies, million m^3; waste generation, million tons; amount of deposited waste, million tons; pesticide usage, kg/ha; forest wildfire, ha; atmospheric emissions, thousand tons; freshwater usage, million m^3; stationary source atmospheric pollution, thousand ha; forested area, thousand ha.

The social module includes 10 criteria: marriage to divorce ratio, divorces per 1,000 marriages; sex ratio, women per 1,000 men; infant mortality rate; mortality rate; disease incidence per 1,000 population; registered crime rate; Internet access; library access; life expectancy, number of sports facilities.

The economic block includes 10 criteria: population size, 1,000 people; monthly income, roubles; economically active population, 1,000 people; number of small enterprises per 10,000 population; vegetable crop yields, 100 kg/ha; livestock and poultry production (carcass weight), 1,000 tons; residential development, 1,000 m^2; road density, km per 10,000 km^2; cost of consumer basket, roubles; unemployment rate.

Evaluation scales of integrated indicators were devised for two levels of convolution (within and between groups) with equal and unequal priorities (weights). Four variants of coefficient correlation were considered for the second level of indicator convolution: equality of priorities: $p_1 = p_2 = p_3$; priority given to the environment: $p_1 > p_2 = p_3$; priority given to social conditions: $p_2 > p_1 = p_3$; priority given to economy: $p_3 > p_2 = p_1$ (p_1 stands for the priority of the economic module, p_2 for the priority of the social module, and p_3 for the priority of the environmental module). In the case of equal weights of the first and second convolution level, QOL of ten regions falls into classes II — IV. Class II comprises two regions — Saint Petersburg and the Leningrad region. Class III includes the Kaliningrad, Vologda, Novgorod, Arkhangelsk, Murmansk, and Pskov regions and the Republic of Komi. Class IV consists of the Republic of Karelia.

'Priority 2' moves the Leningrad region from class II to III and the Murmansk region from class III to IV. 'Priority 4' moves the Kaliningrad region and the republic of Komi from class III to II.

The results obtained for the first and second groups of models are consistent. Further, it is necessary to analyse the effect of changes in initial indicators on the integrated indicator value. These calculations are performed for the first scenario (equal priorities). It is shown that an increase in the quality of the environment of below 30 % does not result in a change in QOL class at the second level of convolution. It is proposed to establish the stability of regional SEES based on critical values of integrated indicators, which ensures the preservation of the system's properties and regime parameters within one QOL class.

This work was supported by Russian Foundation for Basic Research grant No. 16-05-00715.

References

1. Biktimirova, Z. Z. 2005, Kachestvo zhizni: problemy izmerenija i ocenki [Quality of life: problems of measurement and evaluation], *Jekonomika regiona* [The region's economy], no. 2, p. 147—162.

2. Boblakova, L. M., Dmitriev, V. V. 2014, Integral'naja ocenka kachestva zhizni naselenija g. Sankt-Peterburga i g. Mosvy [Integral assessment of the quality of life of the population of St. Petersburg and Moscow], *Mezhdunarodnyj zhurnal jeksperimental'nogo obrazovanija* [International Journal of Experimental Education], Vol. 3, Part. 1, p. 91—95.

3. Vinogradova, V. V. 2015, Prirodno-klimaticheskie i bioklimaticheskie uslovija zhizni naselenija Murmanskoj oblasti [Natural and climatic and environmental conditions of life of the population of the Murmansk region], *Izvestija RAN. Serija geograficheskaja* [Izvestiya RAN. Geographical Series], no. 6, p. 90—99.

4. Vozmitel, A. A. 2013, Kachestvo zhizni v doperestroechnoj i poreformennoj Rossii [The quality of life in the pre-perestroika and post-reform Russia], *Sociologicheskie issledovanija* [Sociological studies], no. 2, p. 25—32.

5. Gershanok, G. A. 2006, Social'no-jekonomicheskaja i jekologicheskaja emkost' territorii pri ocenke ustojchivosti ee razvitija [Socio-economic and ecological capacity of the territory in the assessment of the sustainability of its development], *Jekonomika regiona* [The region's economy], no. 4, p. 166—180.

6. *Gosudarstvennyj doklad Minprirody Rossii "O sostojanii i ob ohrane okruzhajushhej sredy Rossijskoj Federacii v 2011 godu"* [Report of the Ministry of Natural Resources of the Russian Federation "On the State and the Russian Federation Environmental Protection in 2011"], 2011.

7. *Gosudarstvennyj doklad Minprirody RF "O sostojanii i ob ohrane okruzhajushhej sredy Rossijskoj Federacii v 2007 godu"* [Report of the Ministry of Natural Resources of the Russian Federation "On the State and the Russian Federation Environmental Protection in 2007"], 2007.

8. Dmitriev, V. V. 2010, Integral'nye ocenki sostojanija slozhnyh sistem v prirode i obshhestve [Integral assessment of the state of complex systems in nature and society], *Biosfera* [Biosphere], T. 2, Vol. 4, p. 507—520.

9. Dmitriev, V. V. Boblakova, L. M. 2014, Integral'naja ocenka kachestva zhizni naselenija v regionah Rossii [Integral assessment of the quality of life in the regions of Russia], Informacionnye tehnologii i sistemy: upravlenie, jekonomika, transport, pravo [Information technology and systems: management, economics, law], Istomin, E.P (ed.), sbornik trudov *Mezhdunarodnoj nauchno-prakticheskoj konferencii «Infogeo 2014»* [International scientific-practical conference "Infogeo 2014"], no. 3, St. Petersburg, p. 38—44.

10. Dmitriev, V. V. Ogurtsov, A. N., Vasiliev, V. Yu., Primak, E. A., Lobachyova, Yu. V., Skrygina, V. K. 2013, Ocenka jemerdzhentnyh svojstv slozhnyh sistem v prirode i obshhestve na osnove modelej integral'nogo ocenivanija [Evaluation of emergent properties of complex systems in nature and society on the basis of integrated assessment models]. In: Carlin, L. N., Vorobyov, V. N., Shelutko, V. A., Dmitriev, V. V. (eds.), *Sbornik trudov VI mezhdunarodnoj konferencii «Jekologicheskie i gidrometeorologicheskie problemy bol'shih gorodov i promyshlennyh zon, JeKOGIDROMET — 2012»* [Proceedings of the VII International Conference "Ecological and hydrometeorological problems of big cities and industrial zones, EKOGIDROMET — 2012"], 2013, July 2—4, St. Petersburg, p. 18—27.

11. Dmitriev, V. V., Chistilina, V. S., Kravchenko, V. A. 2015, Razrabotka i aprobacija modelej integral'noj ocenki socio-jekologo-jekonomicheskih sistem i kachestva zhizni naselenija v regionah Rossii [Development and testing of models of integrated assessment of the socio-ecological-economic systems and the quality of life in the regions of Russia]. In: Istomin, E. P. (ed.), Informacionnye tehnologii i sistemy: upravlenie, jekonomika, transport, pravo, sbornik trudov [Information technology and systems: management, economics, law, Proceedings], International "Infogeo 2015" scientific conference, no. 4(15), St. Petersburg, p. 86—94.

12. Doklad mezhuchrezhdencheskoj gruppy jekspertov po pokazateljam dostizhenija celej v oblasti ustojchivogo razvitija. OON. Jekonomicheskij i social'nyj sovet. 47 sessija [Report of the inter-agency expert group on indicators of achievements in the field of sustainable development. UN. The Economic and Social Council. 47 session], 2016, 8—11 March, E/CN.3/2016/2, 46 p.

13. Korchagina, E. V. 2012, Analiz i ocenka ustojchivogo razvitija socio-jekologo-jekonomicheskih sistem [Analysis and evaluation of sustainable social, ecological and economic systems], PhD Thes., Gatchina, 377 p.

14. Lapin, N. I. 2012, Izmerenie modernizacii rossijskih regionov i sociokul'turnye faktory ee strategii [Measurement of the modernization of the Russian regions and socio-cultural factors of its strategy], *Sociologicheskie issledovanija* [Sociological studies], no. 9, p. 4—23.

15. Osipova, A. A., Dmitriev, V. V. 2014, Integral'nye ocenki kachestva zhizni naselenija i kachestva gorodskoj sredy g. Sankt-Peterburga [Integral estimates of the quality of life of the population and the quality of the urban environment of St. Petersburg], Mezhdunarodnyj zhurnal jeksperimental'nogo obrazovanija [International Journal of Experimental Education], no 3, Part. 1, p. 96—102.

16. *Preobrazovanie nashego mira: Povestka dnja v oblasti ustojchivogo razvitija na period do 2030 goda. Rezoljucija, prinjataja General'noj Assambleej OON 25 sentjabrja 2015 goda* [Transforming Our World: The Sustainability Agenda for the period up to 2030. Resolution adopted by the UN General Assembly on September 25, 2015], 2015, A/RES/70/, 44 p.

17. *Regiony Rossii. Social'no-jekonomicheskie pokazateli. 2007* [Regions of Russia. Socio-economic indicators. 2007], 2007, p. 991 p.

18. *Regiony Rossii. Social'no-jekonomicheskie pokazateli. 2010* [Regions of Russia. Socio-economic indicators. 2010], 2010, 996 p.

19. *Regiony Rossii. Social'no-jekonomicheskie pokazateli. 2013* [Regions of Russia. Socio-economic indicators. 2013], 2013 990 p.

20. Sdasyuk, G. V. 2015, Prioritetnye geograficheskie problemy perehoda Rossii k ustojchivomu razvitiju [Priority geographical problems of Russia's transition to sustainable development], *Izvestija RAN. Serija geograficheskaja* [Izvestiya RAN. Geographical Series], no. 6, p. 121—123.

21. Tretyakova, V. E. 2014, Ocenka ustojchivosti razvitija jekologo-jekonomicheskih sistem: dinamicheskij metod [Evaluation of sustainable development of ecological and economic systems: the dynamic method], *Problemy prognozirovanija* [Problems of forecasting], no. 4, p. 143—154.

22. Hovanov, N. V. 1996, *Analiz i sintez pokazatelej pri informacionnom deficite* [Analysis and synthesis of indicators in an information deficit], St. Petersburg, 196 p.

23. Dmitriev, V. V. 2008, Integral Estimation of Ecological Condition and Quality of Anthropogenic Transforming System Environment, Building together our territories. Construire ensemble nos territories: Abstracts. Resume. *31st International Geographical Congress, Tunis 2008, August 12—15*, p. 410—411.

About the authors

Prof. Vasily Dmitriev, the Department of Land Hydrology, the Institute of Earth Sciences, Saint Petersburg State University, Russia.
E-mail: vasiliy-dmitriev@rambler.ru

Dr Nikolai Kaledin, Head of the Department of Regional Politics and Political Geography, the Institute of Earth Sciences, Saint Petersburg State University, Russia.
E-mail: kaledin@politreg.pu.ru

To cite this article:
Dmitriev V. V., Kaledin N. V. Russian Northwest: An Integral Assessment of the Conditions of Regional Social, Environmental and Economic Systems and Quality of Life, Baltic region, Vol. 8, no. 2, p. 87—98. doi: 10.5922/2079-8555-2016-2-7.