Supplementary material

Methodological approaches to the integral assessment of the ecological state of the environment

1. Methodology for a comprehensive assessment of the state of the environment

For a comprehensive assessment of the state of the environment from dissimilar indicators in 1990-2000. mainly point assessment was used, which is not devoid of some subjectivity. In the 2000s, for an integral assessment of the ecological state of the environment, using the example of the Republic of Sakha (Yakutia), we proposed a methodological approach using a quantitative indicator: the social risk index (SRI) (Burtseva, 2005, 2006). The analysis of the integral assessment of the state of the environment in the republic was carried out in three blocks. **Block A**. Anthropogenic load: a) population (2 indicators), b) mining industry (2 indicators), c) forestry (1 indicator), d) agriculture (3 indicators), e) transport (5 indicators). **Block B** Environmental and social consequences: a) air pollution (1 indicator), surface water pollution (1 indicator), disturbance of the earth's surface (1 indicator), medical and demographic situation: birth rate per 1000 people. population (1 indicator), total mortality per 1000 people. population (1 indicator), infant mortality per 1000 people. population (1 indicator), total morbidity per 1000 people. population (1 indicator), primary access to disability per 10,000 people. population (1 indicator), malignant tumors and neoplasms per 100,000 people. population (1 indicator). **Block C** Stability of natural complexes: climatic factors (3 indicators), biotic factors (3 indicators), lithogenic factors (2 indicators). In total, the processing included 30 indicators in three blocks. The main problem of the integrated assessment of dissimilar factors is to bring indicators with different units of measurement into a single, quantitatively comparable system. For these purposes, we consider it quite acceptable to use not unnecessarily complicated indices for assessing the state of an object for each block or simple points obtained in an expert order, but a simpler, reliable and universal quantitative indicator

widely used in practice - the percentage of a feature in the estimated system of parameters. This is the social risk factor (SRI), which is a deviation from the average state of an object in relative terms and which is sufficiently free from the elements of subjectivity characteristic of simple points. The ranking procedure can be divided into two stages. At the first stage, all indicators of the estimated factors for each block are brought into comparable ones by converting absolute values into relative ones. For this, the SRI is determined, which is calculated as the share of the characteristic in the average republican indicator. For the convenience of calculations, a better perception of the results and the release of the index from the dimension, instead of one hundred percent, one is accepted. Moreover, all indicators of the assessed factors and the indices calculated for them are presented by their average values. SRI is determined by the formula:

$$SRI_i = \frac{a_i}{M}$$

where a_i is the absolute value of the i-th indicator, and M is the absolute average value of a set of indicators.

Then the objects are ordered (ranked) according to the increase in factor strength (average SRI). The second stage of the ranking technique consists in dividing a continuous series into discrete classes (groups), that is, building a rating scale. We have identified five groups and each group has been assigned a certain range of values of the factor intensity with their uniform increase from rank to rank. The choice of the ranking axis is the most crucial moment of the study, since it is not devoid of certain subjectivity. To obtain more objective results of assessing the factor under study, it is necessary to choose the most informative (indicator) from the set of its features (indicators).

A comprehensive ecological and economic assessment of the state of the regions was carried out in three blocks: anthropogenic load, ecological and social consequences, resistance of permafrost landscapes to anthropogenic influences. Research consists of two stages. The first stage is analytical, where a comparative analysis of the object is carried out according to the three above-mentioned blocks. To determine the intensity of anthropogenic loads, indicators were adopted that characterize a certain type of nature management and population settlement. All indicators of the economic burden are combined into three large groups: industry, transport, agriculture; the population load is taken as its density and the number of settlements. Socio-ecological consequences are combined into two large groups: disturbance of the natural environment, morbidity of the population. The resistance of permafrost landscapes to anthropogenic impacts was assessed by climatic, biotic and lithogenic factors (Table 1). The second stage of a comprehensive assessment of the state of the environment is synthetic, which is a generalized assessment of the ecological state in administrative regions and includes the procedure for bringing the obtained assessment indicators for three blocks into one system. As a result of these works, each administrative region receives a certain ecological and economic status according to the state of the environment, i.e. a specific place in a generalized ranked series.

Table 1. Structure of indicators for a comprehensive assessment of the state.

Groups of Factors Determining the State of the ES	Assessment Objects	Assessment Indicators
Anthropogenic Load	Population	Population density, people/km^2; settlements by population
	Mining Industry	Volume of rock mass production from the beginning of field development to 2000, million m^3; environmental hazard of waste
	Forestry	Volume of timber harvesting, thousand m^3/ year
	Agriculture	Number of farm animals, livestock, sown area, ha
	Transport	Specific freight turnover, t-km / S ulus; passenger turnover, passenger-km / S of the ulus; number of vehicles per person
Groups of Factors Determining the State of the ES	Assessment Objects	Indicative indicators of assessment
Environmental and Social Consequences	Air Pollution	Emissions, t/year
	Surface Water Pollution	Discharges, t/year
	Disturbance of the Earth's Surface	Disturbed land, ha/km^2 of territory
	Medical and Demographic Situation	Fertility per 1000 people
		Total mortality per 1000 people
		Infant mortality rate per 1000 people
		General morbidity per 1000 people
		Primary access to disability per 10,000 people
	Environmentally Caused Diseases	Malignant tumors and neoplasms, cases per 100,000 people
Stability of Natural Complexes	Climatic Factors	Average annual air temperature, °C
		Sum of temperatures above 5°C
		Long-term average precipitation, mm
	Biotic Factors	Average timber stock, m^3/ha
		Species diversity of mammals, number
		Rare species of mammals, number
	Lithogenic Factors	Depth of seasonal thawing of soils, m
		Ice content of permafrost, points

Usually, the characteristics of natural complexes in accordance with the tasks set by the researcher are given in natural boundaries. The territorial organization of the state is based on the system of administrative division and its subsystems at different levels. Since the state of the environment is primarily associated with indicators characterizing the socio-economic aspects of environmental management, we have taken the administrative district as the lowest unit of the object of a comprehensive environmental and economic assessment of the state of the environment. The processing includes only those indicators that are available for all administrative regions. At the same time, it should be emphasized that the lack of objective statistical as well as scientific information on individual regions complicates the introduction of

indicators into the system for a comprehensive assessment of the state of the environment.

2. Examples of calculating the assessment of the state of the environment with the use of SRI.

2.1. Population. Settlements

The population density and the number of settlements are taken as indicators characterizing the burden of the population on the environment. The distribution of the population in the administrative districts is uneven: the density ranges from 0.01 in the Oleneksky district to 2.8 people per 1 km2 in Megino-Kangalassky. In total, there are 75 cities and workers' settlements in the republic, 61 rural settlements (Table 2.1.1).

Table 2.1.1 Population load on environment

Regions (districts)	density		Number of settlements, scores				SRI (mean)	Ranking scale	Level
	on 1 км^2	SRI	Urban	Rural	total	SRI			
Eveno-Bytantaysky	0,05	0,02	0	4	4	0,18	0,10	1 (<0,3)	Very low
Anabar	0,07	0,03	0	4	4	0,18	0,10		
Oleneksky	0,01	0,01	0	4	4	0,22	0,11		
Zhigansky	0,04	0,02	0	5	5	0,26	0,14		
Allaikhovsky	0,04	0,02	1	6	7	0,35	0,19		
Momsky	0,05	0,02	0	7	7	0,35	0,19		
Abyisky	0,08	0,04	1	6	7	0,35	0,19		
Verkhnekolymsky	0,12	0,05	1	5	6	0,35	0,20		
Bulunsky	0,06	0,03	2	11	13	0,66	0,34	2 (0,31-0,7)	Low
Srednekolymsky	0,08	0,03	1	13	14	0,66	0,35		
Nizhnekolymsky	0,12	0,05	1	12	13	0,66	0,36		
Ust-Yansky	0,21	0,09	4	7	11	0,71	0,40		
Tomponsky	0,15	0,06	2	14	16	0,84	0,45		
Mountain	0,24	0,10	0	17	17	0,84	0,47		
Ust-Maisky	0,19	0,08	8	12	20	0,97	0,53		
Tattinsky	0,91	0,40	0	15	15	0,75	0,57		
Amginsky	0,58	0,25	0	20	20	0,97	0,61		
Oymyakonsky	0,27	0,12	7	16	23	1,15	0,63		
Kobyaysky	0,17	0,07	1	26	27	1,28	0,68		
Neryungri	1,15	0,50	7	2	9	0,93	0,71	3 (0,71-1)	Middle
Nyurba	0,55	0,24	1	23	24	1,19	0,72		
Lensky	0,62	0,27	3	17	20	1,19	0,73		
Verkhoyansk	0,14	0,06	4	26	30	1,41	0,74		
Mirninsky	0,54	0,23	6	9	15	1,28	0,76		
Vilyuisky	0,51	0,22	2	25	27	1,32	0,77		
Verkhnevilyuisky	0,52	0,22	0	29	29	1,37	0,80		
Aldan	0,37	0,16	10	12	22	1,46	0,81		
Namsky	1,64	0,71	0	24	24	1,15	0,93		
Churapchinsky	1,54	0,67	0	29	29	1,37	1,02	4 (1,01-7)	High
Khangalassky	1,45	0,63	3	27	30	1,50	1,07		
Ust-Aldansky	1,23	0,54	0	35	35	1,63	1,08		
Suntarsky	0,46	0,20	0	46	46	2,12	1,16		
Olekminsky	0,19	0,08	3	51	54	2,52	1,30		
Megino-Kangalassky	2,80	1,22	1	34	35	1,68	1,45		

Yakutsk	63,07	27,52	6	8	14	1,15	14,33	5 (>7)	Very high
Average for RS (Y)	**2,29**	**1,00**	**75**	**601**	**676**	**1,00**	**1,00**		

2.2. Economic load

All indicators of the economic burden on the environment are combined into three large groups: industry, agriculture, and transport. Since different sectors of the economy differ in the intensity of their impact on the environment, for their leveling, appropriate amendments were introduced by expert means - the coefficients of the impact force (KS.B). For this, two extreme stages of loads on the axis of the factor's intensity have been selected: the mining industry is taken as the maximum, and agriculture is taken as the minimum. All other sectors of the economy were ranked between them. Industry. Industry dominates in the structure of the republic's economy - 49.4% of the gross regional product (GRP). A high level of industry is observed in Neryungrinsky, Olekminsky, Lensky districts (South Yakutia) and Mirninsky district (West Yakutia) (Table 2.2.1).

Table 2.1.1 Industrial load on environment

Regions (districts)	Timber industry	Mining industry	Total SRI	Load	
				Ranking scale	level
Кс.в	2,0	4,0			
Bulunsky	0,06	0,005	0,03	1 (>0,19)	Very low
Abyisky	0,04		0,04		
Eveno-Bytantaysky	0,06		0,06		
Zhigansky	0,10		0,10		
Nizhnekolymsky	0,10		0,10		
Oleneksky	0,10		0,10		
Allaikhovsky	0,19		0,19		
Srednekolymsky	0,20		0,20	2 (0,2-0,6)	Low
Anabar		0,21	0,21		
Momsky	0,21		0,21		
Mountain	0,44		0,44		
Verkhnekolymsky	0,28	0,77	0,52		
Verkhnevilyuisky	0,56		0,56		
Nyurba	0,90	0,22	0,56		
Verkhoyansk	0,69	0,46	0,58		
Tomponsky	0,67	0,55	0,61	3 (0,1-2)	Middle
Tattinsky	1,07	0,17	0,62		
Churapchinsky	0,64		0,64		
Ust-Aldansky	0,71		0,71		
Namsky	0,83		0,83		
Suntarsky	1,75	0,00	0,88		
Kobyaysky	0,58	1,17	0,88		
Amginsky	1,37		1,37		
Megino-Kangalassky	1,77		1,77		
Khangalassky	1,88		1,88		
Vilyuisky	0,61	3,95	2,28	4 (2,01-5)	High
Oymyakonsky	0,75	4,09	2,42		
Yakutsk	4,26	1,23	2,74		
Ust-Maisky	5,37	1,85	3,61		
Ust-Yansky	0,08	7,36	3,72		
Aldan	8,50	6,60	7,55	5 (<5)	Very high
Neryungri	1,94	14,30	8,12		
	8,82		8,82		

Olekminsky	0,23	25,53	12,88		
Mirninsky	24,20	3,55	13,87		

Comprehensive assessment of the economic burden. Industry (especially mining) and transport have the highest load on the environment (Table 2.2.3).

Table 2.2.3 Complex economic load

Regions (districts)	Industry		Agriculture	Transport	SRI (mean)	Load	
	Timber industry	Mining industry				Ranking scale	level
$K_{с.в}$	2,0	4,0	1,0	3,0			
Zhigansky	0,10		0,22	0,18	0,17	1 (<0,4)	Very low
Oleneksky	0,10		0,27	0,18	0,18		
Abyisky	0,04		0,32	0,29	0,22		
Bulunsky	0,06	0,00	0,54	0,33	0,24		
Allaikhovsky	0,19		0,35	0,21	0,25		
Eveno-Bytantaysky	0,06		0,60	0,22	0,29		
Srednekolymsky	0,20		0,54	0,22	0,32		
Anabar		0,21	0,57	0,19	0,32		
Nizhnekolymsky	0,10		0,62	0,41	0,38		
Momsky	0,21		0,84	0,31	0,46	2 (0,41-1)	Middle
Verkhnekolymsky	0,28	0,77	0,23	0,56	0,46		
Mountain	0,44		0,62	0,50	0,52		
Verkhoyansk	0,69	0,46	0,97	0,60	0,68		
Verkhnevilyuisky	0,56		1,17	0,40	0,71		
Tomponsky	0,67	0,55	0,93	0,93	0,77		
Kobyaysky	0,58	1,17	0,90	0,44	0,77		
Tattinsky	1,07	0,17	1,41	1,01	0,91		
Nyurba	0,90	0,22	1,85	0,90	0,97		
Namsky	0,83		1,32	0,93	1,03	3 (1,01-2)	High
Ust-Aldansky	0,71		1,57	0,84	1,04		
Suntarsky	1,75	0,00	1,87	0,62	1,06		
Churapchinsky	0,64		1,58	1,29	1,17		
Amginsky	1,37		1,90	0,90	1,39		
Vilyuisky	0,61	3,95	1,16	0,76	1,62		
Khangalassky	1,88		1,79	1,31	1,66		
Oymyakonsky	0,75	4,09	0,67	1,45	1,74		
Ust-Maisky	5,37	1,85	0,21	0,87	2,07	4 (2,01-4)	Very high
Ust-Yansky	0,08	7,36	0,55	0,68	2,17		
Megino-Kangalassky	1,77		2,33	3,05	2,38		
Olekminsky	8,82		1,42	0,62	3,62		
Aldan	8,50	6,60	0,65	2,29	4,51	5 (>4)	Exremaly high
Neryungri	1,94	14,30	0,34	4,22	5,20		
Mirninsky	0,23	25,53	0,27	2,86	7,22		
Lensky	24,20	3,55	0,44	2,03	7,56		
Yakutsk	4,26	1,23	0,74	54,61	15,21		

2.3. Technogenic violations of the natural environment

Within the territory of Yakutia, according to the level of pollution of atmospheric air, surface waters and the degree of disturbance of the earth's surface, five groups are distinguished. Table 2.3.1 presents a ranked series of analyzed indicators and their overall assessment.

Table 2.3.1. Comprehensive assessment of violations in the natural environment

Regions (districts)	Discharge of contaminated wastewater into surface water bodies		Land violation at the end of the year		The amount of pollutants emitted into the atmosphere		Total SRI	Violations	
	million м^3	SRI	hectare	SRI	tn	SRI		Ranking scale	Degree
Eveno-Bytantaysky			5,9	0,00			0,002	1 (<0,37)	Very Low
Zhigansky			5,2	0,00	42	0,01	0,005		
Mountain			26,6	0,02	165	0,04	0,02		
Namsky			8,9	0,01	224	0,05	0,02		
Oleneksky			30,5	0,02	218	0,05	0,02		
Momsky	0,07	0,01	160,9	0,12	253	0,06	0,07		
Tattinsky			47,8	0,04	1110	0,26	0,10		
Ust-Aldansky			55,8	0,04	1097	0,25	0,10		
Vilyuisky			106,1	0,08	952	0,22	0,10		
Srednekolymsky					1336	0,31	0,10		
Verkhnevilyuisky	0,03	0,01	132,1	0,10	896	0,21	0,11		
Allaikhovsky	0,15	0,03	362,3	0,28	89	0,02	0,11		
Megino-Kangalassky			97,5	0,08	1177	0,27	0,12		
Amginsky			217,0	0,17	1062	0,25	0,14		
Suntarsky			380,5	0,29	675	0,16	0,15		
Abyisky	0,10	0,02	369,9	0,29	1175	0,27	0,19		
Churapchinsky			35,8	0,03	2487	0,58	0,20		
Kobyaysky	0,04	0,01	163,9	0,13	2280	0,53	0,22		
Nyurba	0,53	0,12	186,3	0,14	2085	0,48	0,25		
Bulunsky	1,57	0,35	283,5	0,22	1106	0,26	0,27		
Anabar	2,81	0,62	354,2	0,27			0,30		
Olekminsky	0,08	0,02	479,4	0,37	2833	0,66	0,35		
Nizhnekolymsky	1,62	0,36	6,7	0,01	3622	0,84	0,40	2 (0,38-0,8)	Low
Khangalassky	1,76	0,39	305,2	0,24	2996	0,70	0,44		
Verkhnekolymsky	0,17	0,04	334,5	0,26	4438	1,03	0,44		
Lensky	1,80	0,40	878,0	0,68	3030	0,70	0,59		
Verkhoyansk	0,52	0,11	507,4	0,39	7322	1,70	0,74		
Tomponsky	1,21	0,27	514,8	0,40	8266	1,92	0,86	3 (0,81-1,3)	Middle
Oymyakonsky	2,04	0,45	2080,5	1,60	7276	1,69	1,25		
Ust-Maisky	1,15	0,25	3134,0	2,42	7376	1,71	1,46	4 (1,31-3,7)	High
Ust-Yansky	0,62	0,14	4255,8	3,28	8745	2,03	1,82		
Yakutsk	24,86	5,52	241,8	0,19	9757	2,27	2,66		
Aldan	8,70	1,93	8861,4	6,83	21198	4,92	4,56	5 (>3,71)	Very high
Mirninsky	23,91	5,31	11189,6	8,62	10759	2,50	5,48		
Neryungri	25,32	5,62	8295,7	6,39	26105	6,06	6,03		
Average for RS (Y)	**4,50**	**1,00**	**1297,5**	**1,00**	**4308**	**1,00**	**1,00**		

2.4. Health status of the population

Human health is closely related to the state (quality) of the environment, which includes, in a broad sense, a set of abiotic, biotic and social environments. A low level of susceptibility to the population was established for four industrially developed uluses: Neryungrinsky, Mirninsky, Ust-Maisky, Lensky, which indicates the best socio-economic living conditions of the population (Table 2.4.1).

Table 2.4.1. Medical and demographic characteristics of the population (1990-2000)

Regions (districts)	Fertility		General mortality		Infant mortality		General morbidity		Primary exit to disability		Total SRI	Affected population	
	On 1000	SRI	On 1000	SRI	On 1000	SRI	On 1000	SRI	On 1000	SRI		Ranking scale	Degree
Neryungri	11,7	0,68	5,3	0,59	19,3	0,89	822,9	0,86	28,2	0,55	0,71	1 (<0,83)	Very Low
Mirninsky	12,1	0,70	5,8	0,64	18,2	0,84	928,4	0,98	43,0	0,83	0,80		
Ust-Maisky	11,6	0,67	9,4	1,04	18,7	0,86	818,1	0,86	35,6	0,69	0,83		
Lensky	13,4	0,78	9,8	1,09	17,7	0,82	677,4	0,71	38,2	0,74	0,83		
Oymyakonsky	9,5	0,55	7,2	0,80	22,6	1,04	1032,2	1,08	36,5	0,71	0,84	2 (0,84-0,95)	Low
Verkhnekolymsky	13,4	0,78	8,8	0,98	21,8	1,01	800,4	0,84	40,0	0,78	0,88		
Ust-Yansky	11,6	0,67	6,6	0,74	27,6	1,27	866,5	0,91	43,1	0,84	0,89		
Bulunsky	14,2	0,82	7,9	0,87	18,1	0,84	1108,3	1,16	37,8	0,73	0,89		
Nizhnekolymsky	12,7	0,74	8,0	0,89	24,4	1,12	800,6	0,84	45,7	0,89	0,90		
Aldan	12,3	0,72	12,2	1,35	16,2	0,75	837,8	0,88	48,6	0,94	0,93		
Tomponsky	14,8	0,86	8,2	0,91	19,7	0,91	837,9	0,88	58,4	1,13	0,94		
Yakutsk	14,2	0,82	10,5	1,16	18,3	0,84	915,6	0,96	52,5	1,02	0,96	3 (0,96-1,05)	Middle
Verkhoyansk	17,2	1,00	9,1	1,01	24,7	1,14	667,5	0,70	51,5	1,00	0,97		
Allaikhovsky	15,5	0,90	9,1	1,01	16,0	0,74	1140,4	1,20	53,9	1,05	0,98		
Vilyuisky	18,6	1,08	8,4	0,93	19,0	0,88	1045,3	1,10	53,4	1,04	1,00		
Amginsky	21,7	1,26	8,1	0,89	19,0	0,88	1027,0	1,08	48,2	0,93	1,01		
Churapchinsky	22,2	1,29	8,9	0,99	21,2	0,98	807,9	0,85	49,4	0,96	1,01		
Zhigansky	16,8	0,98	9,6	1,06	23,0	1,06	1017,0	1,07	50,8	0,99	1,03		
Abyisky	17,4	1,01	9,8	1,09	20,4	0,94	1139,5	1,20	48,8	0,95	1,04		
Khangalassky	15,3	0,89	9,8	1,08	20,2	0,93	1050,9	1,10	60,9	1,18	1,04		
Kobyaysky	18,1	1,05	9,6	1,07	20,0	0,92	1072,3	1,13	53,1	1,03	1,04		
Srednekolymsky	18,3	1,06	8,5	0,94	19,5	0,90	1046,5	1,10	61,8	1,20	1,04		
Megino-Kangalassky	19,5	1,13	9,3	1,03	22,6	1,04	903,3	0,95	56,4	1,09	1,05		
Ust-Aldansky	19,9	1,16	10,4	1,15	22,3	1,03	732,9	0,77	60,5	1,17	1,06	4 (1,06-1,15)	High
Tattinsky	22,6	1,31	8,0	0,89	18,0	0,83	1009,9	1,06	61,8	1,20	1,06		
Suntarsky	21,0	1,22	8,9	0,99	24,0	1,11	965,8	1,01	51,9	1,01	1,07		
Nyurba	19,6	1,14	8,9	0,99	21,4	0,99	1017,6	1,07	60,1	1,17	1,07		
Momsky	20,0	1,16	10,2	1,14	22,3	1,03	1084,1	1,14	53,0	1,03	1,10		
Namsky	21,5	1,25	10,1	1,12	17,8	0,82	1141,6	1,20	58,5	1,14	1,10		
Olekminsky	16,8	0,98	11,2	1,24	24,9	1,15	753,8	0,79	71,8	1,39	1,11		
Mountain	21,8	1,26	8,1	0,90	19,0	0,88	1145,0	1,20	68,7	1,33	1,12		
Verkhnevilyuisky	23,5	1,36	9,2	1,02	21,9	1,01	1168,0	1,23	52,8	1,02	1,13		
Anabar	22,0	1,28	9,2	1,02	33,9	1,56	1054,5	1,11	46,6	0,91	1,17	5 (>1,15)	Very High
Oleneksky	22,6	1,31	10,2	1,13	26,8	1,24	937,5	0,98	67,1	1,30	1,19		
Eveno-Bytantaysky	19,9	1,16	11,2	1,24	38,4	1,77	940,3	0,99	54,1	1,05	1,24		

The prevalence of cancer diseases increases depending on the transition of the economy of the districts from agricultural to industrial specialization. Low and low levels of susceptibility are characteristic mainly for agricultural areas (Anabarsky, Eveno-Bytantaysky, Amginsky, etc.), high and high - for industrial (Yakutsk, Neryungrinsky, Aldansky, Mirninsky Lensky, etc.) (Table 2.4.2).

Table 2.4.2 Prevalence of malignant neoplasms (1990-2000)

Regions (districts)	Soreness of malignant neoplasms		Affection	
	on 100000	SRI	Ranking scale	Degree
Anabar	182,7	0,49	1 (>0,7)	Very low
Eveno-Bytantaysky	248,6	0,66		
Oleneksky	265,2	0,71	2 (0,71-0,9)	Low
Ust-Yansky	271,8	0,73		
Namsky	278,7	0,74		
Abyisky	298,4	0,80		
Zhigansky	299,0	0,80		
Tattinsky	299,0	0,80		
Amginsky	305,6	0,82		
Suntarsky	310,0	0,83		
Vilyuisky	315,5	0,84		
Nyurba	316,4	0,84		
Verkhnevilyuisky	321,9	0,86		
Churapchinsky	323,7	0,86		
Mountain	329,0	0,88		
Ust-Aldansky	335,3	0,89		
Oymyakonsky	340,4	0,91	3 (0,91-1)	Middle
Ust-Maisky	343,5	0,92		
Bulunsky	343,6	0,92		
Verkhoyansk	347,6	0,93		
Kobyaysky	376,0	1,00		
Allaikhovsky	384,1	1,02		
Megino-Kangalassky	385,8	1,03		
Momsky	394,6	1,05		
Srednekolymsky	408,1	1,09		
Khangalassky	424,2	1,13	4 (1,1-1,6)	High
Verkhnekolymsky	424,7	1,13		
Nizhnekolymsky	429,7	1,15		
Tomponsky	445,0	1,19		
Neryungri	469,9	1,25		
Aldan	494,0	1,32		
Mirninsky	499,8	1,33		
Olekminsky	508,1	1,36		
Lensky	612,7	1,63	5 (<1,6)	Very high
Yakutsk	786,0	2,10		

Table 2.4.3 provides an assessment of the state of health of the population, taking into account the indicators of malignant diseases. The first three levels (low, low, medium) are mainly typical for agricultural areas, the last two (high and high) - mainly

for industrial and urban administrative areas. Yakutsk occupies the last place in the ranking.

Table 2.4.3 Assessment of the health status of the population

Regions (districts)	Medical and demographic indicators	Malignant neoplasms	Total SRI	Affection	
				Ranking scale	Degree
Ust-Yansky	0,89	0,73	0,81	1 (>0,88)	Very low
Anabar	1,17	0,49	0,83		
Ust-Maisky	0,83	0,92	0,87		
Oymyakonsky	0,84	0,91	0,87		
Bulunsky	0,89	0,92	0,90	2 (0,89-0,95)	Low
Amginsky	1,01	0,82	0,91		
Zhigansky	1,03	0,80	0,91		
Abyisky	1,04	0,80	0,92		
Vilyuisky	1,00	0,84	0,92		
Namsky	1,10	0,74	0,92		
Tattinsky	1,06	0,80	0,93		
Churapchinsky	1,01	0,86	0,94		
Suntarsky	1,07	0,83	0,95		
Verkhoyansk	0,97	0,93	0,95		
Oleneksky	1,19	0,71	0,95		
Eveno-Bytantaysky	1,24	0,66	0,95		
Nyurba	1,07	0,84	0,96	3 (0,96-1,05)	Middle
Ust-Aldansky	1,06	0,89	0,98		
Neryungri	0,71	1,25	0,98		
Verkhnevilyuisky	1,13	0,86	0,99		
Mountain	1,12	0,88	1,00		
Allaikhovsky	0,98	1,02	1,00		
Verkhnekolymsky	0,88	1,13	1,00		
Kobyaysky	1,04	1,00	1,02		
Nizhnekolymsky	0,90	1,15	1,02		
Megino-Kangalassky	1,05	1,03	1,04		
Tomponsky	0,94	1,19	1,06	4 (1,06-1,3)	High
Srednekolymsky	1,04	1,09	1,07		
Mirninsky	0,80	1,33	1,07		
Momsky	1,10	1,05	1,08		
Khangalassky	1,04	1,13	1,08		
Aldan	0,93	1,32	1,12		
Lensky	0,83	1,63	1,23		
Olekminsky	1,11	1,36	1,23		
Yakutsk	0,96	2,10	1,53	5 (<1,3)	Very high

Analysis of environmentally related diseases showed that there is a close relationship between the prevalence of malignant neoplasms and the level of anthropogenic impact of economic activity (mainly mining). In general, when the indicator of ecologically caused diseases is included in the overall assessment of the health status of the population (the official medical and demographic characteristics do

not take it into account), there is a clear dependence of the deterioration in the health status of the population when the specialization of the regional economy changes from agricultural to industrial, which confirms the existence of a close relationship between technogenic impact and the state of human health, and the quality of his life.

3.1. Assessment of the stability of natural complexes to man-made impacts

The North differs from other territories in extreme natural and climatic conditions that negatively affect wildlife and human life. As the most "indicator" climatic indicators for assessing the stability of natural systems to man-made impacts, the average long-term annual air temperatures, the sum of the average daily temperatures above 5 ° C and the average long-term precipitation are considered. Table 3.1.1 shows a ranged series of average annual air temperatures.

Table 3.1.1 Average annual air temperature

Regions (districts)	Air t, °C	SRI	Ranging scale	Level
Lensky	-6,0	0,53	1 (<0,7)	Relatively moderate
Aldan	-7,3	0,66		
Olekminsky	-7,8	0,70		
Suntarsky	-7,8	0,70		
Momsky	-8,4	0,75	2 3(0,71-0,9)	Relatively extreme
Neryungri	-8,6	0,77		
Mirninsky	-8,7	0,78		
Nyurba	-8,8	0,79		
Vilyuisky	-9,3	0,84		
Khangalassky	-9,4	0,84		
Verkhnevilyuisky	-9,8	0,88		
Ust-Maisky	-10,0	0,90		
Yakutsk	-10,3	0,92	3 (0,91-1,1)	Extreme
Megino-Kangalassky	-10,3	0,93		
Namsky	-10,3	0,93		
Kobyaysky	-10,4	0,93		
Amginsky	-11,1	1,00		
Mountain	-11,1	1,00		
Ust-Aldansky	-11,6	1,04		
Tomponsky	-11,7	1,05		
Churapchinsky	-11,7	1,05		
Verkhnekolymsky	-11,8	1,06		
Zhigansky	-12,0	1,08		
Tattinsky	-12,2	1,10		
Srednekolymsky	-12,5	1,12	4 (1,11-1,26)	Very extreme
Oleneksky	-12,6	1,13		
Bulunsky	-13,4	1,21		
Abyisky	-13,6	1,22		
Nizhnekolymsky	-13,8	1,24		
Anabar	-14,0	1,26		
Verkhoyansk	-14,1	1,26		
Allaikhovsky	-14,4	1,29	5 (>1,26)	Absolutely extreme
Ust-Yansky	-14,5	1,30		
Eveno-Bytantaysky	-14,9	1,34		
Oymyakonsky	-15,5	1,39		
Average for RS (Y)	**-11,1**	**1,00**		

The average timber stock per 1 hectare of forested area according to the data of the Forestry Department of the Republic of Sakha (Yakutia) was taken as an indicator of forest productivity. Table 3.1.2. presents a ranked series for the vulnerability of territories depending on the productivity of the forest.

Table 3.1.2. Vulnerability of territories depending on forest productivity

Regions (districts)	Stock, m3 / ha	SRI	**Vulnerability**	
			Ranging scale	Level
Lensky	137,71	0,02	1 (<0,5)	Relatively low
Amginsky	114,66	0,05		
Olekminsky	107,07	0,08		
Khangalassky	105,68	0,22		
Megino-Kangalassky	100,01	0,27		
Ust-Aldansky	103,89	0,27		
Churapchinsky	98,58	0,27		
Namsky	94,31	0,34		
Aldan	93,81	0,42		
Suntarsky	93,28	0,54	2 (0,51-1)	middle
Tattinsky	78,98	0,56		
Ust-Maisky	88,65	0,56		
Mountain	72,47	0,58		
Neryungri	68,53	0,58		
Yakut	64,32	0,63		
Tomponsky	47,06	0,67		
Mirninsky	43,27	0,69		
Verkhnevilyuisky	39,55	0,72		
Kobyaysky	38,08	0,79		
Nyurba	36,71	0,86		
Vilyuisky	34,43	1,17	3 (1,01-1,5)	Relatively high
Momsky	31,80	1,25		
Oymyakonsky	31,80	1,32		
Zhigansky	30,77	1,44		
Oleneksky	30,77	1,61	4 (1,51-2)	high
Verkhoyansk	29,89	1,70		
Eveno-Bytantaysky	23,28	1,71		
Bulunsky	18,46	1,72		
Srednekolymsky	15,02	1,79		
Abyisky	14,92	1,82		
Verkhnekolymsky	14,92	1,89		
Ust-Yansky	11,95	1,92		
Anabar	4,62	1,95		
Allaikhovsky	2,98	2,09	5 (>2)	Very high
Nizhnekolymsky	1,20	2,51		
Average for RS (Y)	54,96	1,00		

3.2. Lithogenic factors

Employees of the Permafrost Institute of the Siberian Branch of the Russian Academy of Sciences have identified 8 zones of seasonal thawing within Yakutia (Fedorov et al., 1989). The greatest thawing depth from 3.9 to 5 m is typical mainly for the southern, south-western and some regions of Central Yakutia, the smallest (below 2 m) - for the Arctic regions (Table 3.2.1).

Table 3.2.1 Long-term maximum depth of seasonal thawing *

Regions (districts)	Zones and subzones *	Long-term maximum thawing	SRI	Seasonal thawing	
				Scale ranking	Depth
Lensky	7 (8)	5,00	0,59	1 (<0,75)	The greatest
Megino-Kangalassky	6 (5)	4,20	0,70		
Olekminsky	6 (7)	4,20	0,70		
Aldan	6 (5a)	4,00	0,74		
Amginsky	6 (5)	4,00	0,74		
Neryungri	5a	4,00	0,74		
Khangalassky	6 (5)	3,90	0,75		
Yakutsk	6 (5)	3,90	0,75		
Namsky	5, 6	3,50	0,84	2 (0,76-0,97)	Above middle
Ust-Aldansky	5 (6)	3,40	0,87		
Mountain	5 (6)	3,20	0,92		
Suntarsky	5 (6, 4)	3,10	0,95		
Vilyuisky	5 (3, 4, 6)	3,00	0,98	3 (0,98-1,08)	Middle
Verkhnekolymsky	4a (4)	3,00	0,98		
Tattinsky	5	3,00	0,98		
Ust-Maisky	5	3,00	0,98		
Churapchinsky	5	3,00	0,98		
Oymyakonsky	4a, (4)	2,90	1,01		
Verkhnevilyuisky	5 (4, 3)	2,80	1,05		
Momsky	4a (4)	2,80	1,05		
Mirninsky	3 (4, 5, 7, 6)	2,70	1,09	4 (1,09-1,5)	Below middle
Nyurba	4 (5, 2)	2,60	1,13		
Abyisky	4	2,50	1,18		
Verkhoyansk	4 (3)	2,50	1,18		
Kobyaysky	3 (5, 6, 4)	2,50	1,18		
Srednekolymsky	4 (4a, 3)	2,50	1,18		
Tomponsky	4, 5 (3)	2,50	1,18		
Zhigansky	3 (4)	2,30	1,28		
Allaikhovsky	2 (3, 4)	2,00	1,47		
Ust-Yansky	2, 3, 4	2,00	1,47		
Eveno-Bytantaysky	3	2,00	1,47		
Nizhnekolymsky	2, 3 (4)	1,90	1,55	5 (>1,5)	Smallest
Bulunsky	2 (3)	1,80	1,63		
Oleneksky	3 (2)	1,80	1,63		
Anabar	2	1,50	1,96		
Average for RS (Y)		**2,94**	**1,00**		

* The ranking is based on the data of A.N. Fedorova et al. (1989); in the first column numbers of zones and subzones are given in numbers; the order of the numbers of zones corresponds to a decrease in the specific weight in terms of the occupied area; the main zones are listed first, then the rest in brackets.

The indicators of climatic, biotic, lithogenic factors, which play a major role in the stability of ecosystems, served as the basis for a comprehensive assessment of the vulnerability of permafrost landscapes by region (Table 3.2.2, Fig. 3.2.1). In general, it doubles from south to north.

The territory of middle taiga forests is more resistant to technogenic impacts. Relatively high stability is characteristic of the southern part of the republic - Lensky, Olekminsky, Aldansky uluses with an average annual air temperature of -7 ... -9°C and one central Yakutsk: Amginsky, where a weak surface sensitivity to lithogenic factors is noted. Uluses of Central and Western Yakutia, where the average annual air temperature is mainly -10°C, are characterized by medium resistance. The territory of the northern and northeastern parts of the republic is more vulnerable to technogenic impacts, where the average annual air temperature reaches -15.5°C, and the surface sensitivity to lithogenic factors is characterized as strong and relatively strong. The ranked series is completed by two Arctic ulus - Allaikhovsky and Nizhnekolymsky, which are characterized by extremely high vulnerability of natural complexes to technogenic impacts (southern border up to 70 N).

Table 3.2.2. Vulnerability of natural complexes to technogenic impacts, average score

Administrative region (district)	Factors										
	Climatic			Biotic (biodiversity)			Lithogenic		Total SRI	Vulnerability	
	Average annual temperatures	Σ t°C >5°	Long-term average precipitation	Average timber stock	Mammalian		Thawing depth	Ice content		Ranking scale	Level
					species diversity	rare species					
1	2	3	4	5	6	7	8	9	10	11	12
Amginsky	1,00	0,81	0,93	0,05	1,10	0,40	0,68	0,74	0,71	1 (<0,8)	Relatively low
Lensky	0,53	0,46	0,78	0,02	0,67	2,09	0,51	0,67	0,72		
Olekminsky	0,70	0,56	0,85	0,08	0,62	1,95	0,61	0,67	0,76		
Aldan	0,66	1,16	0,60	0,42	0,62	1,36	0,65	0,67	0,77		
Khangalassky	0,84	0,90	0,97	0,22	0,76	1,10	0,68	0,94	0,80		
Suntarsky	0,70	0,96	0,78	0,54	0,95	0,86	0,85	0,87	0,81	2 (0,81-0,9)	Middle
Ust-Aldansky	1,04	0,47	1,02	0,27	1,24	0,43	0,85	1,20	0,82		
Kobyaysky	0,93	0,99	0,86	0,79	0,81	0,40	1,09	0,87	0,84		
Yakutsk	0,92	0,40	1,26	0,63	0,76	0,81	0,78	1,34	0,86		
Megino-Kangalassky	0,93	0,67	1,29	0,27	1,05	0,86	0,61	1,27	0,87		
Vilyuisky	0,84	0,91	0,87	1,17	0,72	0,43	0,85	1,20	0,87		
Verkhnevilyuisky	0,88	1,10	0,90	0,72	0,81	0,43	1,02	1,14	0,88		
Ust-Maisky	0,90	0,51	0,84	0,56	1,38	1,29	0,95	0,67	0,89		
Churapchinsky	1,05	0,83	1,01	0,27	1,24	0,84	0,95	1,00	0,90		

1	2	3	4	5	6	7	8	9	10	11	12
Nyurba	0,79	1,01	0,87	0,86	0,86	0,84	1,02	1,04	0,91	3 (0,91-1,1)	Relatively high
Momsky	0,75	1,07	0,74	1,25	1,34	0,47	1,02	0,80	0,93		
Namsky	0,93	0,81	1,55	0,34	0,86	0,81	0,85	1,34	0,94		
Mirninsky	0,78	1,14	0,74	0,69	1,24	1,26	1,02	0,67	0,94		
Mountain	1,00	1,14	0,95	0,58	1,10	0,86	0,85	1,27	0,97		
Tattinsky	1,10	0,97	1,01	0,56	1,15	0,92	0,92	1,14	0,97		
Neryungri	0,77	1,18	0,54	0,58	0,67	2,61	0,68	0,74	0,97		
Tomponsky	1,05	1,07	0,78	0,67	1,77	0,56	1,19	0,74	0,98		
Verkhnekolymsky	1,06	1,18	0,79	1,89	1,17	0,52	0,88	1,00	1,06		
Srednekolymsky	1,12	1,22	0,96	1,79	0,91	0,49	1,16	1,07	1,09		
Bulunsky	1,21	1,28	0,86	1,72	0,76	0,59	1,43	1,10	1,12	4 (1,11-1,2)	High
Zhigansky	1,08	1,21	0,82	1,44	1,10	1,01	1,33	1,07	1,13		
Oymyakonsky	1,39	1,19	1,11	1,32	1,43	0,98	0,99	0,67	1,13		
Abyisky	1,22	1,22	1,00	1,82	1,15	0,52	1,02	1,14	1,13		
Oleneksky	1,13	1,22	0,86	1,61	0,91	1,40	1,43	0,77	1,17		
Verkhoyansk	1,26	1,19	1,80	1,70	0,72	0,92	1,05	0,74	1,17		
Ust-Yansky	1,30	1,24	1,11	1,92	1,00	0,67	1,36	1,40	1,25	5 (1,21-1,5)	Very high
Eveno-Bytantaysky	1,34	1,22	2,05	1,71	0,76	0,92	1,36	0,67	1,25		
Anabar	1,26	1,23	1,29	1,95	1,05	0,86	1,70	1,10	1,30		
Allaikhovsky	1,29	1,24	1,02	2,09	1,24	2,44	1,33	1,57	1,53	6 (>1,5)	Extreme high
Nizhnekolymsky	1,24	1,25	1,21	2,51	1,10	2,09	1,36	1,74	1,56		

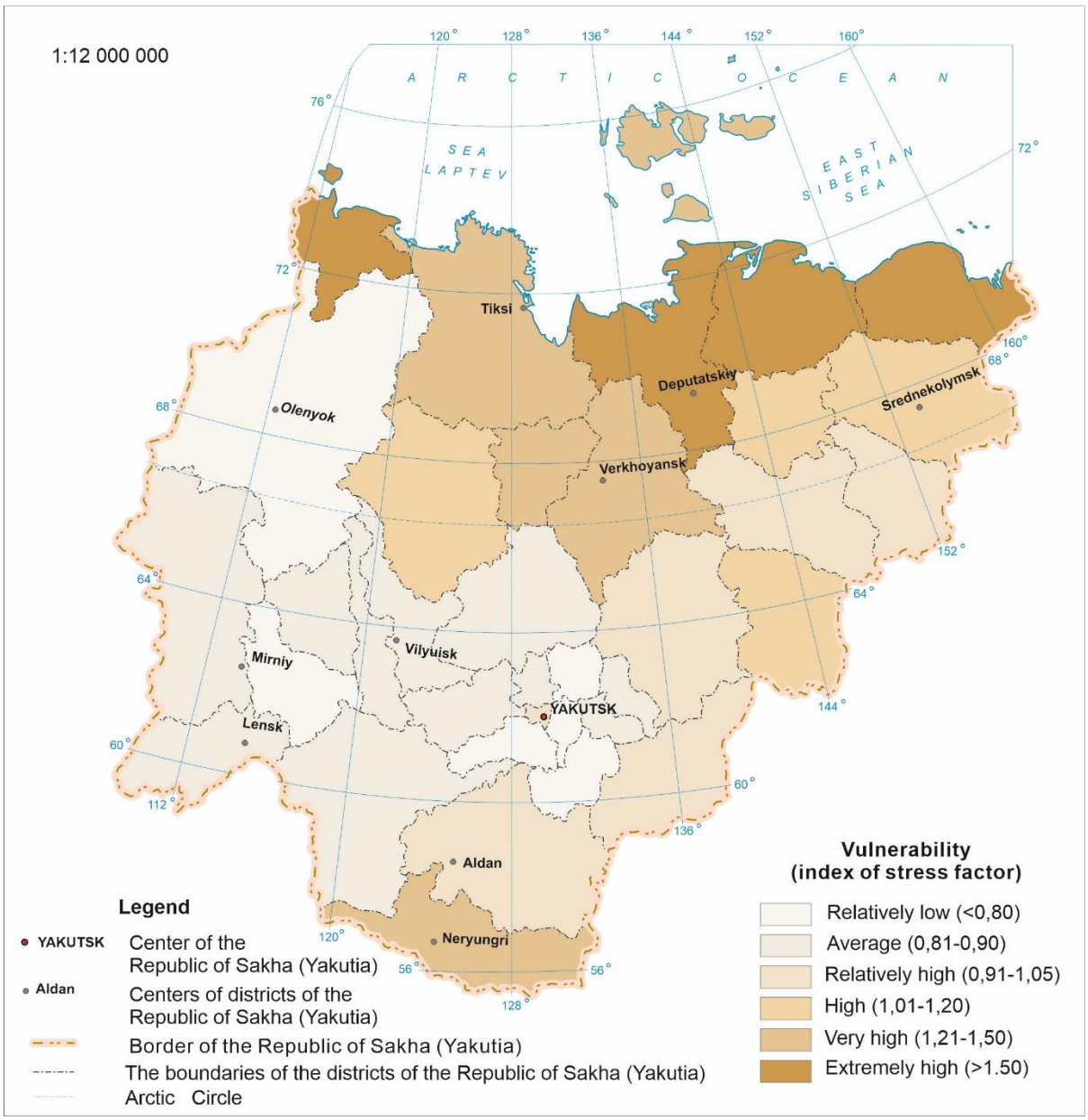

Figure 3.2.1 Comprehensive assessment of the vulnerability of natural complexes to technogenic impacts

3.3. Comprehensive environmental and economic assessment state of the environment

In the "Criteria ..." (1992), the ecological situation in a particular territory is classified according to five levels of environmental conditions: 1) relatively satisfactory; 2) tense; 3) critical; 4) crisis (zone of emergency ecological situation); 5) catastrophic (zone of ecological disaster).

Table 3.3.1 and Fig. 3.3.1 presents a comprehensive ecological and economic assessment of the state of the environment. Within the territory of the republic, there are 3 categories of ecological situation (there is no crisis): favorable, satisfactory, tense. In most regions of the republic (mainly agricultural), the ecological situation is favorable and satisfactory (Fig. 3.3.1).

Table 3.3.1 Comprehensive ecological and economic assessment of the state of the environment

Administrative region (district)	Anthropogenic load						Environmental impact					Vulnerability of natural complexes to technogenic impacts (environmental factors)								SRI (mean)	Enviroments	
	Population		Industry		Agriculture	Transport	Contamination			Health		Climatic			Biotic			Litogenic			Ranging scale	Status
	Density on 1 км²	Number of settlements	timbert	mining			discharge of pollutants into water bodies	disturbed lands	pollutant emissions	medic demographic	cancers	average annual t °C	Σ t > 5°C	precipitation	stock of wood	mammalians		thawing depth	ice content of permafrost			
																species diversity	rare species					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Momsky	0,02	0,35	0,21		0,84	0,31	0,01	0,12	0,06	1,10	1,05	0,75	1,07	0,74	1,25	1,34	0,47	1,02	0,80	0,61	1 (<0,65)	Prosperous
Zhigansky	0,02	0,26	0,10		0,22	0,18		0,00	0,01	1,03	0,80	1,08	1,21	0,82	1,44	1,10	1,01	1,33	1,07	0,61		
Oleneksky	0,01	0,22	0,10		0,27	0,18		0,02	0,05	1,19	0,71	1,13	1,22	0,86	1,61	0,91	1,40	1,43	0,77	0,64		
Mountain	0,10	0,84	0,44		0,62	0,50		0,02	0,04	1,12	0,88	1,00	1,14	0,95	0,58	1,10	0,86	0,85	1,27	0,65		
Abyisky	0,04	0,35	0,04		0,32	0,29	0,02	0,29	0,27	1,04	0,80	1,22	1,22	1,00	1,82	1,15	0,52	1,02	1,14	0,66	2 (0,66-0,7)	Relatively prosperous
Srednekolymsky	0,03	0,66	0,20		0,54	0,22			0,31	1,04	1,09	1,12	1,22	0,96	1,79	0,91	0,49	1,16	1,07	0,67		
Eveno-Bytantaysky	0,02	0,18	0,06		0,60	0,22		0,00		1,24	0,66	1,34	1,22	2,05	1,71	0,76	0,92	1,36	0,67	0,68		
Verkhnevilyuisky	0,22	1,37	0,56		1,17	0,40	0,01	0,10	0,21	1,13	0,86	0,88	1,10	0,90	0,72	0,81	0,43	1,02	1,14	0,69		
Bulunsky	0,03	0,66	0,06	0,005	0,54	0,33	0,35	0,22	0,26	0,89	0,92	1,21	1,28	0,86	1,72	0,76	0,59	1,43	1,10	0,69		
Amginsky	0,25	0,97	1,37		1,90	0,90		0,17	0,25	1,01	0,82	1,00	0,81	0,93	0,05	1,10	0,40	0,68	0,74	0,70		
Kobyaysky	0,07	1,28	0,58	1,17	0,90	0,44	0,01	0,13	0,53	1,04	1,00	0,93	0,99	0,86	0,79	0,81	0,40	1,09	0,87	0,73	3 (0,71-0,79)	Satisfactory
Ust-Aldansky	0,54	1,63	0,71		1,57	0,84		0,04	0,25	1,06	0,89	1,04	0,47	1,02	0,27	1,24	0,43	0,85	1,20	0,74		
Verkhnekolymsky	0,05	0,35	0,28	0,77	0,23	0,56	0,04	0,26	1,03	0,88	1,13	1,06	1,18	0,79	1,89	1,17	0,52	0,88	1,00	0,74		
Anabar	0,03	0,18		0,21	0,57	0,19	0,62	0,27		1,17	0,49	1,26	1,23	1,29	1,95	1,05	0,86	1,70	1,10	0,75		
Namsky	0,71	1,15	0,83		1,32	0,93		0,01	0,05	1,10	0,74	0,93	0,81	1,55	0,34	0,86	0,81	0,85	1,34	0,75		

Tattinsky	0,40	0,75	1,07	0,17	1,41	1,01		0,04	0,26	1,06	0,80	1,10	0,97	1,01	0,56	1,15	0,92	0,92	1,14	0,77		
Churapchinsky	0,67	1,37	0,64		1,58	1,29		0,03	0,58	1,01	0,86	1,05	0,83	1,01	0,27	1,24	0,84	0,95	1,00	0,80	4 (0,8-1)	Relatively satisfactory
Nyurba	0,24	1,19	0,90	0,22	1,85	0,90	0,12	0,14	0,48	1,07	0,84	0,79	1,01	0,87	0,86	0,86	0,84	1,02	1,04	0,80		
Suntarsky	0,20	2,12	1,75	0,004	1,87	0,62		0,29	0,16	1,07	0,83	0,70	0,96	0,78	0,54	0,95	0,86	0,85	0,87	0,81		
Allaikhovsky	0,02	0,35	0,19		0,35	0,21	0,03	0,28	0,02	0,98	1,02	1,29	1,24	1,02	2,09	1,24	2,44	1,33	1,57	0,83		
Tomponsky	0,06	0,84	0,67	0,55	0,93	0,93	0,27	0,40	1,92	0,94	1,19	1,05	1,07	0,78	0,67	1,77	0,56	1,19	0,74	0,87		
Khangalassky	0,63	1,50	1,88		1,79	1,31	0,39	0,24	0,70	1,04	1,13	0,84	0,90	0,97	0,22	0,76	1,10	0,68	0,94	0,90		
Vilyuisky	0,22	1,32	0,61	3,95	1,16	0,76		0,08	0,22	1,00	0,84	0,84	0,91	0,87	1,17	0,72	0,43	0,85	1,20	0,90		
Nizhnekolymsky	0,05	0,66	0,10		0,62	0,41	0,36	0,01	0,84	0,90	1,15	1,24	1,25	1,21	2,51	1,10	2,09	1,36	1,74	0,93		
Verkhoyansk	0,06	1,41	0,69	0,46	0,97	0,60	0,11	0,39	1,70	0,97	0,93	1,26	1,19	1,80	1,70	0,72	0,92	1,05	0,74	0,93		
Megino-Kangalassky	1,22	1,68	1,77		2,33	3,05		0,08	0,27	1,05	1,03	0,93	0,67	1,29	0,27	1,05	0,86	0,61	1,27	1,02	5 (1,01-2)	Relatively tense
Ust-Maisky	0,08	0,97	5,37	1,85	0,21	0,87	0,25	2,42	1,71	0,83	0,92	0,90	0,51	0,84	0,56	1,38	1,29	0,95	0,67	1,19		
Oymyakonsky	0,12	1,15	0,75	4,09	0,67	1,45	0,45	1,60	1,69	0,84	0,91	1,39	1,19	1,11	1,32	1,43	0,98	0,99	0,67	1,20		
Olekminsky	0,08	2,52	8,82		1,42	0,62	0,02	0,37	0,66	1,11	1,36	0,70	0,56	0,85	0,08	0,62	1,95	0,61	0,67	1,21		
Ust-Yansky	0,09	0,71	0,08	7,36	0,55	0,68	0,14	3,28	2,03	0,89	0,73	1,30	1,24	1,11	1,92	1,00	0,67	1,36	1,40	1,40		
Lensky	0,27	1,19	24,20	3,55	0,44	2,03	0,40	0,68	0,70	0,83	1,63	0,53	0,46	0,78	0,02	0,67	2,09	0,51	0,67	2,19	6 (2-3)	Tense
Aldan	0,16	1,46	8,50	6,60	0,65	2,29	1,93	6,83	4,92	0,93	1,32	0,66	1,16	0,60	0,42	0,62	1,36	0,65	0,67	2,20		
Neryungri	0,50	0,93	1,94	14,30	0,34	4,22	5,62	6,39	6,06	0,71	1,25	0,77	1,18	0,54	0,58	0,67	2,61	0,68	0,74	2,63		
Mirninsky	0,23	1,28	0,23	25,53	0,27	2,86	5,31	8,62	2,50	0,80	1,33	0,78	1,14	0,74	0,69	1,24	1,26	1,02	0,67	2,97		
Yakutsk	27,52	1,15	4,26	1,23	0,74	54,61	5,52	0,19	2,27	0,96	2,10	0,92	0,40	1,26	0,63	0,76	0,81	0,78	1,34	5,65	7 (>3)	Extremely tense

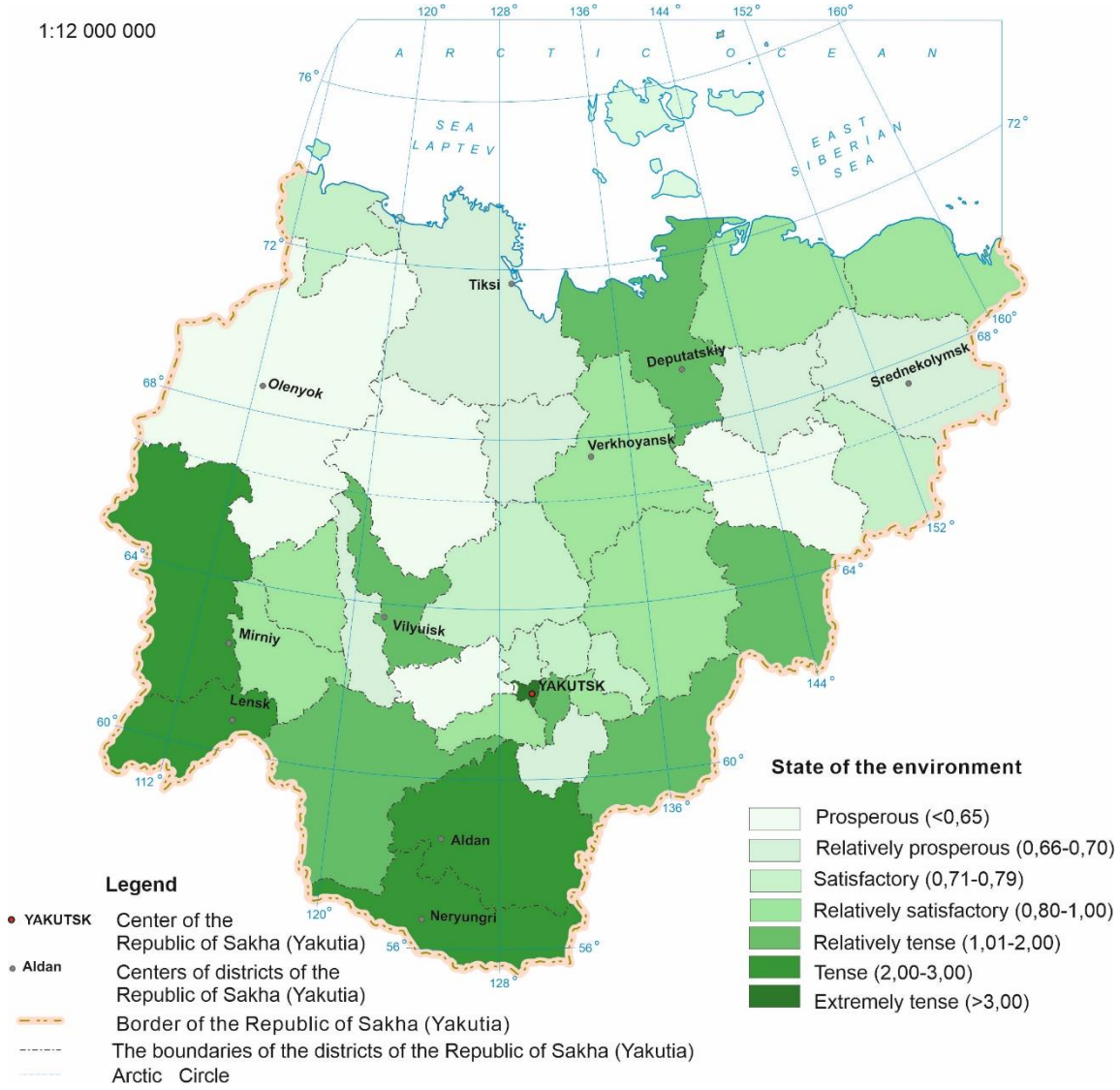

Figure. 3.3.1. Comprehensive ecological and economic assessment of the state of the environment of the Republic of Sakha (Yakutia)

A tense (of varying degree) category of the state of the environment is allocated in 10 regions. The regions are characterized by a relatively tense state, in the structure of the economy of which, against the background of the dominant agricultural production, the mining industry is developing to a certain extent (Ust-Maisky, Oymyakonsky, Ust-Yansky). The tense ecological situation is inherent in areas with developed industrial production (Mirninsky, Lensky, Neryungrinsky, Aldansky). An extremely tense ecological situation has developed in the city of Yakutsk with its subordinate territory.

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