

## Article

# The Impact of Environmental and Anthropogenic Factors on the Migration of the Rural Arctic Population of Western Siberia

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**Abstract:** Environmental and anthropogenic factors represent challenges impacting the lifestyle and demographic rural population's behaviour in the Russian Arctic that threaten its social and food security. We aim to explore (1) which key "push" factors are jeopardising social sustainability and increasing migration outflows in the Arctic rural communities of Western Siberia (2) and how the Siberian population's sustainable development could be secured. The methodology and analysis were based on Lee's theory of migration factors with the main focus on the "push" factors forcing people to migrate to other Arctic and non-Arctic territories. The primary sources included fieldwork data and interviews collected during expeditions to the Arctic zone of Western Siberia between 2000 and 2021. Both men and women confirmed the insignificant impact of environmental factors on their emigration plans. However, they signified social and personal motives related to low standards of living that threatened their social and food security. The rural Siberian population's migration strategies could be re-evaluated only by increasing the physical availability of food products and developing the social infrastructure of the settlements as either "models of rural cities" or "service centres for nomadic and rural population".

**Keywords:** migration; rural arctic population; sustainable development; food security; Yamal–Nenets Autonomous Okrug

## 1. Introduction

Human migration in the Arctic is a complex socioeconomic phenomenon driven by historical, geographical, cultural, economic, and political factors [1–4]. It is also accompanied by the need to adapt to environmental shifts including climate change [5–8]. Rural to urban migration, or "outmigration", is particularly disruptive to many Arctic local communities [9–12]. For example, over the last decades, nine of the twenty-four Alaskan census regions in the state experienced population loss more than twice that of the United States national average in rural areas [13].

The main drivers of the outmigration in the Arctic are the many environmental and social risks [14,15] faced by the population due to harsh climatic conditions, extremely

low population density, insufficient transport logistics, and social infrastructures, fragile ecological systems, climate change, disproportionate industrial and economic development in the Arctic territories. High costs of living result in challenges for the social and food security of local communities.

Heleniak (2021) predicted little change in the total population of the global Arctic but considerable variations in growth rates among Arctic regions up to 2055: a 10% increase in Alaska, Iceland, Nunavut, Troms, Yukon, the Khanty—Mansiy Okrug, and Chukotka; 5% and 10% growth in Finnmark, Nordland, North Ostrobothnia, and Nenets Autonomous Okrug; over 5% decline in Finland, Arkhangelsk, Karelia, Komi, Magadan, and Murmansk in Russia [16]. In nearly all of the Arctic regions, the common demographic trends are “aging populations, more balanced gender ratios between men and women, increased population concentration into larger urban settlements, and the depopulation of smaller settlements” [16].

Environmental changes will drive consequences for individuals, communities, and populations [17]. Climate change is one of the future threats that jeopardise the sustainability of the lifestyles, and livelihoods of the inhabitants of the Arctic. As pointed out by the Secretary-General of the UN António Guterres, “the climate emergency is a race we are losing, but it is a race we can win” [18]. The Arctic ecosystems are suffering from the devastating consequences of climate change: rising temperatures and environmental degradation, increased natural disasters, and weather extremes, resulting in food and water insecurity, and economic disruption [19]. Growing climate change [20–24] encouraged people to “climigration” caused by “immediate threats from erosion and flooding associated with thawing permafrost, increasing river flows, and reduced sea ice protection of shorelines” [5] (p. 115), which local communities are facing nowadays. Harsh cold climatic conditions and “remoteness between population settlements in the circumpolar North” make people leave their homelands and intensify migration outflow in the Arctic [25].

However, the primary critical drivers for “fast society-based and tangible shifts” [26] (p. 9) impacting migration in the Arctic region are geopolitical and socio-economic factors [27–30]. Migration affects the quality of life and lifestyles resulting in a significant impact on Arctic sustainability and food security locally and globally [31]. Food security strategies should be based on the premise that food insecurity and famine derive from the failure of access to food rather than global food shortage [32].

It was shown that there were three major “waves” of population decline in the Arctic: (1) between 1900 and 1919, migration outflow in the North American Arctic caused by the end of the “Klondike Gold Rush” (41% of the population of Alaska and the Canadian Arctic left); (2) in the 1960s, 2.3% of the population of Finland and Sweden moved to central regions and neighbouring countries; (3) since 1990, the migration outflow from the Russian Arctic due to recession in the economy [33]. The Russian Arctic was no longer associated with high living standards due to insufficient social and engineering infrastructure [34,35]. By 2019, the decline was 1046 thousand people, or 30% of the total population in 1989 [36]. The demographic trends, complicated by the increased outmigration mobility, were jeopardising the sustainable development of local Arctic communities: for example, a high degree of urbanisation with a low population density [37], gender imbalance with a higher number of men, increasing proportion of the elderly population, and a high birth rate accompanied by a low life expectancy [33].

Over the last three decades, the population shift in the Russian Arctic due to natural increases was almost covered by net migration. However, Heleniak et al. proved population decline in 139 studied Russian Arctic settlements due to outmigration [38–40]. From 1990 to 2019, the population of the Murmansk region, the Kamchatka region, the Taymyr Autonomous Okrug, and the Komi Republic decreased by one-third, the population of the Chukotka Autonomous Okrug, and the Magadan region declined by nearly 70 percent. There was not such a significant decline of population (13–20%) in the Nenets Autonomous Okrug, the Republic of Karelia, and the Republic of Sakha (Yakutia). In contrast, Siberian areas showed population growth: 29.9% in the Khanty—Mansi Autonomous Okrug, and

15% in the Yamal–Nenets Autonomous Okrug (YNAO) [41]. However, there was high migration outflow during the last decades [42]. It signifies the need to analyse the critical environmental and anthropogenic factors impacting outmigration, and search for possible solutions for updating migration policy in YNAO.

The research question of our study is: “Which environmental and anthropogenic factors threatening social and food security are the key drivers of rural outmigration in Western Siberia?” The significance of this research is to reflect on appropriate policies for strengthening resilience and reducing migration outflows in the Arctic Siberian population.

## 2. Materials and Methods

### 2.1. Settings—The Yamal–Nenets Autonomous Okrug: Geography, Population, and Ethnic Structure

YNAO, the geographic focus of our research, is an important region for the Indigenous Peoples of Russia, and it is located in the circumpolar northwest of Western Siberia (Figure 1). It has a population of 547,010 [43] who live in an area of 769,250 square kilometres [44] with a population density of 0.71 people per square kilometre. The population is mainly concentrated in the urban areas of YNAO (84%) [43]. Almost half of the Indigenous small-numbered population of the Russian Arctic (48,932 people) reside there [45].



**Figure 1.** The map of the Yamal–Nenets Autonomous Okrug.

### 2.2. Study Design

In this paper, we presented the results of a quantitative and qualitative analysis of the impacts of environmental and anthropogenic factors on migration outflow in YNAO. The objectives of our study were to analyse (1) which key “push” factors were jeopardising

social sustainability and increasing migration outflows in the Arctic rural communities of Western Siberia; (2) how social, food security, and sustainable development of the Siberian population could be secured.

### 2.3. Measurement Tools, Methodology, and Study Population

This study applied a multidisciplinary approach based on socioeconomic analysis. The primary sources included demographic data on the longitude dynamics of migration flows of different population groups (2000–2021), fieldwork data, and interviews collected during expeditions to the Arctic zone of Western Siberia between 2012 and 2021.

The data on population, natural increase, and migration for the period from 2000 to 2021 were obtained from the open-source platforms (Rosstat [43], Unified information system for modelling and forecasting the socioeconomic development of the Indigenous Peoples of the North of the Yamal–Nenets Autonomous Okrug [45], Russian Fertility and Mortality Database [46], and Database of Indicators of Municipalities [47]). We used the data collected from the following locations in YNAO: the Nadymy, Yamalsky, Tazovsky, Krasnoselkupsky, Shuryshkarsky, Priuralsky, and the Purovsky districts. The number of Indigenous small-numbered Peoples in YNAO was received from the Department of National Policy of YNAO [48].

The data on socio-demographic characteristics of the Siberian population were collected during expeditions to the Arctic zone of Western Siberia from 2012 to 2021. The fieldwork was conducted by researchers of the YNAO Arctic Scientific Research Centre, Northern Arctic Federal University, and the Association of Reindeer Herders in YNAO (two of the researchers were Indigenous).

Semi-structured interviews with the participation of rural residents of the Arctic zone in Western Siberia were collected to study the reasons for migration expectations of the population in YNAO. The inclusion criteria for the respondents were as follows: be over 18 years of age, have resided in the tundra, or the settlements of the Arctic zone of Western Siberia for over five years. Data collection was performed in the Russian language with the assistance of Indigenous Peoples. Participants filled out a confidential paper. The reasons for migration outflow and migration expectations were analysed according to the following questions: “Where do you live now?”, “Are you going to move to a new place of residence?”, “What key factors (environmental, geopolitical, technological, social, and personal) can make you migrate out from your current place of residence?”.

The survey sequence was as follows: during an expedition to the settlement between 2012 and 2021, respondents were invited to participate in the survey, and received information about the programme, both verbally and in writing. The written consent form stated that participation was voluntary and that their confidentiality was assured. Participants’ personal data and their answers were anonymised, numbered, and entered into de-identified databases.

Statistical analyses were performed using Microsoft Excel 2016 and Statistica for Windows, v. 8.0 (StatSoft Inc., Tulsa, OK, USA). Significant differences were defined at a  $p$ -value  $< 0.05$ .

### Theoretical Approaches to Policy Analysis

There were different factors that impact migration processes, and the factors influencing outmigration were identified by various theoretical approaches. In 1966, the American demographer E. Lee developed the theory of migration factors [49]. He described it as a gravitational model for explaining the “pull” and “push” factors of migration and presented the factors influencing the decision to migrate in the following ways: factors correlated with the territory of departure of migrants; factors associated with the territory of the arrival of migrants who “work” in the territories of potential arrival migrants; interfering circumstances; factors related to the structural characteristics of migrants. Different factors of migration operate in each of the territories. Some factors are “pull”, others are «push» ones. Speaking of “push” factors, he means such qualities of the territories of disposal as

political or religious persecution, economic crises, civil wars, military conflicts, natural disasters, and others. Attractive factors may be the following characteristics of migrant entry areas: political stability, freedom of religion, economic well-being, better working conditions, and the possibility of higher wages [49]. In our study, following Lee's approach, we have mainly focused on the "push" factors forcing people to migrate to other territories.

Based on Lee's theoretical approach, L.L. Rybakovsky posits that migration decisions influenced by several factors can be divided into two main groups: objective ("permanent"—environmental; "temporary"—socio-economic infrastructure, gender imbalance, the ethnic composition of the population, and others; "current regulation"—employment opportunities, income rates, national policy, and others) and subjective (personal motivation) [50,51]. V.A. Iontsev differentiated economic, social, cultural, political, ethnic (national), religious, racial, military, and demographic factors of migration [52]. S.V. Ryazantsev identified the following main "push" factors of migration: "ecological and geographical", "ethnic", "military and political", "economic", "social", "demographic, and psychological" [53]. V.I. Perevedentsev offered natural (climatic, orographic, hydrological, and others), and social migration factors (demographic, economic, social, and others) [54]. V.V. Fauser divides all factors of outmigration into constant (climate, geographic location), slowly changing (economic structure, development of the territory, and others), and variables (legal, and others) [28].

With a special emphasis on the Arctic, A.V. Ukhanova et al. specified the list of the critical factors of outmigration: (1) economic (income rates, unemployment, economic, infrastructural development, and investment attractiveness of the region); (2) social (housing, education, healthcare system); (3) demographic (yield of unemployed, yield of youth population); (4) ethnic (ethnic conflicts, customs, and traditions); (5) political, and legal (legislative regulation of migration, instability of the political situation in the region); (6) climatic, and environmental (harsh climate, climate change, ecological situation in the region); and (7) personal psychological (family and historical ties, level of education, qualifications, profession) [55]. In our study, we analysed the mixture of environmental and anthropogenic "push" factors of outmigration in the rural population of Western Siberia.

#### 2.4. Ethics Approval

The study was approved by the Ethics Committee of the Arctic Scientific Research Centre of YNAO, Salekhard, Russian Federation, on 16 January 2012 (approval protocol No. 01/1-13). The research has been done following ethical concerns of working with the Indigenous Peoples in the Russian Federation (Constitution of the Russian Federation, Article 69. 14 March 2020). Communication was initiated with the Associations of the Indigenous Peoples and with representatives from national Indigenous communities in the Nadymsky, Yamalsky, Tazovsky, Krasnoselkupsky, Shuryshkarsky, Priuralsky, and the Purovsky districts of YNAO early in research planning. This resulted in an expression of interest from their representatives in conducting the research in their communities.

### 3. Results and Discussion

#### 3.1. Migration Trends in the Yamal–Nenets Autonomous Okrug

From 2000 to 2020, the total population of YNAO increased by 48,438 (9.7%) (Table 1), which differs from the demographic situation in other Arctic regions of Russia [26].

The interregional migration showed the tendency of moving from rural to urban areas (urban population increased by 43,836, or 10.6%). The previous research proved that "the residents of small settlements replace the migrated population of the municipalities, while the last ones migrate to big cities and other regions of Russia . . . There are similar migration processes in the Priuralsky district: the residents of small settlements migrate to the regional administrative centre, the village of Aksarka, whose residents move to the city of Salekhard" [56] (p. 54). The Arctic researchers, K. Filant and G. Detter, evaluated the impact of depopulation processes in the rural areas of YNAO on the increasing economic burden for municipal authorities: "Migration processes in rural areas have hypertrophied negative

consequences due to the small size of the population, the dispersion of settlement and the insufficient economics. Thus, with a reduction of the population, budget expenditures for maintaining the infrastructure of a settlement will not decrease but will grow per capita" [57] (p. 28). The migration from the rural (especially small settlements) to urban areas became the trend for the Arctic region globally. In Alaska, the population decline in smaller settlements located far from Anchorage and Fairbanks was a result of outmigration, which has cancelled out positive natural population growth. There was the same dominant pattern in Fennoscandia: population growth in larger settlements was accompanied by population decline in surrounding smaller settlements. This was similar to the pattern observed in North Atlantic countries (Iceland, Greenland, and the Faroe Islands) [40]. The Indigenous Sami population inhabited rural northern areas of Norway, Sweden, Finland, and the Kola Peninsula in Russia also partly moved to the urban areas [11].

**Table 1.** Demographic Statistics in the Yamal–Nenets Autonomous Okrug \*.

Indicator	2000	2010	2015	2016	2017	2018	2019	2020	2020/2000 **
Population, total	497,385	524,630	537,130	535,462	537,472	540,109	543,055	545,823	48,438
Urban population, total	414,288	444,464	449,780	447,916	450,164	452,879	455,712	458,124	43,836
Men	209,485	219,676	223,957	221,687	222,777	224,277	225,725	226,438	16,953
Women	204,803	224,788	225,823	226,229	227,387	228,602	229,987	231,686	26,883
Rural population, total	83,097	80,166	87,350	87,546	87,308	87,230	87,343	87,699	4602
Men	42,261	40,354	43,888	43,888	43,612	43,579	43,726	43,931	1670
Women	40,836	39,812	43,462	43,658	43,696	43,651	43,617	43,768	2932
Indigenous small-numbered Peoples	36,992	41,249	47,541	48,106	48,735	48,606	48,932	N/A	-
Nomadic Indigenous small-numbered Peoples	N/A	N/A	13,978	13,921	13,876	13,365	13,079	N/A	-
Natural increase	3076	5390	6091	5436	4916	4667	4283	3744	668
Birth rate	5839	8263	8913	8251	7530	7214	6836	7037	1198
Death rate	2763	2873	2822	2815	2614	2547	2553	3293	530
Migration outflow	17,055	17,874	47,807	39,774	37,581	37,787	34,334	26,427	9372
Net migration	-1309	-4953	-11,972	-3491	-2418	-1735	-1318	-1071	171
Net migration (from YNAO to the Tyumen region)	-224	-1617	-2980	-2730	-2652	-2526	-2035	-1629	
Net migration (from YNAO to other regions of Russia)	-2398	-4391	-5152	-1950	-1636	-1136	-1229	691	
Net migration (from YNAO to foreign countries)	1313	1055	-3840	1189	1870	1927	1946	-133	
Urban population			-8395	-1495	-426	-473	166	-1465	-
Men			-6337	-864	-9	118	196	-1433	-
15–24 years old			-1037	-116	-112	-91	82	24	-
Women			-2058	-631	-417	-591	-30	-32	-
15–24 years old			-517	-189	56	-62	156	241	-
Rural population			-3577	-1996	-1992	-1262	-1484	394	-
Men			-2160	-943	-872	-395	-566	318	-
15–24 years old			-132	-152	-118	-128	35	53	-
Women			-1417	-1053	-1120	-867	-918	76	-
15–24 years old			-82	-115	-130	-139	-63	60	-

\* Sources of the data: [43,45–48]. \*\* Difference between year 2020 and 2000.

In YNAO, the female population of the urban territories increased faster (by 26,883 women, or 13.1%) than the rural population (by 2932 women, or 7.2%). In contrast, the male population was increasing slowly: urban—by 16,953, or 8.1%; rural—by 1670, or 4.0%. However, the previous research proved the opposite trend among one of the demographic groups in YNAO, nomadic Indigenous Peoples: a catastrophic decrease in the number of women. This resulted in the “shortage of brides in the tundra” [58]. A similar consequential pattern was observed in northern Alaska and Greenland: disproportionate outmigration by locally-born women [29]. Emigration of the Indigenous women from small, isolated communities in Alaska and Greenland was seen as a pattern of female flight that resulted from modernization and decreased the sustainability of such locales [59].

From 2000 to 2020, the migration outflow had doubled (by 9372, or 55%), and it finally overwhelmed the immigration flow resulting in decreased net migration at 171 (−13.1%). Until now, the high birth rate (increased by 1198, or 20.5%), and labour immigrants covered the impact of migration outflow on the total population of YNAO. Sokolova and Choi (2019) noticed that this balance of natural increase and net migration maintaining a sustainable increase in the total population is partly the result of initiated fertility support programmes, and the development of the Arctic areas [60]. Additionally, Lazhentsev (2015) mentioned that negative net migration rates reduce the chances for the intensive exploration of the north [61].

However, jeopardising tendencies are associated with intensive outmigration and increased outflow of well-educated population, and highly qualified specialists from the Arctic region. The previous research showed that the share of emigrants with university or vocational schools education leaving YNAO was 52.6% in 2013, 53.8%, in 2015, and 84.6% in 2017 [62]. Moreover, the migration expectations and intentions of the YNAO residents depend on their level of education, and well-being; the higher level of education people have, the more eager they are to emigrate from the region, and better well-being is associated with less intention to migrate to other regions [56]. Ivanter (2016), Selin (2016), Fauzer (2017), et al. noticed that qualified human resources are replaced with temporary and often low-qualified personnel from Russia’s southern regions, or other countries [63–65] due to migration outflow from the Russian Arctic. This impacts “deintellectualisation” of the Arctic zone of the Russian Federation, slowdown of technological development, and losing of the cultural identity of the Arctic population” [63] (p. 597). Along with it, Pilyasov (2009) signified disappearing cultural and intellectual diversity in the settlements since “decreasing total population means decreasing the number of talented and creative people” [66] (p. 294).

To cover migration loss, the Russian government developed programmes of “attracting skilled labour to the North” [67]. The intensified migration outflow was partly initiated by the government, which developed state programmes for the resettlement of the population to other Russian regions [68–71]. These political initiatives impacted the sustainable growth of the population of YNAO and could finally move the depopulation of some local communities.

The threatening migration trends among the youth and economically active population groups revealed the tendency of an “ageing population” in YNAO that had already become the tendency in other Arctic regions in Russia [33,34,72–74]. Common trends seen in nearly all Arctic regions in the future are aging populations, more balanced gender ratios between men and women, increased population concentration into larger urban settlements, and the depopulation of smaller settlements [16]. Rozanova–Smith (2021) noted that “as young professionals continue to leave, resettling compatriots and hiring shift labour may contribute to the vitality of more resilient regions” [75]. Contrariwise, youth’s migration outflow from the region would impact the demographic imbalance social and food security of the region due to the increased economic burden of the government for supporting depopulated communities with a high yield of an ageing population, and finally, jeopardise demographic sustainability of YNAO.

### 3.2. “Push” Factors of Migration Outflow in YNAO: The Survey Results

A total of 843 residents of the rural areas in YNAO were interviewed, including 297 men and 546 women. Five hundred seventy-seven of the respondents were Indigenous. The age of the interviewees ranged from 18 to 69 years old; the mean age was 45.6 (95% CI 32.8–58.4).

Only 9.0% of the interviewed (24 men, 52 women) declared their intention to move to a new place of residence (primarily urban areas) this year, 11.0% (31 men, 62 women)—in one to three years, and 37.0% (97 men, 215 women) in five years or later. These migration strategies of the rural residents in YNAO became a sustainable trend over the last decade. For example, previous research also proved the migration expectations in the villages of YNAO. In 2015, 84.5% of rural respondents were planning to change their place of residence; among those, 15.5% were going to move to another location (a city or a village) in YNAO, 47.8% to the Tyumen region, 21.2% to other areas of Russia [57].

All of those interviewed (100%) prioritised the impact of social factors on their migration strategies: low quality of life, insufficient healthcare systems, social and food security, low level of education, unemployment, bad working conditions, and uncomfortable housing conditions. The key “push” factors were “*the shortage of job positions in the villages*” or “*lack of work at all*”, “*dilapidated, emergency and uncomfortable housing*”, or “*the lack of housing*”. Both female and male respondents were concerned about the lack of prospects for the youth in the villages, and were sure that the best strategy for young people was to move to the urban areas and search for jobs there: “*Even if young people graduate from colleges, where they will go? They don’t have a job here. What are they going to do here? What’s for should they come back to a village?*”; “*At least, there is some kind of prospect for young people in a city. They can have a choice and find a job there*”; “*What kind of job is here in a village? At school, a work of a janitor, and that’s all...*”; “*Limited choice of jobs*”, “*Low salaries*”; “*High cost of living*”; “*High prices for services, products, housing, and electricity*”. These are common trends in other Arctic regions. For example, in Canadian Arctic, the research on policy food programmes indicated the presence of chronically food insecure groups who had not benefited from the economic development, and job opportunities offered in larger regional centres of the Canadian Arctic, and for whom traditional kinship-based food sharing networks had been unable to fully meet their needs [76]. Indigenous Peoples in northern Canada experience food insecurity at a rate that is more than double that of all Canadian households [77]. The population of “crowded” settlements suffered from an increased risk of food security. For example, nearly 62% of Inuit families in the Canadian Arctic resided in such households, placing them at risk of food insecurity [78]. Therefore, moving rural Siberian populations to big settlements and urban areas could not be the only solution to provide their social and food security.

Men were worried about losing their traditional lifestyle. However, they did not insist on young people staying in the tundra since there was a low level of salaries and challenging life. Only those who were enthusiastic about nomadic reindeer herding could enjoy this lifestyle. In contrast, others had no other choice but to leave a village for a city: “*Young people do not want to go to the tundra. No land where to herd a reindeer. No salaries. No jobs. So, the youth is escaping*”. Assimilation of the Indigenous population due to changing traditional lifestyles and globalisation processes is replacing traditional livelihoods with industries. The previous research proved that “traditional economic activities of Indigenous Peoples are not currently dominant in the structure of employment of the population in small settlements . . . only 15% of the total rural population is employed in traditional Indigenous “industries” [79]. The lack of work in their settlements encourages people to search for employment in nearby regions and extends the daily commute to work. Currently, the municipal statistics of YNAO show that 56% are employed in big settlements or urban areas [80]. This is one of the reasons for the depopulation of small villages. However, other Arctic regions (for example, Canadian Arctic) demonstrated opposite trends; most Inuit families complained about reducing the size of their children’s meals because of a lack of money [78].

Previous surveys in other Arctic regions in 2008 [81], 2012 [82], and 2016 [83] also assessed the impact of unemployment and low income on migration outflow. Along with it, high salaries in some Arctic regions (for example, in the Tyumen region [84], and the Murmansk region [85]) do not change youth migration strategies. Ivanova (2017), et al. explain this intensive migration outflow with limited possibility of professional careers for talented young people in the Murmansk region [85]. The common trends of the youth migration aspiration were observed in Alaska. About 50% of the rural students expected to migrate permanently away from their home region. The likelihood of expecting migration increased curvilinearly with community size. Young women and college-aspiring students disproportionately expected outmigration [86]. However, some in Finnish Lapland, demonstrated the phenomenon of an increasing number of young people who, despite the general tendency towards youth outmigration in rural areas, decided to stay in their hometowns [87].

The problem of increasing unemployment is mainly rooted in the limited approaches to the economic development strategies of the rural areas in YNAO and the lack of economic specialisation of the settlements. This formed unique “ecosystems” in the rural areas, where people adapted to their sustainable lifestyle with minimum needs and expectations, and low requirements for modern social and technological infrastructure [80]. Rural residents’ households are mainly based on a subsistence economy, and they are not focused on producing goods and increasing their income [88]. Therefore, finally, the life-system support of these settlements, social benefits, and insurance for the population to maintain minimum living standards are budgeted by regional governments. Over 60% of residents of these settlements are employed in educational organisations (schools, kindergartens), housing and utilities, and local governments, while only about 40% are working in agriculture [80].

A low density of population and insufficient transport logistics resulted in limited access to medical services. Most respondents mentioned that the most painful issues are the lack of hospitals, medical doctors, and insufficient quality of medical help: *“Healthcare and roads. That is the essential basis for everyday life”; “Severe climate results in worsening health. However, we have no chance to visit medical doctors. We need to go to the hospitals in the big settlements for that.”*

Over 70% of those interviewed confirmed that one of the critical drivers of emigration is insufficient housing and educational infrastructure: *“All housing is old”, “Houses are almost destroyed”; “Most buildings need capital repair”; “They lack central heating, hot and cold water, electricity in the houses.”* However, we disagree with Shelomentsev (2018), et al. [27], who noticed that the most significant factor impacting migration outflow in YNAO is “price of houses”. This factor was not mentioned by any of our respondents, they primarily worried about bad conditions, and the lack of modern conveniences in the houses.

Over 90% of women signified the critical factor of low level of education, and the lack of secondary schools in many settlements: *“I have to send my kids to school to another big settlement since we have an only primary school here. I can’t see my children for several months while studying and living there. I want a better life for my kids. Maybe, we will have to move somewhere else.”* The interviewees mostly did not complain about the quality of the education. However, they highlighted the importance of the communication services in their settlements (sustainable Internet and mobile connection). It was especially significant for the youth respondents: *“The quality of the Internet is low, that does not allow me to participate in the social life of other districts and regions, to receive information and knowledge, and study online”.*

Intensive educational migration in YNAO since 2010 can be explained by the closing of the branches of universities, and increased unemployment rates in the region. So, young people finish school and leave for other cities outside YNAO to get higher education and find better jobs. All interviewed respondents (100%) aged 18–24 years old were not interested in using the opportunities of getting higher education online based on the Internet distance-learning platforms, and they plan to move to other regions. Over 90% of people aged 18–24 years old leave their residence and study in different places [80]. However, the rates of “educational migration” are also high in those Arctic regions of Russia which

have universities. The surveys conducted by Rosstat (2005, 2008) [89], and by Arkhangelsk Scientific Center of the Ural Branch of the Russian Academy of Sciences [83] confirmed that this is one of four key drivers of youth migration outflow in the Russian Arctic.

Most respondents (over 90%) were not satisfied with the social infrastructure, and the quality of social services, which provides their personal motivation to emigrate from the region. Some of them decided to move to a new place of residence following their families or close relatives (14%), and others hoped to get married in a new location (primarily women). Some people were forced to migrate due to limited access to medical services since they have chronic diseases and need regular doctor visits. Over 70% (mostly women) do not see any changes or prospects for the life of their children in the region and are ready to emigrate with them. The respondents mentioned: *“The kids at school are not motivated to stay. They just don’t see their future here”*; *“What will happen to Nyda? I don’t think that anything will change for the better in 5–15 years”*; *“It’s better moving than losing everything here”*; *“I don’t particularly believe that something will happen in the future. People have no hope”*; *“If you would come in the spring when our children go to school in swamps”*; *“In 15 years, only people who were born here will stay here. Our children and grandchildren will move to the city”*. The interviewed did not believe that any changes could happen since *“The system will never change. So, everything will stay the same”*. Furthermore, personal motives were always supported by other factors (primarily social and technogenic) since the desire to change a life, lifestyle, or location is always rooted in some objective factors. Parlee (2012) studying Canadian Arctic mentioned that people can easily face the challenges of food insecurity since their individual views of their own well-being contradict regional statistics on quality of life [90].

All respondents could clearly explain the reasons for their migration expectations (what exactly they were not satisfied with, in their current residence) and listed the number of factors impacting their decision (why they want to leave for another location). It was noticed that *“A great dissonance in subjective perceptions of the quality of life is a result of the comparison of the level and quality of life in urban or large rural areas while people are travelling, and the media (television, through information channels on the Internet) also has important influence”* [80]. When making a final decision on moving to the new location, people are comparing the “losses” and “benefits” of this change. The researchers Beglova and Musin (2017) mentioned that *“A migrant’s decision about possible relocation is formed under the influence of a rational comparison of the actual standard of living with its potentially improved option, predetermined by the migrant’s resettlement. A migration flow occurs when a non-disabled household member prefers the “move” option to the “stay” option, with the costs of moving being offset by expected future benefits.”* [91]. The priority impact of personal factors on migration strategies of the Russian Arctic population was also confirmed in the previous surveys conducted by Rosstat (2005, 2008) [89], Kola Scientific Research Centre (2008) [81], and the All-Russian Center for the Study of Public Opinion (2012) [82]. Similar results were received in Alaska where personal rural residents’ outmigration motives were also dominant [92].

The respondents considered another group of factors referred to so-called “technogenic factors” as one more critical driver of migration. Over 50% were not satisfied with logistics infrastructure since it limited access to social infrastructure and jeopardised their food security. The interviewee responses signified the correlation between insufficient logistics, high prices, and low quality of products in the local shops: *“The products are delivered here by helicopters in summer, autumn and winter (if not bad weather), or we have to wait until winter when the rivers are frozen, and we can deliver what we need by “zimnik (frozen river or lake used as a logistic route—E.B.)”*, *“If there were a good road, probably the products would be cheaper. Because it would be easier to deliver them here”* *“The doctors would be more accessible, and everything would be more accessible if there are good roads. We have to buy everything in the city and it deliver here”*. The shortage of vegetable food and dairy products, high food prices, and limited access to food products strongly impact women’s migration expectations: *“Marketplaces are almost empty, there are no deliveries here. We depend on deliveries by helicopters”*. One woman complained that her little child aged seven years old had never tried ice cream there, and

they could not buy fresh milk in their settlement but only dried milk due to complicated logistics. Transportation, distribution, and handling services have direct impacts on food security as exemplified by other authors on the Arctic food system [93,94].

In contrast, the problem of transport accessibility of the settlement was not so significant for men, and it slightly affected their migration strategies since they considered it an employment opportunity. Some remote settlements can be reached only by helicopters and boats, and the products are delivered there once a month: *“If you need to buy some products or goods you can either wait until the helicopter arrives in a month or go by boat to the big settlement. However, it is very costly, and if there is no urgent need, it is better to delay and wait”*.

High costs of products and services in YNAO (as well as in other Arctic regions) can be explained by high production and logistic costs. Due to rising inflation and political and economic crises, these costs tend to grow. Vasiliev and Selin (2017) noticed that the coefficients of increasing production costs would change in the interval of 1.3–3.0 in the north; these values are higher in the north and northeast of Russia. The increase in production costs in the north varies from 30–35% in the European North to 60% in the Far Northeast of Russia [95] (p. 24). However, the researchers signified that an increase in these production costs should not be “compensated” and “subsidised” only by the government. Instead, the enterprises are to focus on reducing costs to increase their products’ competitiveness [95] (p. 24). The same issue with high costs of living is faced by other Arctic global communities. For example, current food systems within the northern subarctic and arctic regions of Canada rely heavily on imported foods that are expensive (when available) and are environmentally unsustainable [22].

The insufficient logistics also impact the shortage of medical personnel and medicines in the pharmacy, the lack of a general practitioner, a dentist, and other doctors in the remote settlements [23] that “determines public health in the Arctic areas” [24]. The interviewee mentioned: *“Health care and roads. We all depend on them. We have helicopter service. We can’t go by car and get to the city quickly”*. The situation is complicated by the fact that the transport accessibility of small settlements totally depends on weather conditions and seasonality [58] since the main transports are water (in summer), and air (in winter). Using automobile transportation is possible only in winter. Several remote settlements in YNAO are accessible only by snowmobiles in winter, and during the off-season, logistic routes are closed due to weather conditions, and distant geographic locations.

One more component of the technogenic factors, digitalisation, and the insufficient innovative technologies, was more relevant for the youth respondents since they all complained about *“bad Internet”*, and *“limited choice of mobile phone service”*. They noticed that *“there is no ATM in the village, which worsens already the low quality of life”*, *“It is difficult to buy the tickets for a helicopter that is the only regular transport here”*. However, in total less than 20% of the interviewed mentioned this factor as significant for their migration strategies. Lazhentsev (2013) prioritises the role of digitalisation since it is the critical instrument of innovative development of the Arctic region: *“The localisation of human, intellectual, industrial, and other resources for the north for the Arctic is necessary . . . It is possible only due to high-speed transport, and a fibre-optic network with its connection to educational and scientific centres in Russia and foreign countries.”* [82].

Geopolitical factors associated with ethnic conflicts, the criminal situation, and the COVID-19 pandemic did not strongly impact the migration strategies of YNAO residents. Over 60% of respondents did not mention these factors, while about 40% of them noticed that this is important without giving any additional explanations. In 2016, a survey of the Arctic regions’ residents showed that one of the significant reasons for outmigration in the Russian Arctic was the *“insecure criminal situation”* (yield was 17.4%) [96]. However, Shelomentsev (2018), et al. [27] considered this data to be unreliable and considered that geopolitical factors did not have a relevant impact on migration expectations of the Arctic population.

Significant warming trends have already affected the Arctic Peoples’ traditional lifestyle, well-being, and health in Scandinavia and the Russian Arctic [97–100]. Climate

change represents a global challenge that impacts the Siberian population's environment, traditional lifestyle, and health and threatens its food security [19]. This requires increased adaptive capacity [101,102], and coping strategies [103] for changes in the terrestrial ecosystem caused by climate change are urgently needed [104,105]. However, climatic factors were not signified as the critical drivers for migration strategies of the interviewed participants (less than 5%). The respondents mentioned that the climate is changing worldwide but did not specify any significant impact on their lives. The same results were received by the researchers in the Canadian Arctic: significant changes in climate being observed were not currently affecting female food security, with socio-economic-cultural factors as the primary determinants of food security [106].

More important for the respondents were environmental pollution (15%) and limited access to natural resources (hunting and fishing) relevant to food security. In contrast, the survey conducted by Goncharenko, et al. (2008) [81] in another Russian Arctic region, the Komi Republic, showed that one of the critical drivers of their migration strategies was the intention to change to a milder climate. This was also confirmed later by the results of a survey initiated by the All-Russian Center for the Study of Public Opinion (2012) [61].

Finally, none of the respondents offered the only key factor that impacted their migration strategy; all the interviewees listed at least 3–to 4 most relevant factors. The social, technogenic, and personal factors dominated, and they were closely linked.

The main strength of our study was using the unique data of quantitative and qualitative research collected from residents of the local rural communities during the expeditions that took place over ten years (2012–2021). Most similar studies remain fragmentary and are often hard to access. However, our study had several limitations. We interviewed only a part of the population in different districts of YNAO. Participation was voluntary and did not include all representatives of all local communities of the studied territories, limiting the generalizability of our findings. Future research could also benefit from exploring the outcomes of migration outflow from the region (with a particular focus on the social security of the local communities), and “pull” factors of migration. Nevertheless, this analysis can give precious results for improving and updating governmental programmes of socio-economic policy in YNAO.

#### 4. Conclusions

Our findings showed that migration expectations are a complex phenomenon, and critical drivers for the human adaptation strategies to the changing Arctic ecosystems. Both men and women confirmed that environmental (with emphasis on climatic) factors did not significantly impact their emigration plans. However, both of them signified the impact of social and personal motives: low-quality housing, uncomfortable living conditions, high costs of living, limited access to medical care, lack of life prospects in the settlement, desire for changes and a better life for their children, the decision of family members to move to a new place of residence. They also considered migration to other settlements or cities to meet new people, make new friends, and obtain access to active social activities.

As the critical factors for their migration strategies, women signified social (limited access and insufficient quality of medical care, education, unemployment, high prices for food products and goods, food security issues, the lack of conditions and social support for disabled people) and personal factors (health issues, the lack of prospects of living in the rural areas, desire to “give a better life for their children”). Women were also more motivated to migrate to improve their social status. Conversely, men consider the more significant influence of the following factors: changing traditional lifestyle, environmental risks, soil degradation, and transformation of natural landscapes, political situation, the insufficient introduction of innovative technologies in the social sphere (medicine, housing construction), low income, and personal motivation (for example, desire to change their lives and become independent from relatives).

The influence of a group of factors threatening social and food security and impacting migration outflow from the rural areas of YNAO differed, with the prevalence of a group

of social factors and other factors directly related to low standards of living. At the same time, none of the factors was the critical driver influencing migration strategies of the rural Siberian population. The combination of factors was individual and depended both on the objective socio-economic conditions in the settlement, and on the subjective perception by the residents of acceptable, sufficient, and desirable living standards, as well as on the ideas about the perspectives for sustainable development of the Arctic territories. Residents consider the logistical inaccessibility of YNAO settlements as a factor that primarily affects the availability of social services, health services, and food security (physical and economic). Along with it, it is also one of the factors increasing migration opportunities of the population.

We offer short-, medium-, and long-term measures to support the sustainable development of the local communities that can improve quality of life in the rural areas of YNAO with consequences on migration strategies of the population:

*Short-term measures:*

- To develop state programmes for subsidising and compensation of logistics costs of delivery and storage of goods and food in the rural areas of YNAO;
- To introduce state programmes for digitalisation of educational, medical, and social services;

*Medium-term measures:*

- To improve the quality of housing (primarily, providing houses with a water supply and sewerage systems);
- To introduce the programmes for developing social infrastructure (for example, increase in the number of feldsher-midwife stations in remote settlements);
- To improve the logistics infrastructure of rural areas (enhance the logistics between the settlements);
- To develop innovative high-tech bioproduction industries in the region (livestock, poultry, aquaculture), including traditional economic activities of local communities;

*Long-term measures:*

- To identify and develop the settlements that can become the “*models of rural cities*”.

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