# Environmental & Human Impact of the Northern Sea Route & Industrial Development in Russia's Arctic Zone

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*The consequences of global climate change are mostly portrayed as negative for environment and society, due to the warming in temperatures. However, there are certain benefits from this process as well. One of them is the opening of a polar shipping route between the Pacific and Atlantic oceans. The Northern Sea Route may cut travel time from Europe to Asia by 40% and allow Russia to export its vast natural resources much faster. Some expert assessments point out that remote northern Russian towns which have been experiencing economic depression in the transition period may turn to economic and social revival. But this process may entail new risks for fragile Arctic ecosystems and traditional nature management by Indigenous populations. Most discussions about Russia's Northern Sea Route focus on shipping traffic, sea ice assessments and expected socio-economic benefits. However, assessments of the impact of further industrialization for the adjacent coastal zone ecosystems and northern residents are still inadequate. Thus, this paper is aimed not only at analyzing the Russian Arctic zone development strategy connected with the Northern Sea Route, but also to highlight the broad spectrum of human and environmental consequences of these activities. Among them, impacts on the economy (national and regional), the environment and population (effects caused by navigation activity and industrialization as well as risks for the coastal ecosystems and Indigenous people) will be assessed.*

## Introduction

Since the beginning of the 21st century the Arctic zone has attracted the attention of many states, including even those which are situated far from it (Germany, China, Japan etc.). This is explained by its richness in natural resources and cultural heritage, and its ecosystem functions and services which are important both at the regional and global scales. Russia is a northern state whose modern economy is closely connected with the economic development of the Russian Arctic zone (Overland, 2010; The Russian Federation Government Program, 2014). Its terrestrial limits were adopted after the President's decree in 2014 (Figure 1). According to the Russian Federation's Policy for the Arctic to 2020 (2009), the Arctic zone of the Russian Federation includes a part of the Arctic which involves, in full or in part, the

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territories of the Republic of Sakha (Yakutia), Murmansk and Arkhangelsk Oblasts (provinces), Krasnoyarsk Kray (provinces), Nenets, Yamal-Nenets and Chukchi autonomous districts, as well as internal maritime waters, territorial sea, exclusive economic zone and continental shelf of the Russian Federation adjoining such territories, areas and islands. The terrestrial area of the Arctic zone is about 3,700,000 km$^2$ and the population is about 2.5 million (encompassing only 2% of the Russian population but more than half of the population of the global Arctic region) (Rosstat, 2015).


***Figure 1**:* The Arctic zone of Russia (Lukin, 2016)

The impact of global climate change has certain benefits for the Arctic zone. One of them is the opening of a polar shipping route between the Pacific and Atlantic oceans. Several important documents concerning economic and social development of the Russian Arctic zone were adopted recently (SAP, 2009; State Program..., 2014; Strategic planning…, 2013; The Federal Law…, 2012; The rules…, 2013). Among the priority targets mentioned in those documents are the revival and development of the Northern Sea Route (NSR), commercial use of the new transport corridor, reconstruction of coastal infrastructure, development of innovation centers etc. (Figure 2) (State Program…, 2014). The NSR is defined as lying between the Kara Gate, at the western entry of the Novaya Zemlya straits, and the Provideniya Bay, at the southern opening of the Bering Strait, for a total length of 5,600 km. There are multiple shipping channels (lines), and the NSR crosses through waters of varying status: internal, territorial and adjacent waters, exclusive economic zone, and the open sea (The Northern Sea Route Administration, 2013). The NSR has been historically important to Russia both economically and socially, especially in the soviet period when it was used solely as a domestic sea route, being closed to international shipping. Today, under conditions of global warming as Arctic ice continues to melt, the NSR is becoming more accessible for navigation (Zalyvsky, 2015). Moreover, Russia has significant interest in transforming the NSR into a strategically important sea line of communication opened to international trade (Strategic planning…, 2013). The NSR may cut travel time from Europe to Asia by 40% and allow Russia to export its vast natural resources much faster (Zalyvsky, 2015). Some expert assessments point out that remote northern Russian towns that have been experiencing economic depression since the period of transition of the 1990s to the early 2000s, may

potentially experience economic and social revival (Gordeev et al., 2011; Kuzmenko & Selin, 2014; Zalyvsky, 2015; Zelentsov, 2012). New economic clusters will be formed, including transportation, providing modern infrastructure (Figure 3).

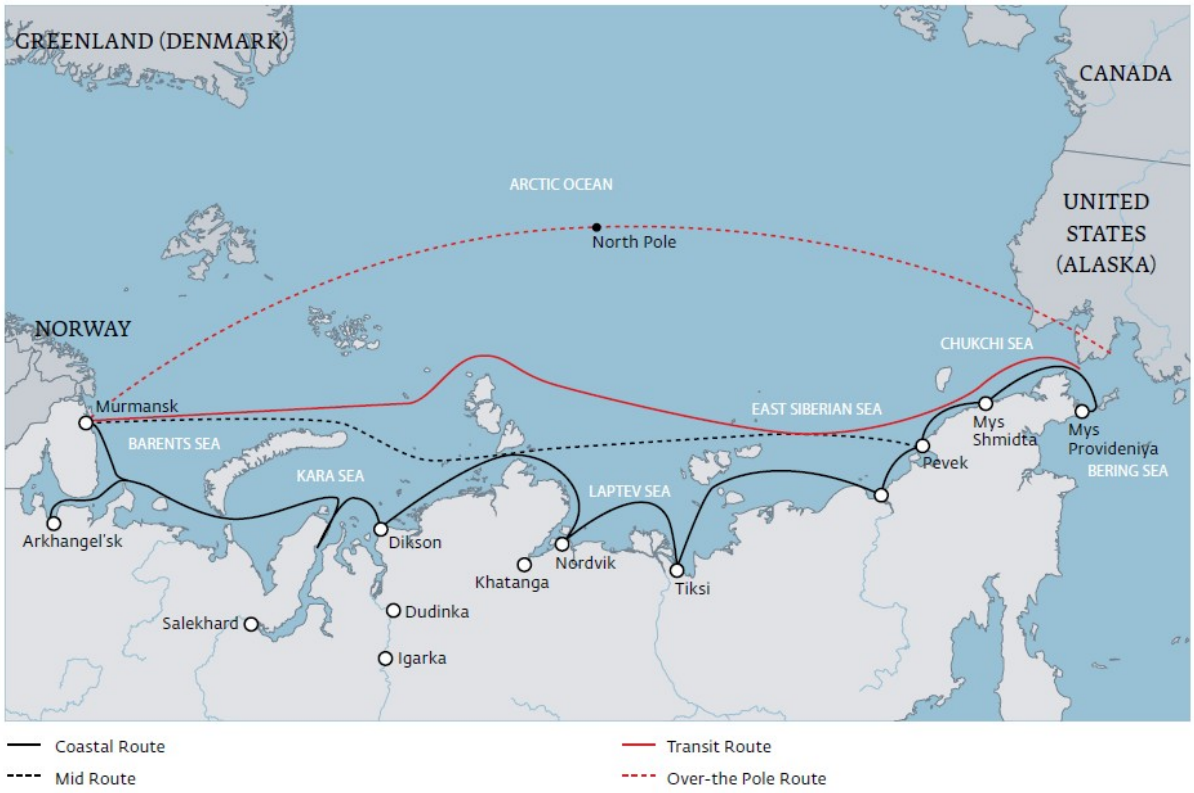


***Figure 2.*** Variants of the Northern Sea Route – shipping corridors (Source: Heininen et al., 2014)

At the same time all of the documents concerning economic and social development of the Russian Arctic zone mentioned above include special sections concerning the connected environmental and social aspects of the economic development plans. They outline activities directed at nature conservation and support for Indigenous populations. In this connection, it is necessary to study the possible negative effects on local populations for monitoring and control.

Most discussions about Russia's NSR focus on shipping traffic and sea ice assessments and expected benefits (Lasserre, 2014; Meng et al., 2017). However, assessments of the impact of further industrialization at the adjacent coastal zone ecosystems and northern residents are still inadequate. Thus, the paper is aimed to analyze the Russian Arctic zone development strategy connected with the NSR and to highlight a broad spectrum of human and environmental consequences of these activities. Among them, the impact on the economy (national and regional) and environment (effects caused by navigation activity and risks for the coastal ecosystems) were assessed. In addition, the consequences that the process of Northern Sea Route development may entail for traditional nature management of Indigenous people as well as human health and well-being of other populations are analyzed.

The study presented in this paper is based on an analysis of Russian Federal and regional documents relevant to the topic. They include social-economic development programs,

Indigenous population support documents, regional reports on environment and human health assessments etc. (e.g., Russian Federation's Policy for the Arctic to 2020 (2009), State Program "Social-Economic Development of the Arctic Zone of the Russian Federation up to 2020").


***Figure 3.*** Basic centers of transport development (Source: Strategic planning of the development of the Arctic zone of the Russian Federation, 2013).

Long term field experiences in different regions of the Russian Arctic enabled the revealing of several gaps concerning possible negative environmental and health impacts. System analysis was the principle method for this study. It also relies on the results of previous research in the framework of the following projects: "Peculiarities of using nature in connection with the conditions of human health in the industrial regions of the Russian North seen from the goal of sustainable development" (2010-2012, Moscow State University), and "Ecological buffer territories as an element of modern nature management structure at the Russian North" (2011-2013, Russian Foundation for basic research). In addition, the study presents the evolution and extension of research conducted within the project "Diagnostic analysis of the environmental status of the Russian Arctic" (2011) supported by the United Nations Environmental Programme (UNEP) and Global Environmental Facility (GEF).

## Economic and Social Revival of Remote Arctic Towns

The Russian Arctic covers about 18% of the Russian Federation (Gordeev et al., 2011; SAP, 2009; State Program…, 2014 etc.). The spatial development of the Russian Arctic is focused predominantly on exploiting natural resources. Historically, the Arctic has played a key role in the Russian economy because of its mineral wealth but also its significance in terms of shipping and transportation (Heininen, et al., 2014; Zelentsov, 2012). The major and biggest northern route lies in this part of the Arctic: the NSR, supplemented by fragments of the Transpolar Railway (Ruxpert, 2015).

The region has a great number of heavy industrial facilities, including some of the world's largest metallurgical plants, quarries, mining and processing enterprises, coal mines, radioactive waste storages and other environmentally hazardous facilities. According to regional assessments (SAP, 2009; Rosstat, 2015), the region holds some 200 billion tons of oil equivalent hydrocarbons as well as mineral and raw energy deposits worth the equivalent of roughly 3 trillion USD. It provides more than 30% of the domestic seafood harvest (Strategic planning of the development of the Arctic zone of the Russian Federation, 2013). The area is also the largest supplier of nickel, gold, copper, tungsten, diamonds, rare metals, and precious stones in Russia (Strategic planning of the development of the Arctic zone of the Russian Federation, 2013). In this sense, turning the NSR into a unified national transport corridor and line of communication for further maintaining the region as a zone of international cooperation is one of the main goals underlined in the Foundations of the State Policy of the Russian Federation in the Arctic to 2020 and Beyond (Medvedev, 2008). According to Russia's plans for 2020 regarding the multifaceted development of its northern territories, the NSR is perceived as a very important factor in the economic and social development of Russia (Bashmackova et al., 2013; Kuzmenko & Selin, 2014; Medvedev, 2008; The Federal Law, 2012; The Northern Sea Route Administration, 2013; Zalyvsky, 2015). Moreover, the Arctic is expected to become Russia's "leading strategic resource base" (Zalyvsky, 2015).

As was already mentioned, the Arctic shipping passage has been used irregularly for about a century, connecting the Atlantic Ocean and markets in the west with the Pacific and its eastern trading partners (Humpert, 2013). However, as Arctic ice in the past years continues to melt, it has brought an increase in the number of commercial transits both for intra-Russian destinational shipping and for international transit shipping (Moe, 2014; Northern Sea Route Information Office, 2015). There are diverse functions for the NSR: global shipping route, strategic point of military control and facilitator of resource extraction. It is expected that not only the shipping industry would be affected by the warming Arctic, but also mineral explorations particularly in northern Russia can be more easily explored due to the melting ice. Furthermore, the Russian economy has grown steadily since 1999 and is supposed to export hydrocarbons from the Russian North either via pipe line southwards or via the NSR westwards (Moe, 2014; Zalyvsky, 2015). Oil and gas are primarily transported from western Siberia to the White and Barents Sea ports via pipelines and by train (Bambulyak & Frantzen, 2005), however, if the NSR was ready for navigation it would reduce the transport time for multiple cargo. Accordingly, it is expected that cost would also be reduced, especially with the anticipated production boom (Zalyvsky, 2015). According to some assessments, it would take only nine days for an oil tanker to travel from the West Siberia and Timan-Pechora basins, via a deep-water terminal on the Barents Sea, to reach the United States, which is much less than a trip from the Middle East or Africa that takes at least two weeks (Heininen et al., 2014). However, as stated by Lasserre (2014), the time and money saved depends on numerous parameters.

Economic development of the coastal zone of the NSR is connected with sea ports infrastructure renovation and construction investment projects that were elaborated and developed by the state in the last years to internationalize the sea route. Among them are new logistic and storage complexes construction in Chersky (the Kolyma river mouth), Belaya

Gora (the Indigirka river), Tiksi (the Lena river), Dudinka and Dixon (the Enisey river), Pevek (Chauna Bay of the Chuckchi Sea), Capes Harasavey (the Kara Sea) and Varandey (the Pechora Sea), the Indiga river mouth (the Barents Sea), Pechenga (the Pechenga river entering Pechenga Bay of the Barents Sea) etc. (State Program…, 2014). Murmansk, Archangelsk and Anadyr airports are planned to be transformed into large transport logistic centers both for national and international communications (Figure 3). According to the Federal program for transport development, 3 billion rubles will be invested to support northern aircraft complexes in 2017-2020.

While the position of the NSR as a global transportation corridor is perceived as uncertain, its use as a route for moving Russian Arctic natural resources to eastern and western markets is emphasized as the most enduring material driver (Bjørkli, 2015; Heininen et al., 2014). For example, the NSR is used year-round by the Russian Nornickel (or Norilsk) mining and smelting company, the world's largest producer of nickel and palladium and one of the leading producers of platinum and copper. Also, the Taymyr Peninsula holds coal and oil deposits, while the Yamal Peninsula holds Russia's largest gas reserves, propelling the transport infrastructure development: a liquefied natural gas terminal, seaport and airport were constructed and a railway line is planned in Sabetta (Gordeev et al., 2011; Heininen et al., 2014). At least one platform for offshore oil extraction is in permanent operation in the Pechora Sea. For all these industries, the NSR is an important route for raw building materials and supplies. According to regional reports (Northern Sea Route information office, 2015; Rosstat, 2015), usage and viability of the NSR as an export route to deliver natural resources out of the Arctic to the markets is on the rise. For these territories, the NSR is perceived as a national transport communication route, and a key factor in the dynamic economic recovery of each of the Arctic regions recognized as a strategic reserve of the country (Zalyvsky, 2015).

However, the route still suffers from a general lack of backup infrastructure such as shipment and repair docks, fueling stations and communication, rescue and navigation hubs. Economic crises made the modernization of equipment slow. Berthing facilities in the majority of Arctic ports need repairs as well as reconstruction and dredging to receive modern vessels. In many ports, facilities for recycling are in critical condition. Thus, necessary modernization of the NSR is required, as well as surrounding infrastructure to ensure the viability of the maritime industry. As the Russian government considers the NSR an effective resource for developing the Russian Arctic Zone – both domestically and internationally – it plans to make considerable investments in the NSR and bring its infrastructure in line with international standards. The inclusion of the Northern Sea Route in the priorities of the "Transport Strategy of the Russian Federation until 2030" opens the way for investments in the technological enhancement of transportation infrastructure (Zalyvsky, 2015). The revival of some seaports (e.g., Tiksi) and the construction of a railway to Yakutsk are real steps in developing a new prospective transport corridor from Asia to Europe. The more such projects develop, the faster the population and business areas of the Arctic would be satisfied by the positive influence of the NSR and its role in strengthening the country's geopolitical position. According to some economic assessments (Bashmakova et al., 2013; Zalyvsky, 2015), the NSR will be a catalyst

for attracting federal taxpayer funding, a macroeconomic sponsor of modernization of business in municipalities of the Russian Arctic.

## Impact on the Environment: Actual and Potential Risks

Geographically, the territory of the Russian Arctic is characterized by vast expanses of tundra and forest-tundra, islands featuring polar deserts and semi-desert terrain, mountains, lakes, streams and surrounding shelf seas. The area is rich in wildlife with nearly every species of Arctic mammal, including polar bears, Arctic foxes, Greenland whales, narwhals, beluga whales, Atlantic walruses, ringed seals, thousands of wild reindeers and about 1000 varieties of plants (Gordeev et al., 2011). The area is located within the harsh climate conditions of the Arctic and subarctic climate: low temperatures, heavy snow and short, light summers, permafrost, and ice cover in the seas and rivers characterize the Arctic zone during the long winters.

Although climate change will allow better shipping routes in the Arctic within the coming decades, there is concern about the impact on Arctic ecosystems. The inevitable growth in anthropogenic impact connected with environment mechanical disruptions and pollution may produce negative environmental changes causing several social effects which are necessary to monitor.

The current environmental situation in the Russian Arctic is a result of intensive industrial activities from the past 80 years. According to different assessments (Dushkova & Evseev, 2012; Gordeev et al., 2011), the territory of anthropogenic transformation of the ecosystems covers 5–10% of the total areas of the Russian Arctic. However, even in the context of extremely low population density of 1–2 persons per $km^2$ (it is almost 10 times lower than the average in Russia), anthropogenic stress here is significantly higher than in the non-Russian Arctic. Twenty-seven of the so-called impact zones have been identified (the number varies depending on actual and potential risks) where pollution has led to environmental degradation and increased morbidity among the local population. The main impact zones include the Murmansk Region (10% of total pollutants from the 27 impact zones), Norilsk urban agglomeration (more than 30%), West Siberian oil and gas fields (more than 30%) and the Arkhangelsk Region (around 5%) (Gordeev et al., 2011; Dushkova & Evseev, 2012).

According to different forecasts, maritime traffic within the NSR in the Arctic region will increase the risk of accidents, which pose an environmental hazard (Bjørkli, 2015; Gordeev et al., 2011; Heininen et al., 2014). Thus, drilling in the Arctic is connected with a risk of oil spills and fracturing of the Arctic's ecosystems. However, taking precautionary steps may mitigate these potential harms if concerns are taken seriously and investments in extra safety measures and emergency response infrastructure are made (Heininen et al., 2014). The recent international Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response, signed under the auspices of the Arctic Council in May 2015, is a helpful step in the effort to address environmental threats but is still insufficient to solve the problem. There are currently two main official documents – the Federal Law on the NSR (2012) and the Ministry of Transport's Rules of Navigation through the NSR (2013) – that stipulate conditions of transit and impose new insurance requirements, under which responsibility for possible environmental damage and pollution lies with ship owners, and which set rather

costly tariffs for assistance and logistics. In 2014-15, the international Polar Code of Safety for Ships Operating in Polar Waters was adopted by the International Maritime Organization (IMO) and entered into force in January 2017.

The marine environment within the NSR may be subjected to both types of pollution, the operational and accidental pollutions, which may carry significant environmental consequences. The rise in shipping traffic may make the NSR extremely vulnerable to pollution threats such as, exhaust, sewage and garbage from new maritime traffic. Although the majority of ships operating in the NSR are already equipped with pollution prevention equipment to deal with threats, unfortunately not all the requirements may be implemented nowadays. Among them is water pollution from daily activities such as cooking and showering, which is considered by the Arctic coastal states as a minor threat to the environment, and hence is not included in national regulations (Gordeev et al., 2011; Essallamy 2008; Heininen et al., 2014). Another problem is connected with the accidental pollution mentioned above.

Despite numerous environmental problems, which occur in up to 10% of the Russian Arctic, vast areas of its territory are still almost pristine and it remains a biosphere resource of global importance (Gordeev et al., 2011). In fact, it may take several decades of monitoring to determine the potential effects of opening the NSR for international shipping traffic on the natural environment (Dushkova & Evssev, 2012; Heininen et al., 2014). Moreover, ecosystem studies in the Arctic Ocean suffer from high costs (i.e., surveying is extremely expensive), harsh climatic conditions, time constraints, and a lack of infrastructure in remote Arctic areas. Long-term studies are needed to analyze the impact of further intensive development of the NSR shipping on Arctic ecosystems and humans.

## Potential Impact on Indigenous Populations

There is a wide recognition that natural-resource dependent communities in the developing world are especially vulnerable to environmental hazards and environmental change (Bogoyavlensky, 2008; Krasovskaya & Tulskaya, 2013). During the long history of their living and coexisting with nature, northern communities have accumulated valuable knowledge about adapting to the region's unique environmental conditions. Active industrial development in the Russian Arctic during the 20$^{th}$ century, and the disregard of environmental imperatives in the pursuit of economic goals, has caused dramatic environmental change and negative consequences on the living conditions of Indigenous populations in various Arctic regions (Bogoyavlensky, 2008). The development of the NSR may produce an additional impact on the vulnerability of Arctic communities due to changing societal and environmental conditions.

Russia is the largest Arctic country, as it has half of the land area in the Arctic and about half of the total Arctic coastline. In addition, the largest domestic Arctic population is found in Russia, numbering approximately 2.5 million individuals, among them 82,500 belong to 20 different Indigenous groups (Bogoyavlensky, 2008, Tishkov, 2014). The following live in the coastal zone and adjacent territories: Saami, Nenets, Dolgans, Evenks, Yukagirs, Chuckchi, Evens, Eskimo, Koryak. Many of them are still occupied in traditional nature management/subsistence lifestyles (e.g., reindeer herding, fishing, hunting, etc.) and 25% are

nomadic or partly nomadic and annually migrate from Arctic areas to the sub-Arctic and back (Figure 4). Thus natural landscapes provide Indigenous peoples well-being and are an important ethnic-forming factor.

The negative impact on the living conditions of Indigenous peoples has mainly resulted from a forced change of lifestyle (Dushkova, 2017). Among the main reasons, which affect the original habitat of the Indigenous peoples of the Russian Arctic, are increasingly the environmental risks caused by active industrial development and processes associated with climate change. In particular, domesticated reindeer populations are decreasing due to the degradation of winter reindeer pastures by mechanical disruptions connected with infrastructure and industrial sites development, industrial pollution (mining, oil and gas industries) and overgrazing. Consequently, it leads to greater pressure on fragile tundra and forest tundra ecosystems and impacts other types of conventional land use by Indigenous populations (hunting, fishing, foraging).

According to some assessments (Gordeev et al., 2011; Dushkova, 2017; Dushkova & Evseev, 2012), anthropogenic factors affecting the original habitat of Indigenous populations of the Russian Arctic include impact of industrial facilities on reindeer pastures and hunting grounds covering up to 40% of the traditional land use areas. Areas with a high level of anthropogenic impact on territories of traditional land use include: the central part of the Kola Peninsula, Timan-Pechora, Vorkuta, Pur-Nadymsky, Yamal, Norilsk, Anabarsky, Yano-Indigirsky, Valkumeysky and Bilibinskiy regions. In addition large-scale tundra reindeer breeding already suffers from processes of climate change (frequent ice covering of the ground, and summer temperature rise over $10^0$C resulting in herd loss). The effects of climate change also impacts other types of conventional land use (hunting, fishing etc.).

A B

***Figure 4.*** Life camp herders: Saami in Lovosero tundra, Murmansk region (a), Nenets in Nents Autonomous district (b)

Economic development in the coastal zone may cause conflictual situations for the management of traditional and modern practices. It includes the increase of industrial, settlement, transport and recreation centers which may have negative effects on traditional nature management lands. Their possible variants are shown in Table 1, presenting the so-called nature management conflict matrix (Krasovskaya, 2008). It presents the overlapping of territories exploited for different types of nature management and its ecological effects.

***Table 1.*** Traditional nature management possible conflicts matrix (Krasovskaya, 2008)

| **Economic activity in traditional land management** | **Potential types of nature management/type of impact on traditional** | | | | |
|---|---|---|---|---|---|
| | **Industrial** | **Marine transport** | **Terrestrial transport** | **Settlement** | **Recreational** |
| Reindeer breeding | +/pollution | | +/pastures fragmentation | | +/poaching |
| Marine fishing and hunting | | +/pollution, noise | | | Disturbances of sea animal populations |
| Fishing | +/pollution | | | +/pollution | +/depletion of fish resources |
| Hunting | +/habitats disturbances (chemical and noise pollution) | | +/habitats fragmentation | +/poaching | +/depletion of hunting resources |
| Wild plants picking | +/pollution | | | +/depletion of resources | +/depletion of resources |

"+" means potential impact

The vulnerability of Indigenous peoples in the Arctic results from their strong dependence on the use of biological resources – hunting and fishing, especially using a small number of species. Not only industrial impact s(e.g., environmental pollution and landscape transformation) but also consequences of climate change (e.g., reduced sea ice area and its effect on the ringed seal and polar bear etc.) will affect the traditional way of life of Indigenous populations making them more vulnerable to these hazards. In addition, changes in food supply may have the most negative health impacts for Indigenous peoples. Consuming animal food is vital not only for the health, but also for the personal and cultural well-being of Indigenous populations. High levels of stress and even a negative transformation of the traditional way of life poses the risk of not being able to gain access to, and to eat traditional foods because of the high level of industrial pollution or depletion of biological resource potential (wild food resources) (Dushkova, 2017).

Adaptation capacity to such hazards depends greatly on lifestyle, sex, access to resources and other factors (e.g., during soviet times the majority of the population had to switch to a sedentary life that poses more pressure on natural resources etc.) (Revich, 2008). Additional stress and increasing vulnerability provide living in small isolated rural communities with underdeveloped social systems, poor infrastructure, and underdeveloped or remote public health systems. Of great importance are low-income levels, high unemployment rates, poor sanitation, etc.

To complete the data, the semi-structured interviews were carried out between 2006 and 2013 in different localities of Murmansk Oblast, Nenets Autonomous District and the Komi Republic. A key interest was to find out how local inhabitants (Indigenous peoples of the

North) evaluate and interpreted environmental change since the industrialization era (i.e., environmental degradation, visible elements, landscape planning etc.), assuming that they are direct consumers and managers of landscape biological resources due to specific relations with spatial surroundings of their every-day life. We conducted 38 semi-structured individual interviews (19 in Murmansk Oblast, 8 in Nenets Autonomous district and 11 in Republic of Komi). In each case study region, both male and female adult residents from Indigenous populations (e.g., Saami, Nentsen and Komi Izem), ages 14 to 62 years, were interviewed from various social and occupational backgrounds. Some of the interviews were based on several meetings; they ranged from 38 to 92 minutes, were conducted in the Russian language and were recorded. The interviews addressed participants' perception of the environmental situation and its dynamics, its significance and impact on their lives, their relationship to nature and feelings of regional identities, and dependence. (For further interpretation, they were transcribed.)

As indigenous peoples stated in their interviews, the main cause of negative change was the destruction of the traditional way of life. Thus, for Saami living in Lovozero on the Kola Peninsula, the improvement of environmental quality – affected by industrial pollution and ecological degradation – is a greater priority than the improvement of housing conditions, which are poor. Not only the Saami, but also the Nenets and Komi Izem reported that the climate is becoming less comfortable than in the past for their livelihoods and health. Local Nenets villagers worry about water quality, land and biodiversity being affected by casual oil spills and poaching. Despite acquiring several hectares for reindeer herding according to federal and local legislation protecting their lands, the Nenets feel the impact of the increase of transportation vehicles. Past incidents such as the bursting of pipelines in 2002 which relocated 20,000 herders, symbolize the vulnerability of Indigenous people's territories. Here we may experience the ambivalence of the processes regarding the NSR development: on the one hand, it promotes job employment, while on the other local companies hire workers from other regions. (The environmental impacts are felt locally, but the economic impacts are not.) Although pipelines along the NSR do increase the land's strategic worth, it induces the price of relocation, harms wildlife and promotes badlands development (Gordeev et al., 2011; Meschtyb et al., 2005).

One of the key environmental hazards posed by the NSR that is forced upon the Arctic Indigenous population (e.g., Nenets, Saami) is the negative impact on reindeer herding that is necessary for employment, food and also for cultural identity and cultural heritage preservation (Dushkova, 2007; Krasovskaya & Tulskaya, 2013; Meschtyb et al., 2005). Although reindeer herding is essential to all parts of the land, the NSR places a greater burden on rural villagers. Urban locals develop a short term gain from the NSR's boom of trade and transit due to greater transportation access and job employment from oil fields. Rural locals suffer greater consequences as their food resources (elk, fish, and reindeer) are hunted to feed urban workers (Krasovskaya & Tulskaya, 2013; Meschtyb et al., 2005).

Often conflicts appear because of the fact that traditional land use areas are mainly located within zones of political and economic interests of newcomers, particularly those concerning oil, mineral, and timber production. As reported in interviews, the majority of Indigenous peoples consider poaching, forest fires caused by humans, industrial logging, and clearing of

forests for firewood to be some of the most significant issues that affect the physical environments and well-being of their communities. They have often identified the increasing expansion of the oil and gas industry in the Russian Arctic in the last decade as threatening their traditional way of life. Therefore, the preservation of native habitats and traditional land use of Indigenous peoples are of vital importance for them.

An integrated analysis of new clusters of economic development connected with the renovation of the NSR, alongside Indigenous population distribution in the coastal zone, has revealed where new potential impact zones and a reactivation of existing conflicts with traditional nature management are possible. Regions of existing and emerging environmental hot-spots were identified through an ecological hot-spots map (Evseev et al., 2009), the state documents mentioned above, and from field data published in our previous research (Krasovskaya, 2008, 2011, 2016; Evseev & Dushkova, 2011 etc.). They include the Indiga river mouth, cape Varandey, the eastern Yamal peninsula, the Yenisey and the Yana downstream area.

Today, in spite of the existing protective legislation, it is rather difficult for Indigenous peoples to obtain rights for natural resource use; as well they are being affected by the depletion of resource potential in all sectors of traditional land use. The growing attention to this problem, including through international cooperation, creates a possibility that in furthering economic expansion in the Arctic and sub-Arctic regions, the interests of indigenous peoples will be considered, and that a reliable framework that ensures the preservation of traditional land use and life support of Indigenous population will take shape. The delimitation of traditional land use territories is still the best case scenario for the conservation of natural resources and a support framework for traditional lifestyles of Indigenous peoples (Tishkov, 2014). The existence of such special protected areas could contribute to the preservation of biodiversity and Indigenous communities, as well as promote Indigenous participation in natural resource management.

## Conclusions

The activization of national and international interests in the Northern Sea Route occurred due to modern geopolitical processes and economic developments of the Arctic zone in the Russian Federation and worldwide. According to our analysis, the NSR renovation presents both benefits and problems in the coastal zone. Benefits are connected with the economic development of the Russian Arctic, an increase in international trade, the appearances of new employment opportunities for local populations, new technologies, etc. The integration of regional ports and towns within the NSR to the economic development of the Arctic, of course, will be essential for optimism and business promotion, the civic engagement of business and the local populations, and the formation of alternate public opinions about these remote territories (Zalyvsky, 2015). However, its development may also cause some negative impacts such as environmental degradation due to regular oil spills, deterioration of living conditions of local populations (i.e., local landowners, disruption of the traditional land use of the Indigenous population), increase security dilemmas and accelerate climate change (Heininen et al., 2014). New strategic development plans of the NSR's development

demonstrate awareness of these potential problems and outline general approaches to mitigate them. That is why the study of these problems is urgently needed now, in order to elaborate practical measures. Of special importance among them are detailed assessments of the adaptive capacity of traditional land users and the accumulated traditional knowledge for dealing with environmental risks, especially to loss of traditional culture and social identification. Based on the analysis of current state economic and political interests, one may conclude that Russia is open and willing for cooperation with foreign partners that can contribute to exploiting Arctic natural resources, developing sea routes and solving the numerous socioeconomic and environmental problems of the region (Heininen et al., 2014). One of them is appealing to the administration of the NSR as the main state supervisor and the subject of Arctic shipping organizations to ensure the rational use of the NSR, and provide for the ecological safety of the environment and local Arctic communities (Zalyvsky, 2015).

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