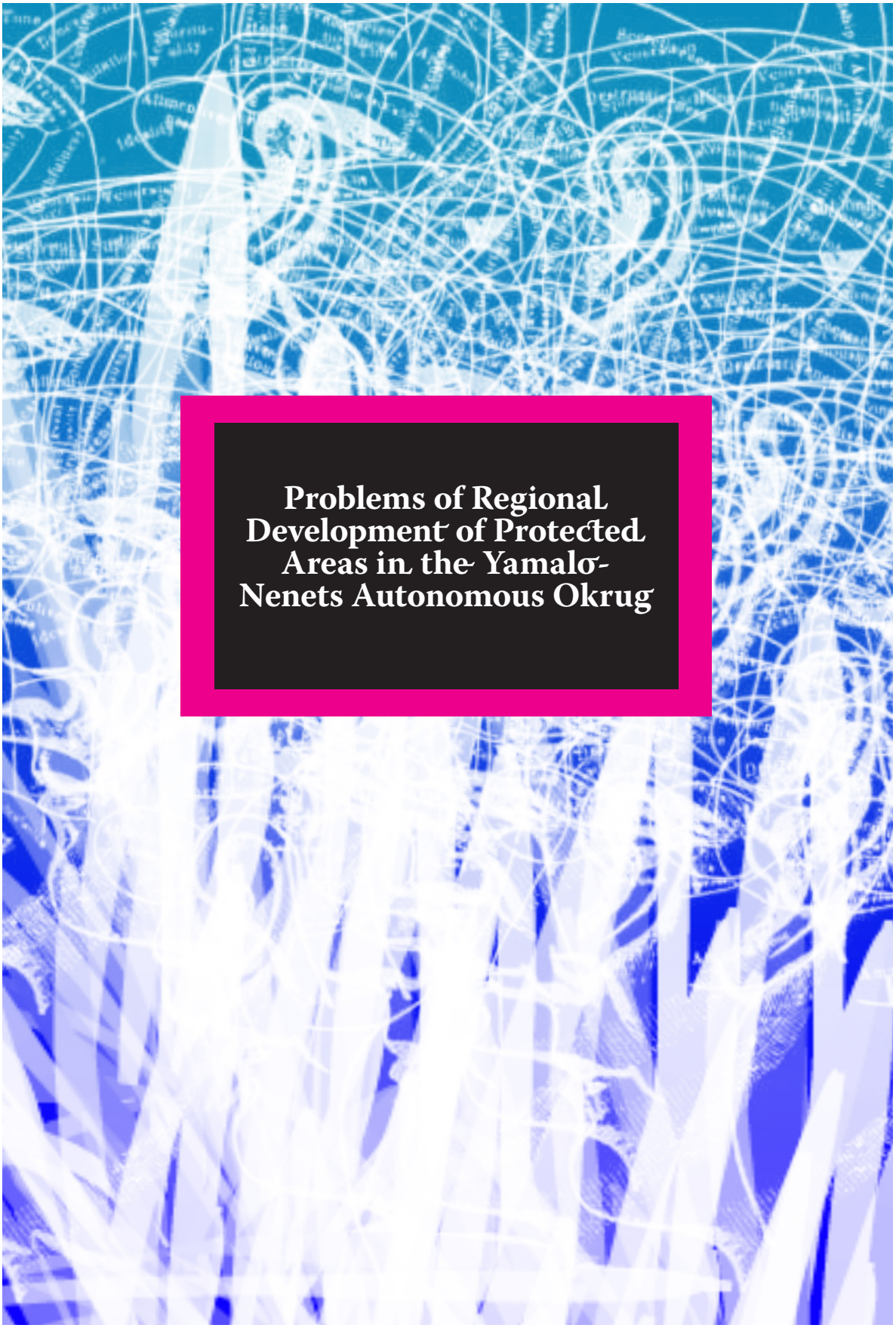

Problems of Regional Development of Protected Areas in the Yamalo-Nenets Autonomous Okrug

PROBLEMS OF REGIONAL DEVELOPMENT OF PROTECTED AREAS IN THE YAMALO-NENETS AUTONOMOUS OKRUG

PROBLEMAS DEL DESARROLLO REGIONAL DE ÁREAS PROTEGIDAS EN EL OKRUG AUTÓNOMO DE YAMALO-NENETS

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Abstract

The paper briefly overviews the development of the regional network of protected areas (PAs) in Yamalo-Nenets Autonomous Okrug (YNAO). The network of PAs of YNAO includes PAs with a variety of statuses (federal, regional, and local importance) and categories (from natural monument to nature reserve), which are intended to prevent irreversible processes in ecosystems and ensure the conservation and balanced use of natural resources. Protected areas are distributed across the YNAO unevenly, and functionally, they only weakly link elements of ecosystems and landscapes into a unified natural and economic system that preserves the biological and landscape diversity. Very few protected areas have been established in wetlands that are candidates for inclusion in the list of Ramsar sites. Optimization of protected areas and amendment of their boundaries involves the integration of approaches and targeted coordinated research by professionals in a variety of fields. Obtaining evidence-based, stable time series of variables that characterize natural and natural-anthropogenic YNAO ecosystems requires coordinated, comprehensive, and prolonged research projects across all the existing protected areas and areas to be protected in the future. The zoning of the Yamalsky State Natural Sanctuary of Regional (Okrug) Importance should be revised. In the future, transboundary protected areas should be established with the Republic of Komi and Krasnoyarsk Krai. Another pressing concern is the need for an integrated survey of island ecosystems and landscapes to prepare a feasibility study for the establishment of Arctic Island Marine Nature Reserve that will include the islands Bely, Vilkitsky, Shokalsky, and Neupokoev.

Keywords: Nature reserve, sanctuary, nature park, natural monument, ethnic territory, Yamalo-Nenets Autonomous Okrug, Russian Arctic, biological and landscape diversity, acclimation, indigenous small-numbered peoples of the North.

Resumen

El documento resume brevemente el desarrollo de la red regional de áreas protegidas (AP) en Okrug autónomo de Yamalo-Nenets (YNAO). La red de AP de YNAO incluye AP con una variedad de estados (importancia federal, regional y local) y categorías (desde monumento natural hasta reserva natural), que tienen como objetivo evitar procesos irreversibles en los ecosistemas y garantizar la conservación y el uso equilibrado de recursos naturales. Las áreas protegidas se distribuyen en todo el YNAO de manera desigual y funcional, solo vinculan débilmente elementos de ecosistemas y paisajes en un sistema natural y económico unificado que preserva la diversidad biológica y paisajística. Muy pocas áreas protegidas se han establecido en humedales que son candidatos para su inclusión en la lista de sitios Ramsar. La optimización de las áreas protegidas y la enmienda de sus límites implican la integración de enfoques y la investigación coordinada dirigida por

profesionales en una variedad de campos. La obtención de series temporales de variables estables basadas en la evidencia que caracterizan los ecosistemas YNAO naturales y antropogénicos naturales requiere proyectos de investigación coordinados, integrales y prolongados en todas las áreas protegidas existentes y áreas que se protegerán en el futuro. La zonificación del Santuario Natural Estatal de Importancia Regional (Okrug) de Yamalsky debe revisarse. En el futuro, se deben establecer áreas protegidas transfronterizas con la República de Komi y el Krai de Krasnoyarsk. Otra preocupación apremiante es la necesidad de un estudio integrado de los ecosistemas y paisajes de las islas para preparar un estudio de viabilidad para el establecimiento de la Reserva Natural Marina de la Isla del Ártico que incluirá las islas Bely, Vilkitsky, Shokalsky y Neupokoev.

Palabras clave: Reserva natural, santuario, parque natural, monumento natural, territorio étnico, Okrug autónomo de Yamalo-Nenets, Ártico ruso, diversidad biológica y paisajística, aclimatación, pueblos indígenas del norte con pequeños números.

Introduction

To create an optimal regional network of protected areas (PAs) and determine an effective strategy for its development in the Yamalo-Nenets Autonomous Okrug (YNAO), it is necessary to assess the impact of approaches to territorial conservation of biodiversity at various times. As pointed out by V. V. Dezhkin, the role of protected areas grows as the biosphere is degraged and environmental crises aggravate (Dezhkin, 1993). They help maintain general and regional balance, preserve natural resources and have an impact on the moral environment in the society that is concerned with growing environmental ill-being of the Earth.

Development of Yamal's oil and gas resources is the largest energy project in the history of the Russian Federation with unprecedented complexity: the peninsula has about 75% of Russia's proven reserves of natural gas (22% of the world's reserves). The significant increase in oil and gas production entails environmental problems. Solving the problems of greener production and non-production activities largely determines the transition to the sustainable development of the region, since the across-the-board integration of the environmental factor into human activity will ultimately make it possible to harmonize the relationships with nature (Granberg et al., 2002).

The problems of reservation and optimization of land use regime of exemplary YNAO areas has been repeatedly addressed by researchers with regard to conservation of landscape and biological diversity (Gileva, 2015, Bogdanov et al., 2004, Degteva et al., 2015, Kulyugina, Patova, 2011, Getsen, 2007, Rozenfel'd, 2016).

Materials and methods

Approaches to solving this problem are based on the use of comparative geographical, landscape-geochemical, ecological-economic, and other methods to analyze and summarize the extensive evidence collected for the past 26 years. The baseline data for these materials were also the data from long-term monitoring of the network of PAs in YNAO, legislation on the establishment and functioning of protected areas, and materials that come to the YNAO Department of Natural Resources, Forest, and Oil and Gas Complex, etc.

Findings

A new trend in the development and expansion of a representative network of PAs should be evidence-based and inclusive of the whole zonal and landscape diversity of YNAO. At this point, YNAO has 14 protected areas that make up 10.8% of its total area. That compares with 237 PAs occupying 13.5% of the area of the neighboring Komi Republic and 26 PAs occupying only 6.4% of the area of Khanty-Mansi Autonomous Okrug. Theoretically, a representative system of environmentally linked PAs should be at least 17% of the terrain and preserve natural diversity to the fullest extent possible (Ministry of Natural Resources and the Environment of the Russian Federation, 2015).

As of May 2019, the network of YNAO PAs includes PAs with a variety of statuses (federal, regional, and local importance) and categories (from natural monument to nature reserve), which are intended to prevent irreversible processes in ecosystems and ensure the conservation and balanced use of natural resources. In YNAO, two PAs of federal importance occupy 1.96% (1,509,000 hectares) of its total area. PAs of regional importance make up 8.86% (6,815,000 hectares) of the total Okrug's area and include 10 state nature sanctuaries, which are managed by YNAO Department of Natural Resources, Forest and Oil and Gas Complex (Morgun, Istrati, 2019) (Table 1).

Table 1. Network of protected areas in YNAO

No.	**Protected area**	**District**	**Category**	**Profile**	**Area (hectares)**	**Year of establishment***	**IUCN category**
Federal Protected Areas							
1	Gydan	Tazovsky	Nature reserve	Nature	878,174.00	1996	Ia
2	Verkhne-Tazovsky	Krasnoselkupsky	Nature reserve	Nature	631,308.00	1986	Ia
Regional Protected Areas							
3	Nizhne-Obsky	Yamalsky	Sancruary	nature, game	142,203.92	1985	Ib, IV
4	Nadymsky	Nadymsky	Sancruary	Biological	562,995.51	1986	Ib, IV
5	Polar Ural	Priuralsky	Natural Park		310,069.70	2005 (1997)	III, IV
6	Kunovatsky	Shuryshkarsky	Sancruary	nature, game	252,960.57	1985	Ib, IV
7	Poluysky	Priuralsky	Sancruary	Nature	63,196.00	2011 (1995)	III, IV
8	Verkhne-Poluysky	Priuralsky	Sancruary	Biological	195,322.00	2009	III, IV
9	Sobty-	Priuralsky	Sancruary	Biological	358,429.	2010	III, IV

	Yugansky				00	(1971)	
10	Yamalsky	Yamalsky	Sancruary	Biological	4,113,685.7	2006 (1977)	III, IV
11	Pyakolsky	Krasnoselkupsky	Sancruary	Biological	438,560.00	2005 (1996)	III, IV
12	Messo-Yakhinsky	Tazovsky	Sancruary	Biological	86,033.00	2005 (1976)	III, IV
13	Kharbey	Priuralsky	Natural Monument	Geologic	650.00	1999	III, IV
14	Synsko-Voikarsky	Shuryshkarsky	Sancruary	Nature	292,049.00	2017 (1994)	III, IV

Note: the parenthesized year is the year of establishment of PAs, the year with no parentheses is the year of approval of the latest change in the status of PAs

In addition to the protection of wildlife and fauna of YNAO, typical ecosystems of tundra, forest tundra, Polar Urals, rivers, lakes and swamps, each PA in the Okrug has its own special mission. For example, the Polar Ural Nature Park specializes in acclimation of muskox, Kunovatsky Biological Sanctuary is focused on the protection of the Siberian white crane (the sacred bird for indigenous small-numbered peoples of the North), the work of Messo-Yakhinsky Biological Sanctuary is mostly focused on the preservation of mass nesting sites of Bewick's swan, greater white-fronted goose and other rare species of waterbirds. In YNAO, polar bear, peregrine falcon, western capercaillie, red-breasted goose, wild reindeer, and other animals are protected.

However, the spontaneous planning of PAs, which has been actively carried out in YNAO, is not quite in line with the current national priority goal to maintain the ecological balance in the region: each natural area should be represented in a natural refuge, where typical and unique natural-territorial habitats would be protected. Analysis of materials showed that when planning new PAs, this principle, more often than not, was followed only formalistically (References 11–13).

In this paper, we review the period since 1993, when the trend started of changing the boundaries and statuses of existing PAs and establishing new ones (Figure 1). Between 2000 and 2019, the total area of the PAs in YNAO decreased.

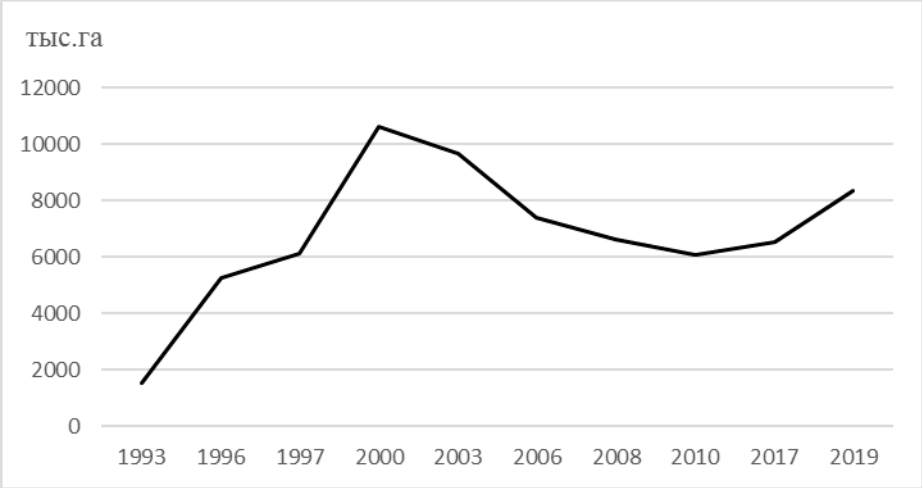

Figure 1. Changes in protected areas in YNAO between 1993 and 2019

Among Pas of federal importance, only the boundaries of Gydan State Nature Reserve did not change, while Nadymsky and Nizhne-Obsky nature sanctuaries of federal importance were transformed into nature sanctuaries of regional importance. The total area of PAs changed due to the establishment of new Pas of regional importance, their removal from the register of Pas of okrug importance, or the reduction of the areas of Pas of local importance.

For instance, in 1993, the network of YNAO PAs included: one state reserve of federal importance (Verkhne-Tazovsky — 1,211,975 hectares), one state nature sanctuary of republican importance (Nizhneobsky — 128,000 hectares), three nature sanctuaries of regional importance (Evo-Yakhinsky — 120,000 hectares, Kunovatsky — 220,000 hectares, Nadymsky — 546,000 hectares), and five nature sanctuaries of local importance (Messo-Yakhinsky — 103,000 hectares, Chaselsky — 92,000 hectares, Tydy-Ottinsky — 40,000 hectares, Sobty-Yugansky — 175,000 hectares, Yamalsky — 1,402,000 hectares). In addition, in Shuryshkarsky District of YNAO, one Synsko-Voykarskaya ethnic territory was detached that holds a great significance for reproduction of whitefish and hucho taimen, preservation of Red-Book flora and fauna species. Thus, the land intended for nature protection in YNAO occupied the area of 1,509,482 hectares (14).

In 1996, the network of PAs in YNAO included: two nature reserves of federal importance (Verkhne-Tazovsky — 1,212,000 hectares and Gydansky — 878,174 hectares), three nature reserves of republican importance (Kunovatsky — 220,000 hectares, Nizhneobsky — 128,000 hectares, Nadymsky — 564,000 hectares), eight zoological sanctuaries of okrug importance (Yamalsky — 1,402,000 hectares, Sobty-Yugansky — 175,000 hectares, Evo-Yakhinsky — 120,000 hectares, Tydy-Ottinsky — 40,000 hectares, Messo-Yakhinsky — 130,000 hectares, Chaselsky — 92,000 hectares, Polar Ural — 31,000 hectares, Pyakolsky — 250,000 hectares), and one Synsko-Voikarsky ethnic territory [15]. The total area of Pas amounted to 6.8% of YNAO's territory. In order to preserve the unique natural, historical, and ethnographic monuments, protect the places of residence of the indigenous small-numbered peoples of the North, the administrations of YNAO and Khanty-Mansi Autonomous Okrug (KhMAO) decided to create an ethnic and natural park called "Numto" on a cross-border area (Nadymsky district of YNAO, Beloyarsky District

of KhMAO). The ecological, ethnographic, and legal feasibility study of this protected area has been prepared. The project was supported by KhMAO's government and in 1997, the Numto Natural Park of Okrug Importance was established in Ugra (the Resolution of the Governor of KhMAO No. 71 dated January 28, 1997, "On the establishment of Numto Natural Park of Okrug Inportance in Khanty-Mansi Autonomous Okrug") (16). The project was not supported in YMAO (17).

In 1997, another two state zoological sanctuaries of orkug importance were added to the above territories (Gornokhadatinsky — 157,000 hectares and Varka-Sylsky — 703,200 hectares) (YNAO Registry of PAs for 1997). The total area of PAs grew to 7.5% of the Okrug's territory.

In 1998, six state nature sanctuaries were established: Gornokhadatinsky biological sanctuary, Polar Urals biological sanctuary, and Sobty-Yugansky sanctuary (Priuralsky District), Yamalsky integrated nature sanctuary, Yadayakhadinsky, and Nizhneobsky nature sanctuary (Yamalsky District) (19). In 1999, another two state nature sanctuaries were established in Shuryshkarsky District — Kunovatsky and Bolsheobsky nature sanctuaries (20). Thus, in 1999, two state nature reserves, three biological sanctuaries of federal importance, nine state biological sanctuaries, and one district ethnic territory with a special environmental regime of okrug importance were already operating. The area of PAs totaled 9.9% of the Okrug's area.

In 1998–1999, the YNAO Department of Game Resources completed the project called "Preparation of a Feasibility Study and Arrangement of the Gydoyamovsky State Zoological Nature Reserve". The second step, the "Draft Design of Gydoyamovsky Biological (Botanical and Zoological) Sanctuary" project, was completed by research staff of the Central Research Laboratory at the Department for Protection and Rational Use of Game Resources (Ministry of Agriculture of the Russian Federation, Moscow). Further, Sibrybniiproekt Institute (Tyumen) prepared a project called "Design of Protected Area: Tazovskaya Guba Nature Sanctuary". Both projects were submitted to the YNAO Tazovsky Committee for Nature Protection (20).

In 2000, the network of PAs included two nature reserves (1,509,482 hectares), 13 nature sanctuaries (3,987,000 hectares), one natural geological monument (0.65 thousand hectares) and one ethnic territory (2,050,000 hectares). In addition, the area of local nature sanctuaries amounted to 3,075,000 hectares. The total area of the YNAO PAs amounted to 7,547,132 hectares, and in combination with the local PAs — 10,622,132 hectares. This was the maximum area in the period of 1993—2019. (Figure 1) (21).

In 2003, in Purovsky district, two PAs were excluded from the registry of Pas of okrug importance. They had been created on March 25, 1985 to protect the population of wild reindeer, elk, upland game bird: Evo-Yakhinsky State Zoological Reserve (120,000 hectares) and Tydy-Ottinsky State Zoological Nature Sanctuary (40,000 hectares) (the Resolution of the Governor of YNAO No. 131 dated April 16, 2003) (22). Further, Chaselsky State Zoological Sanctuary was closed in Krasnoselkupsky District. This reserve (92,000 hectares) was established on December 25, 1995 to protect such species as elk, wild reindeer, sable, ondatra, squirrel, ermine, upland game bird, geese.

Moreover, Varka-Sylsky Biological Sanctuary reserve (703,200 hectares) was also removed from the Registry of PAs of okrug importance of Krasnoselkupsky District. The reason for that has not been found in the state archive of YNAO.

In 2006, the network of protected areas of YNAO included two state reserves (Gydan State Nature Reserve — 4,771 hectares and Verkhne-Tazovsky State Nature Reserve — 633,308 hectares); three state reserves of federal importance (Nizhne-Obsky — 128,000 hectares, Kunovatsky — 220,000 hectares, and Nadymsky — 564,000 hectares); seven state nature sanctuaries of regional importance (Messo-Yakhinsky — 86,592 hectares, Pyakolsky — 407,744 hectares, Sobty-Yugansky — 343,519 hectares, Gornokhadatinsky — 187,461 hectares, Polar Ural — 32,511 hectares, Poluysky — 107,047 hectares, Verkhne-Poluysky — 71,982 hectares) (23). All the regional nature sanctuaries had the "unlimited effective term" status. The network of the YNAO PAs also included one geological natural monument of regional importance (Kharbey, 0.65 thousand hectares) and one ethnic territory with a special environmental regime of the Okrug significance (Synsko-Voikarsky, 2,050,000 hectares). Thus, in 2006 there were ten PAs of regional importance covering the area of 4,976,150 hectares, and five PAs of federal importance covering the area of 2,421,500 hectares.

In 2008, YNAO had 13 protected areas: two state nature reserves of federal importance (Gydan and Verkhne-Tazovsky) covering the area of 1,318,500 hectares (1.7% of the YNAO area), three state nature sanctuaries of federal importance (Kunovatsky, Nizhne-Obsky, Nadymsky), covering the area of 2,216,600 hectares (2.9% of the total YNAO area), eight state biological sanctuaries of okrug importance (Polar-Ural, Gorno-Khadatinsky, Poluysky, Verkhne-PoluSobty-Yugansky, Yamalsky, ийMesso-Yakhinsky, Pyakolsky) on the area of 3,063,500 hectares (4% of the YNAO territory) (24). In order to preserve and restore fauna and flora, protect rare and endangered species of animals and plants, their genebank and home range, preserve unique natural landscapes in the basin of the Yuribey river, the Yarato lake system, and in the basin of the rivers Synya, Voikar, Kunovat, and Zazhimchar, it was planed to establish two more natural parks, Yuribey and Synsko-Voikarsky, by 2009. This would have increased the total area of PAs by 3,086,600 hectares (+4% of the YNAO area).

In 2010, the network of YNAO PAs included 14 protected areas: seven biological sanctuaries of regional importance, one state nature park of regional importance, two state biosphere reserves, three state biological sanctuaries of federal importance, one natural monument of regional importance, which occupied the area of 6,050,300 hectares (7.87%). The area of PAs of regional importance was 4.72% (3,628,800 hectares), PAs of federal importance — 3.15% (2,421,500 hectares). At the same time, there had been quite substantial changes: for example, in in 2009, territories between Bolshaya Hadyta and Malaya Hadyta river flood plains were added to Gornokhadatinsky Sanctuary. Territories between the flood plains of the rivers Nyakkhoba and Bolshoy Sandibey were added to Verkhnepolaya nature sanctuary the same year, which significantly expanded its area. Sobty-Yugansky Nature Sanctuary was completely liquidated in 2009, and in 2010 it was re-established within brand new borders. Its area was now 15,000 hectares more (25).

Until 2017, Synsko-Voikarsky State Natural Biological (Zoological) Sanctuary had had the status of Synsko-Voikarsky Ethnic Territory (Resolution of the YNAO Government No. 126-P dated February 27, 2017) (26). This area was detached on January 14, 1999 to protect spawning rivers, pastures for deers, hunting lands, and traditional lifestyles of indigenous people (27). The river basin of the rivers Synya and Tan'yu includes spawning grounds of the world's largest river stocks of whitefish: humpback whitefish, broad whitefish, northern whitefish, and tugun. In the upper reaches of those rivers, the Urals

hucho taimen is also found, a species of fish in the Salmonidae family, documented in the Red Book of the Russian Federation and the YNAO Red Book. The establishment of this PA contributes significantly to the conservation, restoration, and reproduction of this economically and scientifically valuable species of fish.

As of today, protected areas are unevenly distributed in six administrative districts of YNAO (Figure 2): in Nadymsky District — 1, in Tazovsky District — 2, in Krasnoselkupsky District — 2, in Yamalsky District — 2, in Shuryshkarsky District — 2, in Priuralsky District — 5. There are no protected areas in Purovsky District. The economic activities are fully or partially prohibited in the above protected areas of YNAO in order to preserve the unique ecosystems and individual species. At the same time, the network of protected areas in YNAO today, unfortunately, still does not have the full range of categories: no administrative district of the Okrug has any national or dendrological park, botanic garden, biosphere reserve, cross-regional nature park, landscape park, ethno-natural parks, genetic wildlife refuge, or other types protected areas of local importance.

1	Gydan Nature Reserve	11	Nizhne-Obsky natural hunting reserve
2	Harbay Geological Monument	12	Poluy natural reserve
3	Kunovatsky natural reserve (Bolsheobssky)	13	Pyakolsky Biological Reserve
4	Kunovatsky natural reserve (Kunovatsky)	14	Sobty-Ugan biological reserve
5	Messo-Yakhinsky biological reserve	15	Syn-Voikarsky nature reserve (Evrigortsky area)
6	Nadym biological reserve	16	Syn-Voikarsky nature reserve (Pyatirechensky area
7	Natural Park "Polar Ural" (Gornokhadatinsky area)	17	Verkhne-Poluysky Biological Reserve
8	Natural Park "Polar Ural" (Khanmey-Paypudynsky area)	18	Verkhne-Tazovsky Nature Reserve
9	Natural Park "Polar Ural" (Polar Ural area)	19	Yamal biological Reserve (South Yamal area)
10	Natural Park "Polar Ural" (Sob-Rayiz area)	20	Yamal biological reserve (North-Yamal area)

Figure 2. Protected Areas in YNAO, Ramsar Wetland Sites of international Significance and the “shadow list” wetlands

Discussion

To date, all the 14 PAs in YNAO (Table 1) are in fact refuges with weakened resilience, while their environment-forming potential has a relatively insignificant impact on the environmental protection of nearby residential areas. Instead, the human-induced pressure of surrounding areas dramatically aggravates their transformation, particularly in the areas of gas and oil production (Purovsky, Tazovsky, Nadymsky, Yamalsky Districts, etc.), in the conditions of systematic air pollution, including from adjacent territories, and driven by the impact of uncontrolled reindeer herding in traditional nomadic routes of indigenous small-numbered peoples of the North. Before 2000, the territory of the YNAO was under a relatively low ecological stress, however, nowadays, ecosystems in YNAO are categorized as vulnerable and there is a need for large scale research of the land use in relation to environmental law and the urbanization rate (Granberg et al., 2002). Thus, protected areas are distributed across the YNAO unevenly, and functionally, they only weakly link elements of ecosystems and landscapes into a unified natural and economic system that preserves the biological and landscape diversity.

The deficiency of research studies on the establishment of an optimal and inter-related network of protected areas in YNAO had implications. As the archive materials make clear, in 1993–2019, some protected areas were liquidated, boundaries were changed without sufficient ecological reasons. New PAs were established quite spontaneously, usually bearing in mind the location of licensed sites. In addition, many archive documents display weak and insufficient knowledge of ecosystems (28). Although since the 1980s, extensive and fairly regular research work has been carried out on environmental monitoring, geo-, and biodiversity. For example, commissioned by of the YNAO Department of Natural Resources, Forest and Oil and Gas Complex (formerly the Department for Protection, Reproduction, and Use Management of YNAO bioresources), a number of integrated targeted programs was developed at varying levels, research studies were actively carried out: in 1988–2001 — the research project "Development of the network of protected areas" (Center for Study of Animal Migration, Moscow) (20); in 2000 — GEF project "Integrated ecosystem approach to conservation of biodiversity and reduction of biotopes disturbances in the Russian Arctic" (29); in 2007–2009 — the research project "Assessment of present-day system of PAs as the basis of ecological safety in YNAO and development of future network of PAs in the region for 2007–2009" (Research Center for Concervation of Biodiversity, Russian Academy of Natural Sciences, Moscow) (30), and the regional targeted program "Preservation of the Network of Protected Areas, Preservation and Reproduction of the Biological Resources of Yamalo-Nenets Autonomous Okrug for 2007–2009" (25), "Regional targeted program on reinforcement of combating poaching for 2006–2008 (supplementary materials)" (31), and others. Thus, either the results of these studies did not fall into the field of attention of nature conservation authorities, or they bore too little relation to the priority problems of PA management for YNAO authorities. Although, this work has been regularly funded. In any case, this issue needs further research.

The lack of systematic, integrated research and full-fledged results of inventory of natural landscape complexes and biological resources also makes the prospect of including the wetlands in the "prospective" ("shadow") list in the official list of the Ramsar Convention on 17 wetlands (Figure 2) almost undoable. Those include river basins of Southern Yamal (690,000 ha), river basins of Western Yamal (650,000 ha), the valley of the Yuribey river (150,000 ha), lower reaches of the Messo river (290,000 ha), the basin of

the Mordy-Yakha river (250,000 ha), the Bely island (plus Malygin Strait) (290,000 ha), northeast lakes of the Gydan Peninsula (210,000 ha), islands in the Kara Sea north of the Gydan Peninsula (176,850 ha), the delta of the Pur river (30,000 ha), the lower reaches of the Taz river (350,000 ha), the Oleny Island and the coast of the Yuratski Bay (340,000 ha), the multi-lakes between the rivers Pyaku-Pura and Nadym (269,500 ha), the group of lakes between the Chaselka and Kharampur rivers (30,000 ha), the Yurtovskoye multi-lakes between the rivers Venga-Pur and Ety-Pur (137,500 ha), lake systems of the basin of the river Bolshaya Khadyr-Yakha (30,000 ha), multi-lake on the left bank of the Pur river (30,000 ha), the Chertovskaya system of lakes (50,000 ha). One of the reasons for this is that no regular integrated scientific research has not been carried out there. Only on some territories (river basins of Southern Yamal, the valley of the Yuribey river, the basin of the Mordy-Yakha river, islands in the Kara Sea north of the Gydan Peninsula, the Bely Island) research has been carried out by several research teams (the Environmental Research Station of the Institute of Ecology of Flora and Fauna of the Ural Branch of the Russian Academy of Sciences, the Research Station of the All-Russia Scientific Research Institute on Nature).

To date, the list of wetlands of international importance of the Ramsar Convention (the "Ramsar List") includes only two YNAO wetlands covering the total area of 182,000 hectares — Lower Dvuobje (54,000 ha) and the Islands in Ob River Estuary in the Kara Sea (128,000 ha). In order to conserve the biodiversity of those territories are included in the system of protected areas: Lower Dvuobje wetland — in the Kunovatsky Natural (Game) Sactuary, the wetland of Islands in Ob River Estuary in the Kara Sea — in Nizhne-Obsky Nature (Game) Sanctuary. These territories are located on the mass migration routes of waterbirds, including species listed in the Red Book and Appendix II to the CITES Convention. These wetlands represent the largest breeding and molting grounds for waterfowl in the Northern Hemisphere. In addition, spawning and feeding periods of valuable fish species, mostly whitefish, takes place there. It is essential that both wetlands (Lower Dvuobje and the Islands in Ob River Estuary in the Kara Sea) are considered priority international scientific objects for integrated research studies on environmental monitoring.

The analysis of biodiversity conservation problems, however, cannot take into account their socio-economic nature. For example, the increase in the area of Ramsar wetlands and the attendant changes of the shape, relocation, establishment of new PAs depending on new circumstances (for example, discovery of deposits, economic conditions), is bound to affect the interests of YNAO economic entities.

Protected natural areas are the oldest and most effective form of conservation of natural biodiversity and the functioning of ecosystems and ecosystem cover as a whole (Shvarts, 2003). However, the age of existing PAs in YNAO falls within a rather narrow time interval: the oldest of them are under 50 years of age (Table 1): For example, the Sobty-Yugansky Nature Sanctuary was established in 1971, the Nizhne-Obsky Nature Sanctuary— in 1985, and the youngest reserve were detached in 2017 (Synsko-Voikarsky Nature Sanctuary). Therefore, the long term data series in the Chronicles of Nature and diaries of phenological observations are not sufficiently representative yet. Thus, the Chronicles of Nature is kept in Verkhne-Tazovsky State Nature Reserve since 1989, in Gydan State Nature Reserve — since 2003. In the archive materials, it is mentioned that although Gydan State Nature Reserve was established in 1996, however "... until 2001 had

a purely beautification essence, because it had no staff..." (25, pp. 33–34). The study of Chronicles of Nature showed the fragmentary nature of the presented materials: no full-fledged observations of all flora and fauna species and their seasonal patterns (usually, each volume of the Chronicle includes several indicator species, which depends on which specialist visited this protected area), soils and landscapes are studied insufficiently. According to O. I. Semyonov-Tyan-Shansky, parallel multi-year data series of observations of biotic and abiotic factors in the conditions of relatively stable reservation conditions represent, perhaps, the most valuable protected areas product for humanity, which the background ecosystems of YNAO are mostly deprived of (Semyonov-Tyan-Shansky, 1978).

In 2000, at a meeting about the GEF project "Integrated ecosystem approach to conservation of biodiversity and reduction of biotopes disturbances in the Russian Arctic", it was pointed out the that because the Russian Federation does not have a regulatory framework for the assessment of land, water, and biological resources, their inventory has not been carried out, there is no single public environmental monitoring system, no integrated assessment is possible for YNAO natural resources. It was also noted that there was no federal or regional integrated plan for the prospective development of the network of protected areas. The disregard to the generally accepted criteria for selection of territories of various protection statuses is having a very negative impact on solving the problem of development and improvement of the protected area system (29). No full-fledged comprehensive monitoring in the YNAO protected areas, low salaries of employees, insufficient and sometimes poor protection of borders are the results of the leftover funding of environmental programs. Virtually all the YNAO protected areas are funded from the Ogrug's budget and the environmental fund. And all the above questions remain pending after 19 years. Optimization of protected areas and amendment of their boundaries involves the integration of approaches and targeted coordinated research by professionals in a variety of fields.

One of the greatest performance problems of the YNAO protected areas should is also the fragmented nature of subordination of departmental agencies: bureaucracy sometimes leads to rather ridiculous situations: this is a quotation from the "Explanatory note with disagreements on the audit conclusion of the YNAO Department of Economy on the Draft Departmental Targeted Program "Preservation of the Network of Protected Areas, Preservation and Reproduction of the Biological Resources of Yamalo-Nenets Autonomous Okrug for 2007–2009" (34): *"... due to the fact that water reservoirs simultaneously have fauna species under protection of both federal agencies and regional public institutions, the program should include activities such as joint patrols of intensive fishing sites. At the same time, the PA environmental regime in the Okrug does not allow dividing fauna into federal and regional species in order to protect it. This is also the case with protection in relation of species composition of fauna objects..."*.

In addition to the issue of biodiversity conservation, various attempts were made at various times in YNAO to reproduce individual fauna species, including by means of acclimation. During the period under review, several programs on acclimation and re-acclimation of animals were carried out at various times in YNAO protected areas (Letter from the Deputy Governor, Head of the Department of Economy and Investment Policy to the Department for Development of Agro-Industrial Complex of YNAO, No. 18-25/174, dated June 04, 2002) (35): In the 1980s, there were releases of American mink into the wild

in Shuryshkarsky and Purovsky Districts, acclimation of beaver in Sobty-Yugansky Nature Sanctuary (Priuralsky District), acclimation of muskox and buffalo in Gornokhadatinsky Nature Sanctuary since October 1, 1997 (currently Gornokhadatinsky section of the Polar Ural Natural Park, Priuralsky District). The document includes plans for acclimation of wild boar in Shuryshkarsky District.

We can observe the long-standing popularity of the ideas of acclimation, re-acclimation, and rewilding (Tsarev, Pavlov, 2017, Chibilev et at., 2015, Perion et al, 2019). However, it should be borne in mind that ecosystems of the Far North have abnormally low resilience, low speed of recovery in the conditions of technogenesis, which is accompanied by a rapid loss of biological and landscape diversity in the areas of gas and oil production. In this respect, the problem of acclimation in the YNAO PAs requires a selective approach.

For example, the main population of muskox is kept in the open-air complex located in “conservation zone” of the Polar Ural Natural Park, which already contradicts the very concept of a ”conservation zone”: an exemplary zone aimed at the conservation of indigenous fauna and flora species, and where any introduction of alien species is unacceptable. According to some researchers (39–48), no human intervention should be allowed in the “conservation natural areas”. In this respect, the whole program for muskox acclimation in the “conservation zone” of the Polar Ural Natural Park, which is being implemented in the Okrug since 1997, is in urgent need of bringing to compliance with the environmental legislation of the Russian Federation and YNAO: we believe that in this case, the “conservation zone” should be demarkated from the area of the muskox acclimation program.

Over this period, the number of muskoxen significantly grew, and a part of the animals was released in the Polar Ural Natural Park. As a food chain competitor of reindeer, muskoxen destroy its food resources, and the problem is particularly pressing in the Yamal Peninsula, where pastures suffer from overgrazing enough as it is. And the population of muscox continues to grow (Tsarev, Pavlov, 2017). The situation requires a clear evidence-based plan for the implementation and settlement of muskox in YNAO and other territories of the Russian Federation.

At the same time, most visitors to the Okrug have never seen a muskox. Setting up an exhibition of these animals in Gornoknyazevsk village (Priralsky District) or in the city of Labytnangi will not only promote a new attractive tourist brand of YNAO, but will also contribute to the environmental education of people.

The analysis of these materials reveals such problems of biodiversity protection in YNAO as fires, overgrazing of reindeer, exposure of lichens to pollutants, which, in turn, leads to the destruction of the food resources of reindeer, which entails the disruption of the traditional agriculture and lifestyle of indigenous small-numbered peoples of the North. The death of animals is registered in oil traps, the death of migratory birds on high-voltage power lines, the problem of restoration of northwestern population of Siberian white crane, the need for integrated environmental monitoring, degradation of traditional uses of natural resources (reindeer breeding, fishing, hunting); poaching, the environmental impact of noise, vibrations and electromagnetic radiations, reduction of fishing catch in Ogrug's water reservoirs (including the population of Siberian sturgeon, whitefish), pollution of Arctic seas with oil products and other pollutants, which is linked to the all-year-round steam navigation on the North East Passage.

Of particular note is the shortage of funding for environmental activities and construction of environmental facilities, and no inventory and environmental and economic assessment of natural and biological resources.

Below is the analysis of local problems on the example of Yamalsky State Natural Sanctuary of Regional (Okrug) Importance. The territory of this PA (Southern Yamal area) is under the close attention of gas producers: a number of large gas condensate fields was proven here: Bovanenkovskoye, North-Bovanenkovskoye, Krusensternskoye, and Kharasaveyskoye. In the course of the development of these fields, human-induced disturbance of the animal home range is becoming increasingly evident (49). Large structures have been designed by now, which are going to have an imminent impact on the nature sanctuary, although technically those territories no longer belong to the territories of the nature sanctuary. These are the Bovanenkovo – Ukhta gas trunk line and the Obskaya – Bovanenkovo railroad, 110 km and 24 km of which, respectively, cross the territory of the nature sanctuary (ФМ-445-1-75). In addition to them, there are temporary structures on the territory of the nature sanctuary: a platform for loading and unloading operations and cargo delivery for the construction of the Bovanenkovo – Ukhta gas trunk line (0.9 hectares) at the mouth of the Yara-Yakha river, and winter road route Khralov — Baydaratskaya GCS (the length in the nature sanctuary is 76 km).

In addition, the world's largest herd of reindeer, which belongs to the Panayevskoye and Yarsalinskoye municipal reindeer herding enterprises, as well as private owners, roams on the territory of Yamalsky State Natural Sanctuary of Regional (Okrug) Importance (Southern Yamal area). The basin of the Mordyyakha river includes the main traditional summer grazing areas of domesticated reindeer, this is why for the basin of Mordyyakha and coastal territories, the most dangerous human-induced impact is overgrazing. Apart from that, disturbance of fish habitats in floodplains of the rivers Nadoyakha, Yundyyakha, Mordyyakha, Nyaby-Yakha, Yasavei-Yakha, Yuribei, and others (outside the nature sanctuary), entails the reduction of fish reserves at the mouth of the Mordyyakha river in the nature sanctuary (49).

All those adverse factors already represent sufficient grounds for revision of the zoning of the Yamalsky State Natural Sanctuary of Regional (Okrug) Importance.

Another pressing concern is the need for an integrated survey of island ecosystems and landscapes to prepare a feasibility study for the establishment of an Arctic Island Marine Nature Reserve that will include the islands Bely, Vilkitsky, Shokalsky, Neupokoev.

Conclusions and recommendations.

The network of protected natural areas of the Yamalo-Nenets Autonomous Okrug needs optimization. Protected areas are distributed across the YNAO unevenly, and functionally, they only weakly link elements of ecosystems and landscapes into a unified natural and economic system that preserves the biological and landscape diversity.

The improvement of the network of protected area should be carried out through its expanding: the creation of national parks (IUCN category II), natural monuments (IUCN category II), wetlands of international importance, etc.

The proportion of tundra and forest-tundra ecosystems should be increased in the network of PAs of both federal and regional importance.

In the long term, trans-boundary PAs should be established with the Republic of Komi and Krasnoyarsk Krai, and also Yamal Island Arctic Biosphere Reserve.

Obtaining evidence-based, stable time series of variables that characterize natural and natural-anthropogenic ecosystems in YNAO requires coordinated, comprehensive prolonged research projects across all the existing protected areas and areas to be protected in the future.

To this end, it is necessary to develop a regional "road map" to improve the system of formation of natural territories of the YNAO with different degree of human-induced impact, methods and criteria the detachment of natural areas of YNAO for the conservation of landscape diversity through conservation, reservation, and restoration.

It is also necessary to develop a regional concept and strategy of the protection and management of ecosystems in individual categories of PAs.

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