Ministry of Natural Resources and Environment of the Russian Federation

Yugyd Va National Park Federal State Budgetary Institution

Pechora-Ilych State Nature Reserve Federal State Budgetary Institution

"Republican Center for Ensuring the Functioning of Specially Protected Natural Territories and Nature Management" State Budgetary Institution of the Republic of Komi of the Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi

MANAGEMENT PLAN

for Virgin Komi Forests UNESCO World Natural Heritage Site

2017 – 2031

Vuktyl-Yaksha-Syktyvkar

2017

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WORKING GROUP

The following persons participated in the work on the Management Plan of the Virgin Komi Forests UNESCO World Natural Heritage Site:

Fomicheva T.S., Director of Yugyd Va National Park FSBI - Head of the working group of the National Park;

Simakin L.V., acting Director of Pechora-Ilych State Nature Reserve FSBI - Head of the working group of the Reserve;

Yermakov A.A., Director of "Center for Specially Protected Natural Territories" SBI of the RK - Head of the working group of the Center for Specially Protected Natural Territories;

Experts: Blagovidov A.K., Melnichuk A.V., Puzanova L.V., Smirnov N.S., Shaaf N.L., Shalagina N.V., Shubnitsina Ye.I., Shutova N.I.

Management Plan was developed and adjusted as a result of a series of consultations with specialists and local residents, as well as discussions and working meetings between February 2017 and November 2017.

ACKNOWLEDGMENT

Participants of the working group express their sincere acknowledgement to the administrations of the Vuktylsky, Pechorsky, Intinsky and Troitsko-Pechorsky districts, traditionally taking an active part in the development of Specially Protected Natural Territories and Rosprirodnadzor Directorate for the Republic of Komi for assistance in preparing the Management Plan.

OPENING ADDRESS OF THE DIRECTORS OF THE SPECIALLY PROTECTED NATURAL TERRITORIES

Dear colleagues!

A team of highly qualified specialists worked on the development of the Management Plan for Virgin Komi Forests UNESCO Site; first of all, they are employees of Yugyd Va National Park and Pechora-Ilych State Nature Reserve FSBIs.

Work on the Management Plan for the UNESCO Site was carried out for the first time. There are no analogues of such plans in Russia.

The next and most difficult stage is the implementation of the Management Plan to be carried out jointly with the Republican Center for Specially Protected Natural Territories, the Administrations of the municipalities of Inta, Pechora, Vuktyl, local residents, public environment-oriented organizations, primarily the Pechora Rescue Committee, our partners: Institute of Biology of the Komi Science Center of the Ural Branch of the Russian Academy of Sciences, "Gazprom Transgaz Ukhta" LLC, "Gazprom Transgaz Yugorsk" LLC, "Kozhim RDP" JSC and others.

Virgin Komi Forests Site has various protection duties – from complete reservation to recreation and traditional nature management. For the whole territory of the Site, working group tried to develop a set of programs that shall not only meet the specifics of each component of the Site, but also unite these components for sustainable development.

Fomicheva T.S., Director of Yugyd Va National Park FSBI

SUMMARY

Virgin Komi Forests UNESCO World Natural Heritage Site is located in the Republic of Komi of the Russian Federation. Its area is 3.41 million hectares.[1] The Site includes areas of exceptional natural beauty and aesthetic significance. Territory of the Site is an outstanding example of the ongoing ecological and biological processes in the evolution of ecosystems, the development of plant and animal communities. Mountainous taiga of the Urals is considered one of the 200 ecological regions that support the global ecological balance on the Earth.

The Site consists of 8 specially protected natural territories and is entirely under the legal protection of the state. It includes one of the oldest reserves in Russia and the largest national park in the European part of Russia, as well as adjacent Specially Protected Natural Territories, combining territories with different protection duties – from areas of absolute protection to large areas of traditional nature management.

The Site is a unique polygon for biodiversity conservation, for the implementation of its research and demonstration programs, thanks to the latest Europe unfragmented massifs of boreal forests on the border of natural areas. Combined conditions led to the concentration of key habitats of many rare, endemic and relict plant and animal species protected at the local, regional and international levels on the Site.

Anthropogenic impacts affecting the biological diversity and landscape of the Site have been local and limited for centuries due to the remoteness and isolation of its territory, as well as the harsh climate. To date, these impacts do not critically threaten the habitat of the species, having only a slight effect on the number of groups involved in use in small, accessible areas. On the other hand, anthropogenic impact on the Site has left evidence, important in cultural and historical terms, requiring careful handling, systematization, study and preservation.

The value of the Site is also determined by its tourist potential: on its territory there are the highest peaks of the Urals, landscapes abound with rocks, caves, mountain lakes, glaciers and waterfalls, a well-developed river network. The list of geological, geological-morphological and archaeological monuments is significant. Territory of the Site was developed under the influence of different cultures of sustainable nature management preserving the Site nature unchanged.

Yugyd Va National Park and Pechora-Ilych Reserve are legal entities financed from the federal budget and extrabudgetary sources; they are subordinated to the Ministry of Natural Resources and Environment of the Russian Federation; their activities are regulated by the Charters and Provisions. Management decisions are made by the administration of Specially Protected Natural Territories; the advisory bodies are the scientific and technical councils of Specially Protected Natural Territories.

Duty of regional Specially Protected Natural Territories is governed by the Provisions on them, their territories are managed by forestries, protected by forestries and a specially created center for Specially Protected Natural Territories, which is subordinate to the Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi and is financed by the regional budget. Co-management of the territories of regional Specially Protected Natural Territories by local communities is possible through the Public Council at the Ministry.

[1] The Site is nominated on an area of 3.28 million hectares, after clarifying the boundaries of the Site area is 3.41 million hectares

The total number of staff members of the Site currently stands at 131 people, 128 of them are constant employees of the federal Specially Protected Natural Territories and 3 people are those of the regional Specially Protected Natural Territories. According to the standards, the number of full-time employees of the Site should be about 600 people, of whom the park staff is 329 people. For the successful implementation of the programs of Specially Protected Natural Territories it is necessary to double the number of employees, the deficit of their budget, in this case, is estimated at 25% by administrations.

Protection of the Site is carried out by watches at stationary posts, in places of entry/exit to/from the territory and raids of operational groups through the territory in periods of the year threatening to populations and landscapes (spring and autumn spawning periods and high fire danger period)[2].

Scientific research is carried out by the staff of scientific researchers of Specially Protected Natural Territories and involved scientists and students.

Ecological and educational activity of the Site covers 35-58 thousand people a year in the Park, 700-1200 people a year in the Reserve. Activities are held both at the sites of Specially Protected Natural Territories – in museums and visit centers, and in nature – in educational institutions and clubs.

Annually, the territory of the Site is visited by about 10 thousand tourists, spending about 70 thousand person-days on the territory. 6-7 thousand of them visit, the National Park, 3.5 thousand visitors visit the Reserve with a buffer zone. Tourists in the Specially Protected Natural Territories stimulate the development of service sectors of districts in their areas of location and create additional jobs for the local population.

In addition to the permitted tourist operation of the Specially Protected Natural Territories, one third of the Site territory are the areas where ecologically safe traditional nature management is allowed. However, substantial investments are required in order to implement in such areas programs that can generate additional income for Specially Protected Natural Territories and local communities.

Analysis of the Site's financing shows that the greatest budget deficit is experienced by programs for the protection of territory and conservation of natural complexes, followed by nature restoration and technical support programs. Total budget deficit of baseline scenario (in which the state of the Site natural environment is not deteriorated) is estimated at more than 25 million rubles a year for the implementation of priority programs for the Site protection, restoration and maintenance.

Programs of optimal scenario, when the state of natural complexes is improving, and the majority of the Specially Protected Natural Territories' needs are met, the deficit is about 57 million rubles per year.

In part, financing of the Site programs can manage with the constant underfinancing of Specially Protected Natural Territories, taking into account their priority, but one must be prepared for the fact that part of the Site programs in this case will never be realized. Therefore, for the implementation of a number of the Site programs, administrations of Specially Protected Natural Territories envisage attracting external investments, donor funds and own funds.

In terms of its importance, the main problems of the Site are:

[2] In spawning and fire danger periods, which may constitute half of the tourist season, access to the Site is limited or prohibited, or visit is possible accompanied by the staff of Specially Protected Natural Territories

- ***inadequate financing***, from which there are follow shortcomings of the protection and activities for conservation (financing gap of the Site programs is 25 million rubles), restoration (the program is subtly financed from the own resources of Specially Protected Natural Territories) and development of the Site (need for infrastructure that compensates for environmental damage by increasing its tourist capacity is 61.7 million rubles (or 12.4 million rubles/year). The cost of annual maintenance of the tourist infrastructure is 4.5 million rubles and is fully compensated by income from services to tourists);

- ***legal obstacles*** (lack of buffer zones on the eastern borders of the Site and along the western boundary of the Reserve);

- ***institutional obstacles*** (areas of the Site are managed by various structures, which complicates the coordination of activities and can lead to conflicts in the management process).

A significant obstacle is the deficit of staff (the need for staff is satisfied by 50%) and their competencies – low labor remuneration does not allow Specially Protected Natural Territories to compete in the labor market for professionals

Long-term programs of the Site include tasks to preserve the traditional nature management, which is the basis of the culture of local population, and currently none of the other organizations in the Republic of Komi sets such tasks. Traditionally, cultural preservation activities in the Republic include teaching the national language, cultural activities, celebrations, and preservation of artifacts.

Preservation of traditions could be facilitated by the support of agriculture, but only industrial agriculture is subsidized. Private farming and livestock, including reindeer husbandry, are deprived of subsidies and any support. Other traditional occupations of the indigenous people – hunting and fishing – have practically ceased to exist (taking into account market decline and restrictions), depriving the local population of work during the winter, which contributes to population migration, loss of cultural traditions and degradation of communities.

Paradigm of sustainable development requires a balance between the satisfaction of basic human needs at present time and the rational operation of resources with a view of their transfer for use and development by future generations. In the case of Specially Protected Natural Territories, it is distorted, and involves only saving resources for future generations, forgetting about the current generation, and traditions as the basis of a culture related to the natural environment.

INTRODUCTION

Virgin Komi Forests UNESCO World Natural Heritage Site (hereinafter referred to as the Site) includes specially protected natural territories of various status and subordination. The Site includes: Yugyd Va National Park Federal State Budgetary Institution (FSBI), Pechora-Ilych State Natural Biosphere Reserve FSBI, existing and projected protection zones of federal Specially Protected Natural Territories, Pechora River Site and Uninsky state nature wildlife sanctuaries of the republican subordination, and also "Buffer Zone of the Pechora-Ilych Reserve," created as a republican (regional) wildlife sanctuary.

National Park and Reserve are managed by their directorates, which are subordinate to the Ministry of Natural Resources of the Russian Federation. The nature wildlife sanctuaries are managed through the "Republican Center for Ensuring the Functioning of Specially Protected Natural Territories and Nature Management" State Budgetary Institution of the Republic of Komi ("Center for Specially Protected Natural Territories" SBI of RK), structural subdivision of the Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi.

This Management Plan for the Virgin Komi Forests Site defines the overall development strategy for the long-term period (12 years or more), taking into account the operational and medium-term individual Management Plans for Specially Protected Natural Territories. It was developed in accordance with the Federal Law "On Specially Protected Natural Territories", the provisions of the UNESCO Convention on the Protection of the World Cultural and Natural Heritage[3], the recommendations on the drafting of Management Plans on the World Natural Heritage areas[4], Provisions and Charters: Yugyd Va National Park FSBI, Pechora-Ilych State Nature Reserve and Uninsky Complex Wildlife Sanctuary FSBI

Management effectiveness of Specially Protected Natural Territories for planning purposes was assessed taking into account the UNESCO assessment tools[5].

Management Plan is based on Russia's[6] international obligations, principles of territorial planning, zoning of Specially Protected Natural Territories, development of cooperation with interested organizations and citizens, involvement of local residents in the planning and joint management of Specially Protected Natural Territories, development of cognitive tourism and participation of Specially Protected Natural Territories in environmentally-oriented activities of the population.

Main goal of the Plan is to increase the effectiveness of management and the coherence of actions of all the Specially Protected Natural Territories that are part of the Site. This will increase the guarantees of preserving the natural and cultural values of the Site and reduce the risks of their loss.

Management Plan of the Site is focused on the ecological management system outlined in the State Standards of the GOST R ISO 14000 series, which comply with international ISO 1400 standards.

Financial resources necessary for the Management Plan implementation are defined and justified on the basis of financial analysis.

The Management Plan for the Site is based on a new planning tool for Specially Protected Natural Territories of the Russian Federation – business plans for Specially Protected Natural

[3] Convention for the Protection of the World Cultural and Natural Heritage (Paris, 1972)

[4] Methodical recommendations for the development of management plans for specially protected natural territories in the areas of the World Natural Heritage

[5] Enhancing our Heritage Toolkit. Assessing management effectiveness of natural World Heritage sites. UNESCO, 2008

[6] The Seville Strategy for Biosphere Reserves, the Madrid Action Plan, the Convention on Biological Diversity, and others.

Territories[7]. This tool[8] has allowed the development of various scenarios for the management of Specially Protected Natural Territories, depending on whether the financing gap for Specially Protected Natural Territories will increase, decrease or financing will remain stable in the future.

[7] Business plan of Yugyd Va National Park, 2012, its actualization, 2015; business plan of Pechora-Ilych Reserve, 2011, business plan of "Uninsky" Wildlife Sanctuary, 2015. The documents were prepared within the framework of the United Nations Development Program/Global Environment Facility project for Specially Protected Natural Territories of the Republic of Komi (the project was implemented in 2009-2015): http://undp-komi.org

[8] Business plan for Specially Protected Natural Territories is developed as an instrument for financing programs justified by the Management Plan. The Management Plan determines the tasks of Specially Protected Natural Territories and the costs of implementing them, the business plan determines program priorities, mechanisms for their financing, ways to attract resources and to save costs.

I. GENERAL INFORMATION ON THE OBJECT OF THE UNESCO WORLD NATURAL HERITAGE SITE "VIRGIN KOMI FORESTS "

Virgin Komi Forests UNESCO World Natural Heritage Site is located in the Republic of Komi of the Russian Federation. Its area is 3.41 million hectares[9] (Appendix 1). The Site received its status in 1995 according to the following criteria:

- VII - includes unique natural phenomena or territories of exceptional natural beauty and aesthetic significance);
- IX - is an outstanding example of the ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater ecosystems and plant and animal communities).

Besides, the Site:

- contains unique geological formations, numerous geological monuments and glaciers demonstrating past and current geological processes;
- on its territory, there are more than one hundred archaeological monuments that represent the history of the region;
- on the Site territory, there are preserved ancient living traditions of sustainable nature management and their carriers live compactly in the basins of tributaries of the Pechora River.

Virgin Komi Forests Site is under the legal protection of the state. It combines the territories with different protection duties:

Pechora-Ilych Reserve – strict protection, which guarantees full preservation of the natural complex, and strictly regulated tourism in small specially equipped areas;

Yugyd Va National Park – a combination of protection and regulated tourism and recreation on the major part of the natural complex;

natural wildlife sanctuaries – protection of the territory and preservation of the natural complex or its key components (Pechora River Site ichthyological wildlife sanctuary, Uninsky complex wildlife sanctuary);

natural monuments – protection of unique natural phenomena with the purpose to prevent anthropogenic impacts threatening their integrity (Uninskaya cave and Chameiny ples);

protected zone of Specially Protected Natural Territories – a sparing (non-destructive) duty of nature management for removing the load on the border of Specially Protected Natural Territories;

protected (buffer) zone of the reserve – has a duty of sparing nature management and involves testing of methods and techniques of sustainable (traditional) nature management, monitoring and evaluation of its results on a scientific basis;

assistance zone – is managed by forestries, tenants and other owners as forests of special environment-oriented importance, includes special duty areas, for example – genetic reservations,

[9] After specifying the borders of the Site area was 3.41 million hectares in the Nomination the Site area is 3.28 million hectares

especially valuable forest massifs, water protection zones of rivers and marshes, implies responsible nature management and co-management.

The composition and structure of the UNESCO World Natural Heritage Site is presented in Table 1.

A short description of the Site clusters is included in Box 1.

Table 1.

The composition and structure of the Virgin Komi Forests UNESCO World Natural Heritage Site

	Reserve	**National Park**	**Protected Zones**	**Buffer Zone (group 1 forests)****
Name	Pechora-Ilych state natural biosphere	Yugyd Va	Protected zone of the national park	Buffer zone of the reserve
Date created	May 4, 1930	April 23, 1994	April 23, 1994	February 19, 1992
Special status	Biosphere reservation			Buffer zone of the biosphere reserve
Area, hectares	**721,332**	**1,894,133***	**297,063**	**493,264**[10]
The body *which governs* the Specially Protected Natural Territories and the parent body	Directorate of the Reserve, Ministry of Natural Resources of Russian Federation	Directorate of the Park, Ministry of Natural Resources of Russian Federation	Center for Specially Protected Natural Territories of the Republic of Komi, Ministry of Industry of the Republic of Komi	Center for Specially Protected Natural Territories of the Republic of Komi – Ministry of Industry of the Republic of Komi, Komsomolskoye forestry
Organization that *protects* Specially Protected Natural Territories	Reserve	National park	Center for Specially Protected Natural Territories, National Park	Center for Specially Protected Natural Territories; Komsomolskoye forestry

*-Area of the park in accordance with the title certification documents

**-the buffer zone of the reserve includes Specially Protected Natural Territories: Wildlife sanctuaries: Uninsky complex (created on April 28, 1977, on the area of 32,600 hectares.); Pechora River Site, ichthyological (September 26, 1989, without indication of the area, includes the water protection zone of the Unya River). Natural monuments: Chameiny ples, geological (March 29, 1984, created without specifying the area and describing the boundaries); Uninskaya cave, geomorphological (March 5, 1973). Wildlife sanctuaries and natural monuments are protected by the Center for Specially Protected Natural Territories and forestries, the Pechora River Site wildlife sanctuary is additionally protects the reserve.

Box 1. Information about Virgin Komi Forests Site clusters

Virgin Komi Forests UNESCO World Natural Heritage Site consists of a group of specially protected natural territories, each of them performs certain functions and has a history of development.

The first Specially Protected Natural Territory of the Republic of Komi – Pechora-Ilych Reserve – was established on May 4, 1930 with the aim of restoring the number of valuable game animals, primarily sable. Then it received the status of a research institution (1932) and educational functions in the 90s of the twentieth century, now expanded to create conditions for ecological and educational tourism.

[10] Other values of the buffer zone areas: 456,000 hectares are in the Decree on its creation; 500,000 hectares are in the decision of the UNESCO Office; 521,047 hectares are according to the Provision on the Pechora-Ilych State Natural Biosphere Reserve, 2009.

Yugyd Va National Park (Specially Protected Natural Territory of federal importance) was established on April 23, 1994. Along with the general objectives for all Specially Protected Natural Territories – conservation of nature, one of the statutory objective of the National Park is to create conditions for organized tourism.

Federal Specially Protected Natural Territories are the only sites in the system of specially protected natural territories of the Republic of Komi, where there is a profile (special) staff. Regional Specially Protected Natural Territories are managed by a single body located in Syktyvkar and do not have individual staff. The duty of the wildlife sanctuaries does not exclude the lease of their territories for traditional uses and tourism.

Pechora-Ilych State Natural Biosphere Reserve FSBI

The Reserve is a federal state budget institution and is financed from the federal budget. The Reserve administrative structure includes: the Administration, the Scientific Department, the Territorial Protection Department, the Department for Tourism and Environmental Education, the Elk Farm that has existed since 1949, and the Department for Main Activities. As part of the Department of Environmental Education there is a Museum of Nature, organized in 1973.

On the Reserve territory, any activity that contradicts the tasks of the Reserve and the special protection duty of its territory, violates the natural development of natural processes, threatens the state of natural complexes and sites, and also not related to the fulfillment of tasks assigned to the Reserve is prohibited.

On the Reserve territory, measures and activities aimed at preserving natural complexes in natural state, restoration, as well as preventing changes in natural complexes and their components as a result of anthropogenic impact; maintenance of conditions ensuring sanitary and fire safety of people, animals, natural complexes and sites; prevention of dangerous natural phenomena that threaten people's lives and human settlements; carrying out of scientific Research and environmental monitoring; ecological and educational works; exercise of control functions are allowed.

The Reserve territory is 721,332 hectares and is divided into two separate areas (clusters): pine (plain), an area of 15,800 hectares and dark coniferous (mountainous) – 705,522 hectares.

Zoning of the Reserve allows on the area of 7,785 hectares (1.1% of its area) limited economic use of natural resources: logging (as a rule of other felling) of firewood and industrial wood necessary to meet the needs of the Reserve; limited collection of mushrooms, nuts, berries and other wild-growings (Reserve staff); grazing of cattle belonging to the Reserve employees; provision of service allotments (arable land and hayland) to Reserve employees; organization and arrangement of educational and excursion ecological routes.

The Reserve is a biosphere reservation; its functions include global monitoring of the Earth in the world network of biosphere reservations. For the purpose of testing, monitoring and scientific support of sustainable types of nature management, a "buffer zone" of the Reserve (a biosphere polygon) was built on an area of 456,000 hectares, between the rivers Pechora and Unya and the catchment territory of Unya River, which exists as a regional wildlife sanctuary. Influence of the Reserve on the nature management in the buffer zone is "to determine the order of nature management" and the coordination of certain activities. A stable traditional activity is allowed in the buffer zone territory: hunting, fishing, collecting of mushrooms and berries, haymaking on the principles of sustainable nature management. The duty of forest of group I does not exclude industrial felling in the buffer zone territory.

The Reserve has been domesticating elk since 1949, for which the protection zone of an elk farm with an area of 14 thousand hectares was established by the Decree of the Council of Ministers of the Komi ASSR No. 322 dated September 12, 1971, where any other activity was prohibited, except that directed to the development of elk breeding. The protection zone duty provision was assigned to the Reserve; logging, forestry works were possible in agreement with the Reserve, construction on the territory of the protection zone was prohibited, except for the buildings for the needs of the elk farm.

Pechora River Site ichthyologic wildlife sanctuary adjacent to the boundaries of the Reserve is under the protection of the Reserve; in the absence of the protection zone of the Reserve, the wildlife sanctuary performs its functions. Ilychsky wildlife sanctuary adjoins to the Reserve from the northwest; it also replaces the protection zone of the Reserve, the duty was designated as a reserve when creating the wildlife sanctuary, and the protection function was assigned to the Reserve together with the fish inspection, but in the subsequent Provision (contrary to the title documents) registers the duty as "wildlife sanctuary", and the Reserve is deprived of rights to protect the territory. The Ilychsky wildlife sanctuary is not included in the

territory of the World Heritage Site. Tourism, hunting, haymaking and collection of wild plants are allowed on the territory of the above-mentioned wildlife sanctuaries.

Yugyd Va National Park FSBI

The National Park was created to preserve the unique natural sites and complexes of the Northern and Subpolar Urals, which have great environmental, historical and recreational value, its area is 1,894,133 hectares. The Park activity is regulated by the Provision, according to which it is an environment-oriented, ecological and educational and research institution. The Park territory is intended for use in environment-oriented, educational, scientific, cultural purposes and for regulated tourism and recreation.

The Park has the following main tasks: preservation of the integrity of natural complexes, unique and reference natural areas and sites; preservation of historical and cultural sites; environmental education of the population; creation of conditions for regulated tourism and recreation; and others.

Four operational zones, their share being 26.5% of Park territory, have been identified for the implementation of recreational tasks on the Park territory. Zoning strictly limits the nature of the operation of the Park areas, proceeding from the principle that any activity on the Park territory that can damage natural complexes and sites of flora and fauna, cultural and historical objects, and that contradicts the purposes and tasks of the National Park is prohibited.

A protective zone with a total area of 297,063 hectares with the status of a regional Specially Protected Natural Territory, without withdrawal of land from their owners, but with restriction of their rights, was created to reduce the load on the Park borders.

The tourist potential of the Park is determined by the abundance of unique sites. There are the most attractive tourist sites of the Republic of Komi in the Park – the highest peaks of the Urals: Narodnaya, Telpos-Iz, Sablya, Karpinsky, Kolokolnya mountains and the symbol of the Park – Manaraga mountain. Landscapes of the Park abound with rocks, caves, mountain lakes (which are more than 800 in the Park), glaciers (38) and waterfalls. Transitional and plain types of landscapes are covered with a single, unbroken massif of dark coniferous and light coniferous taiga. It is significant in the list of geological and geological and morphological monuments. Water tourists are attracted to the Park by a well-developed network of rivers. The density of the river network in the foothills of the Subpolar Urals is 1000 m per 1 km^2, it decreases in the plain part to 450-500 m per 1 km^2. The current velocity reaches 3 m/s at numerous rapids and rifts.

The Park's biodiversity is exceptionally high for the northern and subpolar subzones of the taiga, and was preserved due to the unfragmented massif of virgin forest with an area of 994 thousand hectares located in the contact zone of populations of European and Asian species. Due to the strongly crossed terrain, stable cenopopulations of endemic and relict plant species are preserved here.

Regional Specially Protected Natural Territories

The structure of the Site includes six regional Specially Protected Natural Territories: a complex wildlife sanctuary, an ichthyological wildlife sanctuary, a protection zone of the Park and a buffer zone of the Reserve (functioning as regional Specially Protected Natural Territories) and two geological monuments of nature. Complex (landscape) wildlife sanctuary preserves the natural complex as a whole. Ichthyological wildlife sanctuary was established to maintain water balance, water quality and preservation of aquatic life. Geological monuments of nature preserve unique natural sites. The duty of wildlife sanctuaries excludes them from intensive economic use.

A feature of regional wildlife sanctuaries of the Republic of Komi is that a single body (Center for Specially Protected Natural Territories of the Republic of Komi) formed for their management does not have the possibility of systematic control over their territory. The protection of wildlife sanctuaries is entrusted, in addition to the Center for Specially Protected Natural Territories, to various departments (fish inspection, forestries and others), whose purpose is to protect only a certain type of biological resources.

Protected territories included in the World Heritage Site have zoning, which assumes different operating duties for the allocated zones (Table 2).

Table 2.

Zoning of clusters of the Virgin Komi Forests Site

Specially Protected Natural Territories/ /functional zones[11]	Pechora-Ilych Reserve	Yugyd Va National Park	Protection (buffer) zones and wildlife sanctuaries	Total[12]	%
Zones of strict and absolute protection				**2,373,507**	**69.7**
Absolute rest	79,330	-	-	79,330	2.3
Reserve zone	601,565	73,536	0*	675,101	19.8
Special scientific importance	32,652			32,652	1.0
Specially protected zone		1,586,424	-	1,586,424	46.6
Zones of traditional nature management, economic operation and tourism				**1,032,285**	**30.3**
Economic zone	7,785	29,221	297,063	334,069	9.8
Recreation zone		126,710		126,710	3.7
Zone of traditional extensive nature management		78,242	493,264	571,506	16.8
Total	**721,332**	**1,894,133[13]**	**790,327**	**3,405,792**	**100**

*- The area of the Pechora River Site wildlife sanctuary is not indicated in the documents and is superimposed on the area of the buffer zone of the Reserve, the wildlife sanctuary belongs to the reserve zone, according to the Decree on its organization, the Provision fixing the duty of the wildlife sanctuary is not adopted.

Federal reserves, by amendments made in the Federal Law on Specially Protected Natural Territories[14], received the functions of developing cognitive tourism. Pechora-Ilych Reserve approved ecological and cognitive routes on the territory of the Reserve at the Scientific and Technical Council (with their introduction into the Provision on the Reserve), without creating additional functional zones due to the point location of the sites visited.

Regional Specially Protected Natural Territories included in the territory of the Virgin Komi Forests Site do not have zoning. Functionally, the territory of the entire complex Uninsky wildlife sanctuary can be referred to a zone of limited economic use, in view of the duty that excludes industrial felling and mining, but permits the traditional nature management. Duty of Pechora River Site ichthyological wildlife sanctuary will allow it to be attributed to the reserve zone, since the reserve duty is registered in the Provision on this wildlife sanctuary, but the ichthyological wildlife sanctuary status does not correspond to the general duty, since it implies the protection of only one of the natural complexes.

Duty of the buffer zone is consistent with the duty of limited economic use, in view of the fact that in the buffer zone territory there is a duty for the forests of group I that does not exclude their exploitation, including industrial one. Peculiarities of the duty are regulated by individual Provisions on these Specially Protected Natural Territories, which regulate prohibited and permitted types of activities. Development of tourism in the territory of regional Specially Protected Natural Territories is possible through the lease of the territories of Specially Protected Natural Territories for the purpose of recreation[15].

[11] Decoding of functional zone duties and their scheme are given in Appendix 1.
[12] Part of the territories of the regional Specially Protected Natural Territories overlap, the procedure for delineation of these sites was started in 2010, and has not been completed yet.
[13] Area of the National Park in accordance with the title documents is 1,891,701 hectares, in accordance with the title certification documents – 1,894,133 hectares.
[14] Federal Law "On Specially Protected Natural Territories" dated March 14, 1995, amendments: 365-FZ dated November 30, 2011
[15] Forestry Code of Russian Federation (dated July 22, 2008 No.143-FZ)

II. NATURAL AND HISTORICAL AND CULTURAL VALUES OF THE VIRGIN KOMI FORESTS SITE

The World Heritage Site includes a group of 8 Specially Protected Natural Territories located on the boundary between two physiographic lands, the Russian Plain and the Ural Highlands. The territory is noted for its large area, landscape diversity and undisturbedness and exceptional species diversity. Mountainous taiga of the Urals is considered one of the 200 ecological regions[16] that support the global ecological balance on the Earth.

The story of exploration of resources on the territory of the Site started in the 18th century with the first complex surveys, mostly geological ones. In the early 1960s the science department of the Reserve was created, and Komi branch of the Academy of Science of the Soviet Union started working. From this, regular studies of biota in the territory of the western macroslope of the Subpolar and Northern Urals began.

Landscape, hydrology and climate[17]

The landscapes of the Natural Site are unique. More than a third of the area is taken by highlands, about a third is a submontane steeply sloping belt, less than a third is taken by the plains landscape of the Pechora lowland.

Half of the highlands is in the Yugyd Va National Park in the Subpolar Urals. This is a true highland consisting of a belt of ridge-like ranges along the north-south line. In its widest part it reaches a 70 km wide belt, and it spreads 150 km from north to south. The most extended are the ranges: Obeiz, Western Saledy, Eastern Saledy, Sablya, Maldynyrd, Kursambay, Issledovatelsky (Researchers') Ridge. They followings are characterized by the pronounced alpine terrain with sharp crests and rocky peaks that are hard to access: the Kolokolnya mountain (1721 m), the Mansiner mountain (1779 m), the Karpinskogo mountain (1803 m), the Naroda mountain (1896 m), etc. The Manaraga mountain, the "bear's paw" (1,663 m), crowned by the rock pillars, was considered the highest peak in the Subpolar Urals for a long time and became a symbol of the National Park.

The landscape is diversified by the numerous canyon-like river valleys cutting through rock masses. Glacial cirques, cirque lakes, troughs and moraines are common. On the territory of the National Park there are 38 glaciers with the area of 5.5 square kilometers.

South of the Subpolar there is the North Urals. Its mountainous part within the Site borders (the southern part of the National Park and the mountainous area of the reserve) is characterized by a smoother terrain. The average height here is about 1200 m in the northern part and 800 m in the southern part. Here are included the following peaks: Horaiz (1326 m), Lortsempeya (1358 m), Telpos-Iz (1617 m) in the northern part and Kozhimiz (1195 m) in the southern (the highest mountain in the Reserve), and also the lower mountains to the south, Kychiliz, Tumbaliz, Schukaeliz, Parusiz and others.

There are four distinctive mountain ranges within the Reserve, with the width of about 50 km. The longest and the most eastern mountain range is called Korennoy Poyasovoy Kamen, to the west there is the Ilychsky Poyasovoy Kamen, represented, including by the Manpupunyor Plateau[18].

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[16] "Global 200" is the list of ecological regions of the World Wildlife Fund (WWF), which make the biggest contribution to the global ecological balance provision

[17] According to: Reports of the United Nations Development Program/Global Environment Facility project for Specially Protected Natural Territories of the Republic of Komi, http://undp-komi.org

[18] The weathering rock pillars located on the plateau received the status "One of the Seven Wonders of Russia" in 2008.

To the west of the Ilychsky Kamen two more other mountain ridges are located, which stop at the level of the Ydzhid-Lyaga river; they do not form a single group. They are crowned by the granite mountain massifs Torreporreiz, Makariz, Nerimiz, Sotchemëliz (1040 m), etc. The Urals mountainous land ends in the west by the Western range.

The mountain slopes are woody, their tops at the height of 1200-1250 m are covered with stone fields. Rock pillars from geological material resistant to weathering are commonly found on the mountain ranges of the Northern Urals; they have the form of picturesque pillars (Manpupunyor Plateau), towers (Otorten Plateau) and "cities" (Torreporreiz Plateau).

Throughout its existence the mountain belt of the Urals was the area of multiple re-upheavals which were accompanied by the more or less deep destruction of the terrain. The whole area was subject to numerous glaciations, and currently its terrain is mostly formed through the work of denudation agents.

Along the western slopes of the Subpolar and Northern Urals a long submontane belt with mean heights of 220-350 m lies (the Ural Uvaly), which was formed by sedimentary strata. The higher ridges (Ovin-Parma, Mertvaya Parma, Ydzhidparma, Vysokaya Parma) with height up to 500-600 m rise at the places of exposure of solid quartz sandstone and are usually covered with woodland. However, some peaks (Shezhymiz, Tumbuk, Manskiye Bolvany, etc.) have stone fields. The highest in the Uralskiye Uvaly ridge is the Shezhymiz mountain with height up to 857 m.

Between the Uvaly ridges, wide lowlands are located, corresponding to the areas of limestone development and stretching from north to south. In the places of exposure of carbonate rocks, the karstic landforms of the terrain are pronounced – caves, shakeholes, dry gulches. The river tributaries are adapted to the depressions between the uvaly.

Terrain of the western slopes has a continuous gradient to the west, which is followed by the main rivers – Kozhim, Bolshaya Synya (Big Synya), Shchugor, Podcherem, Pechora (on the upper reaches), Ilych and Unya. Picturesque rocks are situated on the valley sides of these rivers.

The plains part of the Site lays within the borders of the Pechora lowland which is basically a plain sloping towards the north. Plain territory is characterized by low heights, not exceeding 150-175 m, and monotonous terrain. Smoothening is caused by burial of terrain roughnesses of an ancient plain with thickness of Quaternary glacial drifts of 100-150 m. The infrequent low hills and crests give the locality a gently rolling nature.

As a result of activity of the rivers, the terrain of riverine areas has a stepped (terrace-like) nature (for example, the Pechora River has five well-defined terraces).

Thanks to the differences in the nature of the terrain, the lithological structure of the ranges, their steepness and height, exposure of slopes, hydrological regime, the nature of the plant formation on the Site territory, diversity of the soil covering and its altitudinal zonality have been observed.

The Site territory has a well-developed river network. The water courses originate on the western slope of the Ural range. The Pechora River is the longest; its first-order tributaries are Shchugor, Ilych, Unya and Podcherem; second- and third-order tributaries are Kos'yu, Kozhim, Vangyr, Bol'shoy Patok, Ydzhyd Lyaga and others.

On its upper reaches all rivers are of a mountain nature, characterized by swift current, a rock wash, rapids, rifts and waterfalls. In the submontane and plains landscapes the rivers achieve a typical plains character with a tranquil current, streams, dead channels and islands.

There are more than 800 mountain lakes in the Subpolar Urals. The most picturesque are lakes of glacial origin, located at significant heights. Among the large lakes are the Torgovoye, the Balbanty, the Okunyovyye lakes, and etc. The depth of the lakes is about 15 m.

The level of water content of rivers depends on winter and summer precipitation. More than half of the annual runoff of rivers is provided by snow feeding, rainfall is in second place (25-35%), groundwater feed has the least specific weight.

The climate of the Subpolar and Northern Urals is severe and sharply continental. It develops under the influence of the western transport of air masses and frequent intrusion of cold Arctic air from the north along the mountain ranges. As a result of this circulation, intensive cyclonic activity and deformation of air currents by mountains are noted. This causes extremely unstable and excessively humid weather. The Subpolar and Northern Urals are the regions of Urals richest in precipitation. Especially much, up to 1500 mm and more per year, they fall on the slopes of the western exposure of the Subpolar Urals. In the mountain regions of the Northern Urals, this index is 1000 mm. On the plains and in the submontane region the annual amount of precipitation is down to 500 mm.

The main part of the precipitation falls down between April and October. Up to 40% of the annual precipitation falls as snow.

On the Subpolar Urals the average monthly temperature of the coldest month, January, reaches -18°C in the south and -21°C in the north. The winter temperature minimum is -55°C. Winter continues from October to mid-April; it is a bit longer in the highlands. For the winter period, strong winds are typical. The thaws are accompanied by sharp fluctuations in daily temperatures: during the night the air cools down to -30°C, during the day it warms up to +10°C. The average monthly temperature of the warmest month, July, in the Subpolar Urals, is +10°C, in its submontane regions it is +12°C. On the whole, the summer is characterized by cool and unstable weather with frequent cold spells and night frosts. The length of summer in the Subpolar Urals is 60-80 days, autumn is 50-60 days, winter continues for about 230 days.

In the highlands of the Northern Urals the yearly average temperature is -4°C. The index changes in the direction of the plains: in the submontane regions (Ust-Unya) it already reaches -1.1°C, and on the plains (Yaksha) – +0.8°C.

In general, the mountainous area of the Reserve is characterized by low air temperatures, short warm period and high humidity. The total amount of precipitation reaches 1000 mm here. Winter in the mountains lasts for twenty days more than in the plain area. The average air temperature in January is 21.1 °C. Western winds bring abundant precipitation in the form of snow. However, it lies unevenly in the territory. There are few snow on the mountain peaks, it is blown off from there and accumulates in the sub-glacial belt, where the height of the snow cover at the end of winter often exceeds 2 meters.

In the mountainous region only 17% of the time from the whole year account for the summer period. The average monthly temperature in July is +14.7°C.

Climate of the plain area of the Site as a whole develops under the influence of the western transport of air masses and frequent intrusion of cold Arctic air from the north along the mountain ranges. The proximity of the Ural Mountains, which are a barrier to the movement of the western air masses, determined here intense cyclonic activity and deformation of air currents. As a result, unstable weather with a relatively high amount of precipitation is formed in the plain area.

The average annual air temperature in the plain part of the Reserve is -0.6 °C. During the year 635 mm of precipitation falls here. Most of them fall in the summer and early autumn in the form of rains. The beginning of winter, coinciding with the timing of the formation of a stable snow cover, falls on October 24. Usually snow lies more than 200 days. The average temperature in January is -17.6 °C. The height of the snow cover reaches an average of 80.6 cm on the plain, which is much larger than in the neighboring western plain areas. The average temperature of the warmest month in the year, July, is +16.5 °C.

The richness of biota at the border of natural areas[19]

The Virgin Komi Forests World Natural Heritage Site is a unique region thanks to the last huge unfragmented massifs of boreal forests on the border of natural areas in Europe. This is a polygon for biodiversity conservation, for the implementation of programs for its study, preservation and demonstration.

In the process of the historical development of the vegetative cover in the post-glacial period, on the western macroslope of the Urals, stable indigenous taiga phytocenoses formed with the predominance of the Siberian polydominant taiga species – primarily Siberian spruce (Picea obovata), Siberian fir (Abies sibirica), Siberian larch and Sukachev's larch (Larix sibirica and L. sukaszewii). Common pine woods (pinus sylvestris) are confined to the sandy terraces of large rivers and boggy areas of watersheds. A significant variety of ecological conditions determines the unique natural diversity of forest vegetation. Forest communities are distinguished not only by a rich set of trees and shrubs, but also by the presence of rare and specially protected herbage plants, bryophytes and lichens, as well as medicinal plants. In this case, the Site landscapes with the massifs of virgin forests of the European North are inviolable and will remain so in the future.

The huge environment-oriented value of the Site is: in the vast area of the unfragmented territory, where the full variety of natural complexes is fully represented (the Site length is 400 km from north to south and 100 km from west to east); in that it occupies a position at the junction of the Russian Plain and the Ural mountainous land; in that the areas of the Site are of different geological origin and are composed of different rocks; in a variety of climatic parameters (precipitation amount and air temperature, delay of air masses by mountain ranges); in the preservation of the natural course of natural processes.

Biodiversity is considered by specialists as a criterion of objective assessment and value of the territory. The diverse vegetation cover of the Site territory has not been thoroughly studied, especially in remote mountain areas. Data on flora, fauna of invertebrate animals, lichen biota and mycobiota are not exhaustive.

Nevertheless, the available scientific evidence indicates a significant level of ecosystem and species diversity. So, for the Pechora-Ilych State Reserve (where the biological diversity has been studies for more than 70 years), habitation of at least 794 species and subspecies of vascular plants, 410 species and 5 varieties of mosses, 866 species of lichens and associated fungi, 295 species of aphyllophoroid and 301 species of agaricoid fungi, 52 species of mammals, 252 species of birds has been confirmed.

[19] Hereinafter: Reports of the United Nations Development Program/Global Environment Facility project for Specially Protected Natural Territories of the Republic of Komi, 2006-2014, http://undp-komi.org

The border position of the Site on the border of Europe and Asia determined the presence here of a number of species of plants and animals that do not occur in the rest of the Republic of Komi. Often the main areas of these species lie in hundreds and thousands of kilometers from it. Thus, some representatives of vascular plants, Phlojodicarpus villosus, Elymus transbaikalensis, Neotorularia humilis, are not found anywhere else in Europe. Locations in the Northeast Europe of Poa urssulensis, Pseudoroegneria reflexiaristata, Festuca pseudodalmatica, Carex mollissima plants and Issoria eugenia, Boloria angarensis, Oeneis melissa butterflies are mainly associated with the World Heritage Site. Among vascular plants, 12 species are endemic to the Urals, Oxytropis uralensis, Lagotis uralensis, Alchemilla semispoliata, Anemonasrtum biarmiense, Gagea samoedorum, and others, and two, Gypsophila uralensis and Lotus peczoricus, are endemic to the European Northeast.

On the National Park territory in the mountain tundra a Pararctia artropunctata butterfly was found, which area until recently was considered to be limited to the Chukotka Peninsula. For fish in some water bodies of the Subpolar Urals there are Arctic grayling (Thymallus arcticus) and Humpback whitefish (Coregonus lavaretus pidschian), which, apparently, indicates the ancient water connections between Europe and Asia.

The fauna of birds is very rich due to the combination of species of the Siberian complex (23%) and European complex (15%). Among the Siberian bird species, some are very common or dominate in the bird population – Arctic warbler (Phylloscopus borealis), Black-throated thrush (Turdus atrogularis), brambling (Fringilla montifringilla), little bunting (Emberiza pusilla). Such Siberian species as Siberian accentor (Prunella montanella) and Siberian rubythroat (Luscinia calliope) are found in Komi only on the Site territory.

Considering the mammalian fauna, it should be emphasized that in the Site territory there is a core of the Ural population of the Northern pika (Ochotona hyperborean), the main area of which is in Eastern Siberia. The Pechora-Ilych Reserve and the National Park are the only place in Europe where two closely related species live together, Pine marten (Martes martes) and Sable (M. zibellina), which give each other hybrids – kiduses. Siberian weasel (Martes sibiricus), a typical Siberian species, lives on the Site territory. Some of the species found here were first recorded not only for the Republic of Komi, but also for Russia as a whole.

Rare and protected species

On the Site territory there are concentrated key habitats of many rare, endemic and relict plant and animal species protected at local, regional and international levels. The analysis of the available data shows that 172 out of 253 species (68%) of the vascular plants included in the Red Book of the Republic of Komi reside here. Out of these, 2 species belong to category 1 (E), 22 – 3 (R), 33 – 4 (I), and 55 are protected in status 5 (Cd). Among the rare plants a number of species are included in the Red Book of Russia – Calypso bulbosa, Castillea arctica ssp. vorkutensis, Cypripedium calceolus, Dactylorhiza traunsteineri, Schiverekia podolica, and the IUCN Red Lists – Cypripedium calceolus.

Several species have their only locations in Europe on the Site territory – Novotorularia humilis, Primula pallasii; others, such as Pinus sibirica, are on the borders of distribution. Participation of endemic species is relatively large: Anemonastrum biarmiense, Gypsophila uralensis, Linum boreale, Thymus talijevii and others.

On the Site territory there live 60 species of mosses, protected at the local level. This amounts to 39% of the total number of bryophytes included in the Red Book of the Republic of Komi. Most of the protected species belong to 3(R) and 5(Cd) categories – 29 and 24, respectively.

Mosses protected in the 2 (V) status – 5 (Dicranum viride, Grimmia unicolor, Racomitrium fusciculare, Myurella sibirica, Pseudoleskea patens) in the 4 (I) status – 2 species (Cynodontium bruntonii, Funaria microstoma). Five species (Dicranum viride, Schistostega pennata, Neckera pennata, Hydrohypnum norvegicum, Scleropodium arellanum) are included in the Red Book of Bryophytes of Europe.

Ecosystems of the Site, primarily virgin forests, play an important role as key habitats for rare lichens. 65 species of them are registered, accounting for 82% of the total number of protected ones in the region. Not only locally but also at the Russian Federation level Bryoria fremontii, Lobaria pulmonaria, Tuckneraria laureri, Leptogium burnetiae, Lichenomphalina hudsoniana, Stereocaulon dactylophyllum are included in the Red Lists. Such species as Lobaria hallii, Leptogium rivulare are extremely rare all over the world and are known only from several points. Pannaria confusa, Cheiromycina flabelliformis, Phaeophyscia hirsuta, Chaenotheca subroscida, Chaenotecopsis vainioana, Phaeocalicium praecedens, Chaenothecopsis haematopus rare lichens from other regions of Russia are not known. Many lichen species found in pristine taiga forests, the genera of Calicium, Cyphelium, Chaenotheca, as well as the species of Usnea longissima, Cetrelia olivetorum, Heterodermia speciosa, Nephroma isidiosum, are extremely rare in Western European countries with similar natural conditions (Sweden, Finland, Norway), where forest ecosystems are subject to strong anthropogenic press. A number of species, for example, Sticta nylanderiana are in the region on the western border of the distribution. The distribution of species by protection categories is as follows: 1 (E) –11, 2 (V) –12, 3 (R) –17, 4 (I) –14 and 5 (Cd) –11. From the standpoint of lichen floristry, the territory under consideration represents a great potential for study, since now we collected samples of lichens which characteristics do not allow for accurate determination of taxonomic affiliation. Presumably, these are new species for science.

The Site mycobiota has been studied less. Nevertheless, 21 species from the Red Book of the Republic of Komi were registered, which is about 75% of the total number of taxa included in the Red Book of the Republic of Komi (1998). Most species (11) belong to 3 (R) category. Fungi of 4 (I) and 5 (Cd) categories are also noted, there are 5 of their species. Four taxa (Tylopilus alutarius, Leccinium percandidum, Grifola frondosa, Hericium coralloides) are protected at a higher level, included in the Red Book of the Russian Federation.

The list of vertebrate animals protected at the local level includes 31 species (57% of the total number included in the Red Book of the Republic of Komi).

Among the avifauna representatives registered in the region under consideration are the white-tailed eagle (Haliaeetus albicilla), the gyrfalcon (Falco rusticolus), the osprey (Pandion haliaetus), the golden eagle (Aquila chrysaetos), the peregrine falcon (Falco perigrinus) included in the IUCN Red Lists and the Red Book of Russia. Many of these species form groupings of relatively high density on the Site territory. At the same time there is a steady tendency to reduce their numbers.

One species of fish included in the Red Book of Russia is the common bullhead, Gottus gobio, the population of which is quite common in the Site watercourses.

Most of the species of vertebrate animals in need of protection have the status of rare (18), 9 species are classified as 4 (I) protection category, 8 species threatened with extinction (1 (E) category), 5 reduce their numbers (2 (V) category).

On the Site territory there are 31 species of invertebrate animals from 53 included in the Red Book of the Republic of Komi (58.5%). Five species, Capnia bifrons, C. vidua, Parnassua faebus, Sterinthus ocellatus, S. caesus, in other regions of the Republic of Komi are not registered.

On the territory of the Reserve and National Park, there are presented the most numerous in Europe populations of such red-listed lepidoptera as Parnassius phoebus, P. mnemosyne, represented here by special subspecies.

The distribution of species by protection categories is as follows: 1 (E) and 2 (V) – according to 5, 3 –R –18, 4 (I) – 3.

Species diversity on the territory of the Virgin Komi Forests Site indicates that its landscapes are complexes of ecosystems that are poorly affected by human activities. They play an important role as habitats for rare species of plants, animals and fungi. To date, information on the biological diversity of the Site territory is not exhaustive and requires further study.

The final data on the biological diversity of the Site is summarized in Table 3

Table 3

Summary indicators of the biological diversity of the Virgin Komi Forests Site.

Taxonomic group	Total number of identified species	Including species included in the IUCN Red List	Including species included in the Red Book of the Russian Federation	Including species included in the Red Book of the Russian Federation
Vascular plants	794	1	5	172
Algae	>500			4
Mosses	410	5		60
Lichens	>866		2	65
Fungi	818		4	21
Invertebrates	Approx. 1500			28
Fish and cyclostomes	22		2	5
Amphibians	4			1
Reptiles	1			
Birds	252	4	12	30
Mammals	52			3

Despite the excellent preservation of natural complexes, signs of anthropogenic impact on them are still evident. For example, some burnt places along the tourist routes arose because of careless handling of fire. Age structure of the populations of grayling, whitefish, Atlantic salmon shows that they have long experienced the effects of overfishing (by many signs, overfishing still exists in the Unya River). The taimen (Hucho taimen) disappeared due to the overfishing and drift floating.

Local anthropogenic impacts, which so far clearly affect the Site biological diversity, are given in Table 4.

Table 4.

Anthropogenic impact on fauna and flora objects and planned measures to reduce threats

Type of anthropogenic impact	Objects of impact	Subjects of impact	Affected territory	Measures to reduce the impact level	Trends in the changes of the impact level

Type of anthropogenic impact	Objects of impact	Subjects of impact	Affected territory	Measures to reduce the impact level	Trends in the changes of the impact level
Poaching	Valuable fish species: Atlantic salmon, grayling, whitefish species of water and upland fowl	Visitors (tourists and packers)	Floating park rivers and ponds accessible to transport	Organization of protection zones with a special duty of nature management. Checking whether there any fishing gear and catch in the baggage of visitors, patrolling, prevention, prohibition of visiting during spawning periods	Impact reduction
Poaching	Types of hunting fauna	Visitors (tourists and packers)	Areas available to transport and (or) in the available periods of the year (snow crust, flood period)	Stations at the entry to the territory during the threatened periods of the year (snow crust period), patrolling accessible areas, prevention.	Impact reduction
Collecting and gathering rare species	Rhodiola rosea, orchid, lepidoptera, minerals	Visitors (tourists and packers)	Areas of the park near roads and routes	Detailed inventory and protection of habitats and growth of threatened species, control of baggage of visitors in exit areas, prevention.	Impact reduction
Water pollution as a result of economic activity	Aquatic organisms and sites	The mining enterprise (quartz), the means of transport of the enterprise, the storages of pollutants, the construction of the Cellulose and Cardboard Mill in the Troitsko-Pechorsky District and the development of mineral resources (potassium salts, gas)	Balbanyu river, Kozhim river, Pechora river	Monitoring pollution, initiating the construction of treatment facilities, requiring the use of the most secure technologies	Emergence of new threats, increase in the impact intensity
Violation of the grazing cycle for domestic deer, overgrazing	Ecosystem of tundra areas, breeding areas of rare bird species	Deer farms	Northern part of the Park, mountain area of the Site	Coordination and control of compliance with grazing cycles, regulation of grazing land pressure	Stable satisfactory state of grazing land

Historical and cultural values

Natural landscapes throughout the entire territory of the Site were not subjected to anthropogenic impact because of their remoteness, inaccessibility and severe climate. Nevertheless, human activity has left its mark on this territory.

Traces of economic activity of various epochs, places connected with historical events, religious places associated with the beliefs of the indigenous population (natural objects mentioned in stories, legends), etc. have been found.

Traditions of sustainable nature management in combination with traditional life are very valuable. Traditions of holidays and creativity – songs, weaving, carpentry – constitute an important element of the local population culture inscribed in the natural environment and one that can not exist outside the natural environment. On the Site territory, Komi, Mansi, Khanty and Russians were neighbors, mutually enriching the culture and traditions.

Ancient dwelling sites and religious places.

Beginning of the settlement of the Pripechore territory by man falls on the period of the Upper Pleistocene, when the relative warming came to replace the glaciation. Since the Mesolithic Age, the Pechora region has served as a constant habitat for tribes that are different in terms of language. In different historical epochs, the Finno-Ugric and Samoyedic groups of population lived here. Here they penetrated, dissolving in within the local tribes, natives of the Priobye and Volga-Kama regions.

Large-scale archaeological studies on the Site territory was carried out in the upper reaches of the Pechora River and its tributaries, 14 archaeological monuments are known (3 monuments on the Kozhim River, 7 on the Podcherem River, 3 in the upper Pechora River and 1 in the upper Unya River).

Many of these monuments can be classified as sacred. Sacred objects are understood as typical, usually revered in the people landscape elements (trees, rocks, springs, etc.), which are the places of worship, administration and, at the same time, elements of the cultural heritage of ethnic groups, peoples or individual groups.

In the valley of Kozhim river, archaeological monument Kozhim 1 at the Balbanyu river outfall, where traces of sacrifices – charred bones of deer and elks – were found, is of special interest. Unfortunately, many of the potential finds on the Kozhim shores were irretrievably lost under bulldozers during the time of placer gold mining.

One of the most interesting sacred monuments, "functioning" to this day, is a memorial stone on the watershed of the Main Ural Range – the border of Europe and Asia, in the upper reaches of the Saran-Sedayu River, on the border of the park. Here are the historical paths of reindeer herders which they annually use to drive herds from the Tyumen region (Saranpaul mount) to the Kozhim river basin. Even now it is customary to leave "sacrifices" at the stone – offerings to the gods: at the foot of the stone men leave axes, women leave utensils, children leave toys.

It should be noted that such historical and cultural sites (Table 5) often coincide with natural monuments. The reason is that the ancient people chose for their sanctuaries, places of sacrifice, etc., notable places – stone rock pillars – "idols", caves and grottoes in the rocks, footsteps and peaks of mountains unusual in form. The name Balbanyu is translated as "the river of idols," or blockheads; the name of the same river in Mansi language – Yalpyng-Ya – means "sacred river". "Kamennaya Baba" geological monument at the Balbanyu river outfall is also an archaeological monument (sacrificial place). The same can be said about Manpupunyor , the three caves of the Jordanian Log, the Kaninskaya cave on Pechora river and Uninskaya cave on Unya river, the "Arka" grotto on Podcherye river.

Table 5

Brief description of some significant monuments within the Site borders.

Name	Brief description
"Arka" grotto – sanctuary of the XI century AD	Dwelling site of an ancient man
Yerkusei mount, Telpos-Iz mount, Sablya mount	Sites related to the beliefs of the indigenous population
"Saran-Ded"	Religious places
"Kamennaya Baba", Kozhim river	Religious places
"Starik-Khozyain"	Religious places
Rock pillars on the Manpupunyor plateau	Sites related to the beliefs of the indigenous population
Bear, ice and tuff caves of the Jordanian Log	Dwelling site of an ancient man and religious places
Kaninskaya Cave, Pechora, Pikhtovka	Dwelling site of an ancient man and religious places
Uninskaya cave, Unya river	Dwelling site of an ancient man and religious places
Caves of rocky outcrops of the Pikhtovka river	Unstudied

Settlements

Villages of fishermen and hunters located along the banks of rivers took a great place in the history of the Pripechore development by men. At the beginning of the last century, they were mentioned along the Podcherye river – 13, along the Shchugor river – 3. At the Ilych, Pechora and Unya rivers, there were at least 14 settlements, where there are currently villages, cordons of the reserve and forest huts. In addition, the Old Believers – "recluses" – settled at no less than 18 points on the Unya river and its tributaries Kisunya and Kultanya. Settlers in the upper reaches of the Pechora river and its tributaries were mainly concerned with the Old Believers. Prayer houses were hidden in the taiga. Thus, the prayer house was located in the upper reaches of the Timenka river (the national park), where local residents – the Old Believers – sent their children to study "reading and writing" according to church books – prayers and psalms, in the Church Russian language, which the children did not understand.

Traces of economic activity.

One of the most interesting monuments of this group are Sibiryakovskiye tracts.

Sibiryakovskiye tracts were built by the Irkutsk industrialist A. M. Sibiryakov, the first one in 1885, the second one three years later, for transportation of goods, primarily cheap bread, from Western Siberia to the Pechora region and Western Europe.

The tract, which traces remained on the territory of the national park, was a 6 m wide and 180 km long clearing, with wooden corduroy roads in the marshes and 5 intermediate stations for recreation of coachmen. It started from the village of Shchekurya upon Lyapin, where the goods were delivered by steamships along the Ob, Severnaya Sosva and Lyapin and were further transported by horses and deer through the mountains, the taiga and the marshes to Ust-Shchugor upon Pechora. The road crossed the Shchugor river, where a pier with barns was built (Pristan rock). The tract was mainly used in the winter. 1000 deer were assigned only for trampling the road along the entire trail from Pechora to Lyapin. The tractor was also used in the summer, making special lugs from deer skins. Subsequently, Sibiryakov intended to make the track wheely for year-round operation, but the construction of a railway from Western Siberia through the Urals to European Russia opened another opportunity for export of Siberian bread to Western Europe. Bread in Siberia immediately fell in price, transporting it along the route became unprofitable, and the tract was abandoned.

The tract passed along the so-called "Zyryansky path", known from the 15th to 16th centuries: when Ostyaks and Voguls brought yasak to Ust-Vym using this path. Sibiryakov restored this ancient path to Siberia along Shchugor.

The second Sibiryakovsky tract was laid later, it was 50 km shorter (130 km), and started to the south — in Yeremeyevo village upon the Ilych river. Ilych crossed Ust Lyaga village and along the Ydzhid Lyaga river followed through the low passes of the Urals to the Severnaya Sosva river. It suffered the same fate as the northern tract. Currently, the tract within the Site borders is supported by the efforts of the reserve, it is used by inspectors and tourists.

Traces of economic activity (Table 6) are valuable as objects for showing tourists, with the aim of popularizing knowledge, preserving traditions and restoring the history of the region development and traditional nature management inextricably linked with the culture of the local population.

Table 6

Brief description of the most significant historical and cultural sites (settlements and traces of economic activity) within the Site borders

Name	Brief description
Former villages: Kamchatka, Parfen, Orlovka, Pilya-kerka, Michabechevnik, Oselok, Mezentsev's Manor, Chameiny, Klyuchiki, Chagin's hut, Shizhim, Sobinskaya, Shaitanovka, Ust-Lyaga and others	Monuments of economic activity (former settlements (villages) of Old Believers) traditional architecture, objects of life and beliefs.
Huts of fishermen and hunters and their trade routes and products	Detached buildings and household buildings – traditional architecture, craft items
Remains of the blast furnaces and mechanisms of the Lukyanov Ironworks in the Ust-Berdysh village (operated in 1899-1901 and melted 900 tons of cast iron, existed until 1911-13), traces of ore extraction.	Traces of industrial activity
Shchugor-Saranpaul Sibiryakovsky tract and "Pristan"	Traces of economic activity
Ilych-S.Sosva Sibiryakovsky tract	Traces of economic activity
Geological bases: Zhelannaya, Vangyr, Omegashor, Onyx, Sanavozh, Khasavarka, Nikolai-shor, Manskaya Volostnitsa	Monuments of industrial development
Forest cemeteries	Burials and burial constructions
Traces of location of prisoners' camps	Traces of economic activity

Preservation of the main values composing the culture of the local population: traditions of sustainable nature management, household and craft items, holiday traditions, applied art takes place in different ways. Local residents independently preserve and restore buildings, collect artifacts of former times and beliefs, continue the traditions of crafts, the Park supports song creativity, the Park and the Reserve compose museum exhibits.

Protecting historical artifacts from adverse impacts (Table 7) requires constant efforts.

Table 7

Factors of adverse impact on historical and cultural values and measures to reduce their intensity

Type of anthropogenic impact	Objects of impact	Subjects of influence/ and trends	Possible mitigation measures
Littering, violation of Site and paths to approach it	Archaeological sites (cult, sacrificial and other significant places and landscapes)	Visitors, impact of technologies, /load increase	Infrastructure that reduces loads and natural erosion of the landscape, visits to monuments accompanied by guides, infrastructure for garbage collection and garbage removal, preservation of monuments in natural form, creation of "scenery spots" remote from monuments, prevention and education of visitors, offering virtual excursions on various media and other.

Type of anthropogenic impact	Objects of impact	Subjects of influence/ and trends	Possible mitigation measures
Natural destruction, restoration without respect for historical identity	Historical settlements of fishermen and hunters, prayer houses	Natural processes, visitors, local residents	Restoration of traditional settlement (exposition in the open air), household items, utensils, excursions and education
Overgrowing, destruction of corduroy roads, bridges and flooring	Sibiryakovsky tract	Natural processes	Restoration of the tract site, creation of a tourist product, using traditional transport — horses and deer, excursions and education
Loss of traditional activities, destruction of the traditional nature management cycle	Culture and traditions of the local population, based on traditional activities (reindeer herding, hunting, fishing, gathering)	Prohibition of traditional activities in the Specially Protected Natural Territories and the lack of a product market	Restoration of traditional activities (crafts) in the buffer zones and zones of assistance, in order to demonstrate them to visitors, sale products and services

Potential for preserving the local living culture is great and relates to the accompanying traditional activities: weaving, traditional joinery and saddlery products, manufacture of household items and others, which can become a component of ecological tourism.

ECOLOGICAL SITUATION AND THREATS

Uniqueness of the Virgin Komi Forests World Natural Heritage Site is due in large part to the fact that it is a territory minimally affected by anthropogenic activities. Nevertheless, its significant areas have clear signs of anthropogenic impact (Table 8).

Table 8

Areas within the World Heritage Site that are experiencing anthropogenic impact

Site, location	Type and consequences of the impact	Ability to prevent and compensate
Places of placer gold development in the 60-80 years of the 20th century.[20], Kozhim river, Yugyd Va National Park, Intinsky district	Violations of vegetation and soil cover, industrial waste (polygons after gold mining are not reclaimed)	Natural restoration of vegetation on polygons (occurs faster on sites with a wavy microrelief)
Zhelannoye village, Kozhim river, Yugyd Va National Park, Intinsky district	Gangue quartz development. Industrial and domestic sewage of the village, emissions of pollutants into the atmosphere — from transport, enrichment of raw materials, boiler. Violation of vegetation and soil cover during the passage of trucks, poaching, anxiety.	Operating enterprise — constant monitoring of pollution and disturbance of vegetative cover, work of treatment facilities, control of exit of residents outside the village, analysis of the status of species - indicators
Kozhim river, Yugyd Va	Vein gold exploration	Qualitative environment impact

[20] Influence of the development of placer deposits of the Subpolar Urals on the natural environment. Syktyvkar, 1994. 171 p.

Site, location	Type and consequences of the impact	Ability to prevent and compensate
National Park, Intinsky district		assessment (EIA) and environment-oriented aspects of projects. Continuous monitoring of the consequences of industrial activities, including analysis of the status of species – indicators
Road Inta – Sana Vozh – Zhelannoye, Yugyd Va National Park, Intinsky district	Unauthorized people access, anxiety, poaching, pollution	Prevention, control over travelers, garbage removal, localization of spilled petroleum, oil, lubricants (POL), prohibition of travel during flood periods
"Siyaniye Severa" gas pipeline, clearing and road along the route, Yugyd Va National Park, Vuktylsky district	Access to the territory for unauthorized visits. Anxiety in the maintenance and repair of a gas pipeline	Agreement on joint pollution control in the area of bridge crossings of the rivers and on the border of the protected zone of the gas pipeline and the park, transparency of the access system. Poaching prevention
Yugyd Va National Park, Intinsky district	Poaching, littering of territory, soil erosion due to improperly organized or unauthorized visits (tourist flow up to 3,500 people/year)	Organization of camping places, garbage collectors, toilets, trails, prevention of violations, publication and distribution of rules of conduct
Interfluve area of Podcherem and Shchugor rivers in the immediate vicinity of the borders of the Yugyd Va National Park, Vuktylsky district	Roads and abandoned dwellings in the felling areas of the 60s and 80s, facilitating access to visitors without a sanction	Including the cut over lands into the park or its protective zone
Abandoned villages in the immediate vicinity of the Reserve borders along the western border of the mountain cluster	Roads and abandoned dwellings in the felling areas of the 60s and 80s, facilitating access to visitors without a sanction	Creation of a protection zone, stations at the entry to the Reserve territory, restoration of forest ecosystems
Sibiryakovskiy tract, in the Reserve, Manskaya Volosnitsa river (tributary of Pechora river), Imperatorskaya river (tributary of Unya river), Klyuchiki land type (river Unya) in the buffer zone	Traces of infrastructure in places of placer gold mining in small volumes in the middle and beginning of the 19th century, and in the 70s of the 20th century	Preservation of historical monuments of industrial development
Projected Cellulose and Cardboard Mill in Troitsko-Pechorsky District	Pollution of watercourses flowing into the Pechora river, approaching the zone of intensive felling to the borders of Specially Protected Natural Territories	Studying the impact on Specially Protected Natural Territories, strengthening border control
Reserve, Manpupunyor plateau	Anthropogenic soil degradation and contamination of the territory as a result of visits of up to 1000 people per year, import of weed seeds	Creation of an adequate infrastructure for servicing visitors and continuous monitoring of the preservation of natural complexes
Actively visited sites and places of temporary residence (cordons, tourist bases) in the Reserve and National Park	Anthropogenic degradation of vegetation cover in places of visitor accumulation, import of synanthropic and invasive species	Developed infrastructure, correct organization of excursions, monitoring of the preservation of natural complexes, use of alternative transport
Grazing lands of domestic reindeer in the National Park	Degradation of lichen cover due to overgrazing, unauthorized shooting of wild reindeer and predators, constant presence of dogs, fishing with nets	Correct turnover of grazing lands, insurance of herds (from predators), grazing control and monitoring of grazing lands

Results of estimating the areas of sites in need of measures to compensate for anthropogenic impact or reclamation are summarized in Table 9.

Table 9

State of natural sites with signs of anthropogenic disturbances, planned ways to compensate for threats and to reduce negative impacts

Site	State of site							Methods for eliminating threats and reducing negative impacts
	Traces of visits, % of the site territory	Trails, sq.m./km	Littering of camping places, sq.m./ha	Littering, t	Damage to vegetation, ha.	Unequipped camping places, pcs/sq.m.	Erosion of slopes, banks, sq.m.	
Naroda mountain	30	-/ 25	- / 0.2	0.1	0.2	3 / 300	-	Development of camping infrastructure at the foot, waste management programs and garbage removal, cleaning of camping places, replicating visiting rules, places of storage for solid waste at the foot accessible to transport
Manaraga mountain	20	-	-/0,2	0.1	0.3	3/300	-	
Arka grotto	+	0.01	50/-	0.1	-	-	0.01	Repair and maintenance of the existing infrastructure in good condition, prohibition of visits to the monument without the accompaniment of trained employees or guides
Kamennaya Baba (Kozhim river)	+	+	+	0.2	-	-	25	Dismantling and transfer, maintenance of the existing infrastructure in good condition, repair of access roads, garbage removal, installation of an information board with rules of conduct, visiting the monument only accompanied by guides
Teplyye Ozera land type	+	1000	+	+	0.01	-	-	Bridges, stairs and gangways in places prone to erosion, camp infrastructure on the banks, waste management programs and garbage removal, reclamation of disturbed sites
Yaruta mountain	20	+	-/0,01	0.01	+	3/12	+	Gangways in places prone to erosion, development of camping infrastructure at the foot, waste management programs and garbage removal, cleaning of camping places, reclamation of disturbed sites
Vorota land type (Shchugor)	+	+	+	0.005	+	-	-	Gangways in places prone to erosion, development of camping infrastructure, waste management programs and garbage removal, reclamation of disturbed sites
Kozhim river with tributaries	1	+	-/7,5	+	+	+/75000	+	Establishment, maintenance and improvement of 34 camping places, waste management programs and garbage removal, reclamation of identified disturbed sites
Kos'yu river	+	+	+/2,0	+	+	2/20000	+	Establishment, maintenance and improvement of 3 camping places, waste management programs and garbage removal, reclamation of disturbed sites
Shchugor river	+	+	93000/-	+	+	32/47600	3300 (33 sites)	Establishment, maintenance and improvement of 32 camping places, waste management programs and garbage removal, reclamation of disturbed sites.
Podcherem river	+	+	20000/-	+	+	14/19600	2100 (21 sites)	Establishment, maintenance and improvement of 14 camping places, waste management programs and garbage removal, reclamation of disturbed sites.
Manpupunyor	+	+	-	-	-	-	-	Development of infrastructure for trails, scenery spots, recreation areas and camping places
Ust-Lyaga-Manpupunyor trail	+	50	300/-	+	5	-	100	Closure of the route until the restoration of its disturbed sites and its reclamation
Pechora source-Manpupunyor trail	+	20	200/-	+	3	-	100	Gangways in places prone to erosion, development of camping infrastructure, waste management programs and garbage removal, reclamation of disturbed sites

The Site territory as a whole is currently not subject to critical man-caused pressures.

It requires studying the effect of atmospheric transfer on the Site ecosystems.

There are common threats to natural complexes and the biota of the Site. This, first of all, fires and import of alien species.

Under the influence of pyrogenic dynamics, pine formations are formed in the plain cluster of the Reserve and along the western border of the mountain cluster of the Reserve and the southern part of the National Park. According to data for the period of 1997-2016, an average number of fires per year is 2. After their localization, the average area of the burned places is about 200 hectares. The main cause of fire during this period were dry thunderstorms.

The result of successful invasion is the replacement of the European mink by the American one. Since the mid-twentieth century, when the American mink was breed in the mass at fur farms, it gradually began to replace the European mink from wild populations. As a result, the European mink is now included in the Red Books, and the American one is dominant. Since these two species are differentiated from pelts after killing, there is no exact information on their ratio in the Specially Protected Natural Territories, but according to zoologists of the Reserve and National Park, the European mink is extremely rare to be met.

III. SOCIAL AND ECONOMIC CONDITIONS AND NATURE MANAGEMENT

Nature management

On the Site territory there are currently operate one quartz mining and one gas transportation enterprise.

Agriculture in the Site territory is traditional and extensive. Reindeer breeding is developed in the National Park. In individual household plots, cordons have very small vegetable gardens, hayfields and grazing lands.

Otherwise, the Site territory is used only for tourist, scientific and environmental education activities.

"Zhelannoye" quartz mine ("Kozhim Exploration and Production Enterprise" JSC) is very small in size. It employs about 100 people on a rotational scheme (a shift of about 30 people). The mine connects machine-and-tractor passway with the city of Inta; the passway crosses the territory of the National Park from east to west in its northern part.

In the Intinsky district near the western border of the Park there is a small enterprise for bottling mineral water.

In Vuktylsky district, the territory of the National Park is crossed by the gas pipeline and the road for its maintenance.

A few tenants of recreational sites in the National Park conduct moderate activities, which have little effect on the natural environment.

Gold mining is stopped. Polygons along the Kozhim river left after the mining require reclamation.

The largest industrial enterprises operating on the territories adjacent to the Site: a branch of "Gazprom dobycha Krasnodar" LLC – "Vuktylskoye Gas Field Administration", "Gazprom Transgaz Ukhta" LLC, "Intaugol" OJSC, "Kozhim Exploration and Production Enterprise" CJSC.

In the Intinsky branch of the National Park, the problem of reclamation of disturbed sites left after gold mining, cleaning of industrial garbage, and development of burnt forest areas is acute. Until now (2016), the area of burnt places, where the forests have not recovered, is 854 hectares.

The southern part of the Site does not experience any pressure from the industry. Large-scale forest felling in adjacent territories is stopped, clearings are restored naturally. Explored mineral deposits and industry are either removed from the territory (deposits of salt, gas, oil), or frozen (Cellulose and Cardboard Mill, ore deposits).

At the same time, a sharp increase in the tourist flow is observed on the territory of the Reserve: if in the 80-90s it was 300-400 people for all its sites, at present more than 1400 official tourists visit the Manpupunyor plateau only.

The relevant task of reclamation of the Site areas suffering from tourists: restoration of vegetation along the coastline of rivers and in the places of tent camps, cleaning of domestic garbage in the National Park and reclamation of a spontaneous transport passage along the border of the Reserve and its buffer zone.

Box 2. History of settlement and nature management

Nomadic reindeer herders exploited the tundra and forest-tundra plots of the Ural range throughout the historical period. Stationary settlements along the Pechora river and its tributaries – the main transport artery – began to appear in the Middle Urals in the 11th century. Since that time, there are known facts of using the territory for fur trade.

Until the 19th century, the nomadic population prevailed here, since the 19th century – settled population prevailed. In the 19th century, fish and fowl, as well as timber from selective (for the best trees) felling, became products of trade and exchange, in addition to furs. Agriculture developed for its own needs. Livestock prevailed, there was a shortage of arable land. Felling industry was developed in the upper reaches

of the Pechora river: in 1880 for Ust-Unya village there is evidence that barges for the Nizhny Novgorod fair were built from "time immemorial". With the advent of steamships, the logging of steamship firewood began. The wood was floated into the lower reaches of Pechora river. The list of Pechora handicrafts in 1880 contained the following in descending order: building of barges – logging – export – fishing and hunting – gold mining – agriculture.

The beginning of industrial development of the Middle Urals – the construction of the first ironworks – dates from the 17th century. At that time, the penetration of migrants into the Northern Urals began, where the ore prospectors were looking for ore deposits. In the 19th century, large-scale systematic geological studies of the Urals began. A. P. Karpinsky, I. V. Mushketov, Ye. S. Fedorov and other prominent scientists took part in them.

At the end of the 19th century, the Lukyanovsky ironworks with two blast furnaces on the rich deposit of high-quality ores near Ust-Berdysh village (on the Unya river) was built and successfully put into operation on the Site territory in a short time. It did not existed for a long time, until the beginning of the Russo-Japanese War. Ruin of the ironworks is associated with competition – due to high transportation costs compared with the factories adjacent to the railway.

In the 20th century, settlement and industrial development of the Site began. A small lead mining enterprise has been operating since the late 40-s in the Northern Urals. Several small mining enterprises existed in the Subpolar Urals. Large-scale searches for hydrocarbons were conducted in the 50-s in the area of Yaksha village. Continuous large-scale logging began in the early 60-s: along the floating rivers and in the interfluve of Shchugor and Podcherem rivers, in the upper reaches of Pechora river, in the interfluve of Pechora and Ilych rivers. At that time, the Reserve was seized most of the submontane area territory.

In the Subpolar Urals, gold was mined in the catchment of Kozhim river. Spent 910.6 hectares of polygons were subsequently included in the territory of the Park, as well as other areas disturbed by human activities: disposal dumps of industrial garbage, settlements, buildings and machine-and-tractor passway.

The main anthropogenic pressure was assumed by the National Park after its creation in 1994. However, the tourist flow to the Site territory was formed much earlier. The history of tourism here has more than 60 years. In the 70-s, the number of tourists increased many times in parallel with industrial development and construction of roads and clearings. This period is associated with an increase in the area covered by anthropogenic fires. In the 1970-s and 1990-s of the last century the number of visitors to the future territory of the park was, according to different sources, 3-25 thousand people per year, now the flows of visitors have stabilized at the level of 6-7 thousand people per year.

Population and visitors of the territory

The constant population living within the Site is very few. There is no local population on the territory of the National Park and Reserve. 3 villages still exist in the buffer zone of the Reserve. There live 110 people. 15 employees of Specially Protected Natural Territories are constantly residing in the Reserve on 9 cordons.

In the immediate vicinity of the National Park borders there are about 95 thousand people. 350 residents live near the mountain cluster of the Reserve, 9 thousand people live near the pine wood.

An important task of managing a World Heritage Site is to interact with visitors. One of the main goals of the National Park is to create conditions for tourism. However, financing for the development of infrastructure and field is clearly insufficient (the need for infrastructure is twice the amount available). Local population support programs aimed at increasing the loyalty to the Specially Protected Natural Territories and self-employment also have very little financial support. This can lead to gradual degradation of natural complexes and increased poaching.

Annually the Site territory is visited by about 10 thousand people, the development of infrastructure is caused by visits made to the Specially Protected Natural Territories by children. The main load for servicing tourists and excursionists lies on the National Park (table 10).

Table 10

Visitors of the Site and their distribution by age groups

Indices	Number of visitors, thousand people	Age groups, %		
		Children	Able to work	Retired people
Visitors to the National Park territory, 2015[21]	6.203	17	70	13
Visitors to the National Park territory*, 2016	6.383	9	91	
Visitors to the Reserve's mountain site, 2016	1.414	2	98	
Visitors to the Reserve's manor site (elk farm and museum), 2016	1.425	24	76	
Visitors to the Reserve's buffer zone. 2016**	1.500	5-10	90-95	
Total:	10.722			

*- excursionists and participants of the actions of the National Park outside its territory – 35 thousand people (mainly children) were not taken into account. **- evaluation of employees of the Komsomolskoye Forestry

In the National Park territory there is no constant population, along its perimeter there are control and security points and manors, which allow to optimally regulate the flow of visitors.

57 residential buildings and 21 bath houses are equipped to accommodate tourists in the Park territory; 78 well-equipped camping places are equipped with 81 gazebos, 104 equipped fire-pits, 86 garbage collectors, 76 toilets, 44 ramps to the water and gangways, bridges and passages. The need for stopping points remains significant.

For sports and ecological tourists the park contains and serves 17 (walking and water) routes, as well as 4 winter routes duplicating their. The flow of tourists poses a threat to the Park's natural complexes (for example, littering, deforestation, degradation of river banks due to unauthorized camping, poaching, etc.), but tourism has an insignificant local impact and does not exceed the possibilities for self-restoration of the Park's natural complexes.

The close location of the cities of Vuktyl and Inta to the territory of Yugyd Va National Park contributes to the demand for "weekend tourism", which the Park can not satisfy due to the weak infrastructure development.

Among tourists visiting the National Park, people working in sectors of the economy with low labor remuneration (workers of industrial enterprises and state employees – health care, education and other sectors, Table 11) prevail.

Table 11

Structure of Site visitors by economy industries[22] (2015)

Employment in industries	Share of employed %	Social characteristics of Park visitors, %
Total in the economy	70	76
Industry	16	35
Agriculture and forestry	3	no data
Construction	5	6
Wholesale and retail sales	11	15
Housing and Utility Infrastructure and service industry	5	no data
Health care, education and budget	14	20
Management	4	no data
Unemployed	30	24
Student	no data	11

[21] Visitor survey, 2015, a full analysis of the visitor survey is given in the National Park Management Plan.

[22] Social and economic characteristics of the population. Results of the all-Russia population census of 2010. Republic of Komi. Volume 4: statistics digest/Komistat - Syktyvkar, 2012 - 236 p. (**http://komi.gks.ru**)

Employment in industries	Share of employed %	Social characteristics of Park visitors, %
Pensioner	13	13
Total number of respondents		100

Obviously, this is due to the price availability of self-supported travel in the Park. Indirectly, this is confirmed by the fact that the main flow of tourists consists of residents of the Republic of Komi. An estimate of the composition of Park visitors was obtained as a result of a survey of 81 visitors of the National Park in 2015. The Site territory is visited by both urban and rural population.

In 2014, the Park territory was visited by 6,097 people, in 2015 the number of visitors was 6,203 people, in 2016 the park was visited by 6,383 tourists[23], the annual growth of visitors is 2-3%. The Intinsky branch accounts for 53% of the flow, the Pechora branch accounts for 7%, the Vuktylsky site – 40%. In the Park preference is given to independent travel. The structure of preferences of types of rest by tourists on the average was distributed as follows: rafting along the park's rivers on non-motorized vessels is 42% of visits; pedestrian and water tourism – 12%, hiking – up to 15% of visitors, city break – up to 31% of tourists.

In 2016 the Reserve was visited by 2,839 people, including visitors to the moose farm and museum (1,425 people). In the mountain cluster 1414 people traveled, most of whom visited the rock pillars of Manpupunyor on foot routes, as well as helicopters and snowmobiles, the minority traveled around the perimeter of the Reserve along the rivers Pechora and Ilych. The access system for visiting the Ilych river within the Reserve is not available, therefore statistics of perimeter visits may be underestimated.

Compared to 2015, the number of visitors to mountain sites has doubled. Buffer zone of the Reserve, according to survey estimates (Komsomolskoye forestry), in 2016, visited about 1500 people, half of which were the floating tourists who got to the territory by helicopters. The rest were accompanied by the local population on boats.

Anthropogenic impact on the territory and adjacent land, illegal nature management

In general, natural complexes of the World Heritage Site are subject to anthropogenic impact to a very small extent. A detailed analysis of anthropogenic impacts on individual sites is made in the relevant chapters. Table 12 lists the main groups of impacts in order of decreasing importance.

Table 12

The main categories of adverse impacts on the natural complexes of the World Heritage Site

Type of impact	Objects of impact	Subjects of impact	Territory of possible impact	Trends in impact (increase or decrease)	Possible mitigation measures
Forest fires (man-made)	Boreal forests, populations of rare species	Humans	All the territory of the Site	Stable	Preventive measures (maintenance of roads, fireproof breaks, etc.), modern methods of operative detection of fires, staffing of fire-chemical stations and fire-fighting boards, training of personnel, trainings, prompt delivery of personnel to the fire points

[23] Visitors: 63% are residents of Komi, 12, 8% are from Moscow and St. Petersburg, 22.7% are from other regions of the country, and 1.5% are from 15 countries of the world.

Type of impact	Objects of impact	Subjects of impact	Territory of possible impact	Trends in impact (increase or decrease)	Possible mitigation measures
Industrial activities, including linear structures and transport	Natural complexes, water, populations	Gold mining, operating enterprises, car-and-tractor roads, gas pipelines	Balbanyu river, Kozhim river, Podcherem river, Shchugor river, Ilych river, Pechora river	The threat can become critical after the intensification of industry.	Monitoring of the state of industrial facilities, monitoring the discharge of water and monitoring the transport of the enterprise and potential pollution facilities (warehouses, sanitary facilities — toilets, bath houses), initiating the construction of buffer structures that interfere with the drainage of substances and treatment facilities, etc.
Visiting by tourists, including transportation	Natural complexes, water, biodiversity	Visitors	Routes of hikes, rafting, delivery sites and routes for visitors	The threat is unimportant and regulated	Protection, monitoring of influence and regulation of visits, inspection of vehicles, creation of solid waste landfills, garbage collectors, sanitary facilities (toilets), infrastructure reducing the impact on natural complexes, etc.

The greatest danger is caused by forest fires. Their control is most difficult due to their unpredictability and inaccessibility of the territory.

Control over the ecological situation in the zone of influence of linear structures is not difficult, but requires constant attention.

Reclamation of polygons after gold mining is not difficult technologically, but it requires a lot of effort, money and time due to the severity of the natural conditions in their locations.

The adverse effects of tourists' stay can and should be compensated in the process of servicing visitors.

IV. SITE MANAGEMENT

Yugyd Va National Park and Pechora-Ilych State Nature Reserve Federal State Budgetary Institutions are legal entities financed from the federal budget, extra-budgetary sources, as well as funds from income-generating activities directed to the implementation of the main tasks specified in the Provisions on these Specially Protected Natural Territories.

The National Park and the Reserve have independent balances, accounts in the bodies of the federal treasury, in the institutions of the Central Bank of the Russian Federation, and the official seals with their names. Federal Specially Protected Natural Territories are subordinate to the Ministry of Natural Resources and Environment of the Russian Federation

Management decisions are made by the Administration of the Specially Protected Natural Territories. Scientific and technical councils which are advisory bodies are organized both in the National Park and in the Reserve.

Two wildlife sanctuaries of republican subordination that are part of the Site are protected by the "Center for Specially Protected Natural Territories" SBI of the RK, which is subordinated to the Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi. Forest resources of the buffer zone of the Reserve are managed by the Komsomolskoye forestry which is subordinate to the same ministry. The Center for Specially Protected Natural Territories interacts with the public, entrepreneurs and scientists through the Public Council at the Ministry.

Regional Specially Protected Natural Territories have a duty that excludes industrial impact, but permits traditional nature management, as well as the use of natural complexes for recreational and educational purposes.

The total number of staff members of the Site as of January 1, 2017 is 131 people, of whom 60 people are constant staff of Yugyd Va National Park, 68 people – Pechora-Ilych Reserve, the buffer zone and wildlife sanctuaries in Verkhne-Pechorskoye district forestry of the Komsomolskoye forestry have a specialized staff of 3 people.

In general, the management system of Specially Protected Natural Territories is adequate to local social and economic and natural conditions. It fully complies with international principles, norms and standards of activities for the conservation of World Heritage Natural Sites[24],

The Site territory is divided into functional zones having special operation and protection duties (Table 13). Detailed description of duties of the functional zones and their layouts are given in Appendix 1.

Table 13

Functional zones of the Virgin Komi Forests Site

	Pechora-Ilych Reserve, hectares	Yugyd Va National Park, hectares	Buffer and protection zones, wildlife sanctuaries, hectares	Total, hectares	%
Zones of strict and absolute protection	713547	1659960	0	**2,373,507**	69.7
Zones of limited operation and tourism	7,785	234173	790,327	**1,032,285**	30.3

Thus, environmentally friendly operation of resources is possible in almost a third of the Site territory: recreational and educational use and traditional nature management by indigenous residents.

[24] Consistent with the Seville Strategy, the Madrid Action Plan and the Convention for the Protection of World Cultural and Natural Heritage Sites

The use of biological resources for own needs by the population outside the Reserve and Park territory is free of charge, it is not associated with leasing (there is a public forest easement)[25] and possibly by permission (haymaking, hunting) or free (collection of wild-growings).

Natural complexes and resources are managed: in accordance with the Provisions on the Park and the Reserve and the Provisions on the buffer zone. According to these documents, the industrial operation of Specially Protected Natural Territories is prohibited.

The main production and territorial structural subdivisions of the National Park are: Vuktylsky Central Park Management Authority (directorate), Pechora and Intinsky branches with the corresponding local forestries: Podcherskoye, Nizhne-Shchugorskoye, Verkhne-Shchugorskoye, Patokskoye, Syninskoye, Aranetskoye, Kosyunskoye, Kozhimskoye, Verkhne-Kozhimskoye.

The organizational structure of the Reserve includes: administration in the central manor of Yaksha village and district forestries: Yakshinskoye, Verkhne Ilychskoye, Nizhne Ilychskoye, Verkhne Pechorskoye.

Each district forestry is managed by the senior state inspector. Labor relations are regulated by individual labor contracts, job descriptions and a collective agreement.

The buffer zone of the Reserve, wildlife sanctuaries and natural monuments belong to the Verkhne-Pechorskoye forestry of the Komsomolskoye forestry. Komsomol forestry is included in the system of the Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi.

Administrations of the Specially Protected Natural Territories manage the infrastructure facilities belonging to the Specially Protected Natural Territories through responsible persons.

Infrastructure of the National Park includes the administrative premises of the central office and branches, 6 control and security posts, 2 visit centers, guest houses, fire and chemical stations and other facilities.

The Reserve has: central manor, consisting of office housing, administrative buildings, household buildings, 2 hotels and 2 guest houses, elk farm facilities. 9 cordons of the Reserve are situated on the territory of the Reserve and at its borders. An unregistered recreation center and two villages are located in the buffer zone.

Management of the Specially Protected Natural Territories, branches and district forestries have the minimum necessary material and technical basis for the protection of the territory: motor vehicles, snowmobiles, motor boats, radio communication facilities, photo and video fixation facilities, office equipment and software.

Tourist infrastructure includes hotels, shelters, temporary accommodation facilities and land improvement facilities (gazebos, toilets, gangways and others). The need for tourist infrastructure is satisfied in the Park by 50%, in the Reserve by 70% without taking into account the buffer zone. Its is maintained in a good condition at the expense of budget and own means of Specially Protected Natural Territories. Infrastructure of the buffer zone is maintained in the funds of the Komsomolskoye forestry and the efforts of the local population.

Territorial structure

The Site occupies the entire western macroslope of the Ural range for more than 500 km: from the Balban-Yu river (the northern tributary of the Kozhim river) in the north, to the Unya river source and the border with the Perm Region in the south (Fig. 2). Description of the Site borders is given in Appendix 1.

[25] Forestry Code of Russian Federation (dated July 22, 2008 No.143-FZ)

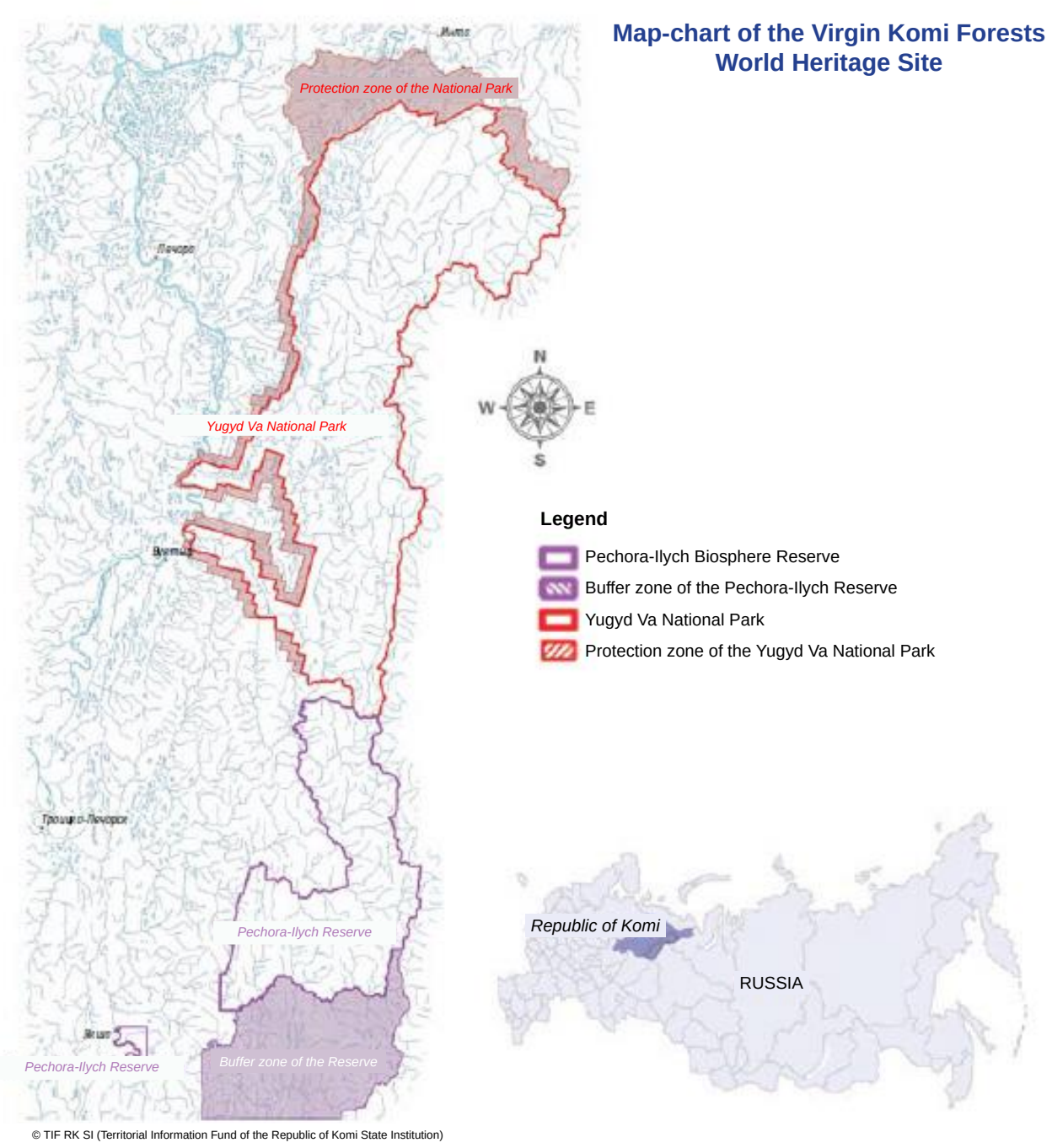

Figure 2. Location of the Virgin Komi Forests World Heritage Site

The National Park has a more developed infrastructure for servicing tourists (Fig. 3). The highest and picturesque mountains with tundra, forest-tundra and north taiga vegetation are situated on its territory. This northern part of the territory is experiencing the highest load from recreation. And it is here that the most vulnerable ecosystems are concentrated, primarily requiring measures to prevent degradation. Efforts to protect the territory, first of all, should be concentrated in places of load.

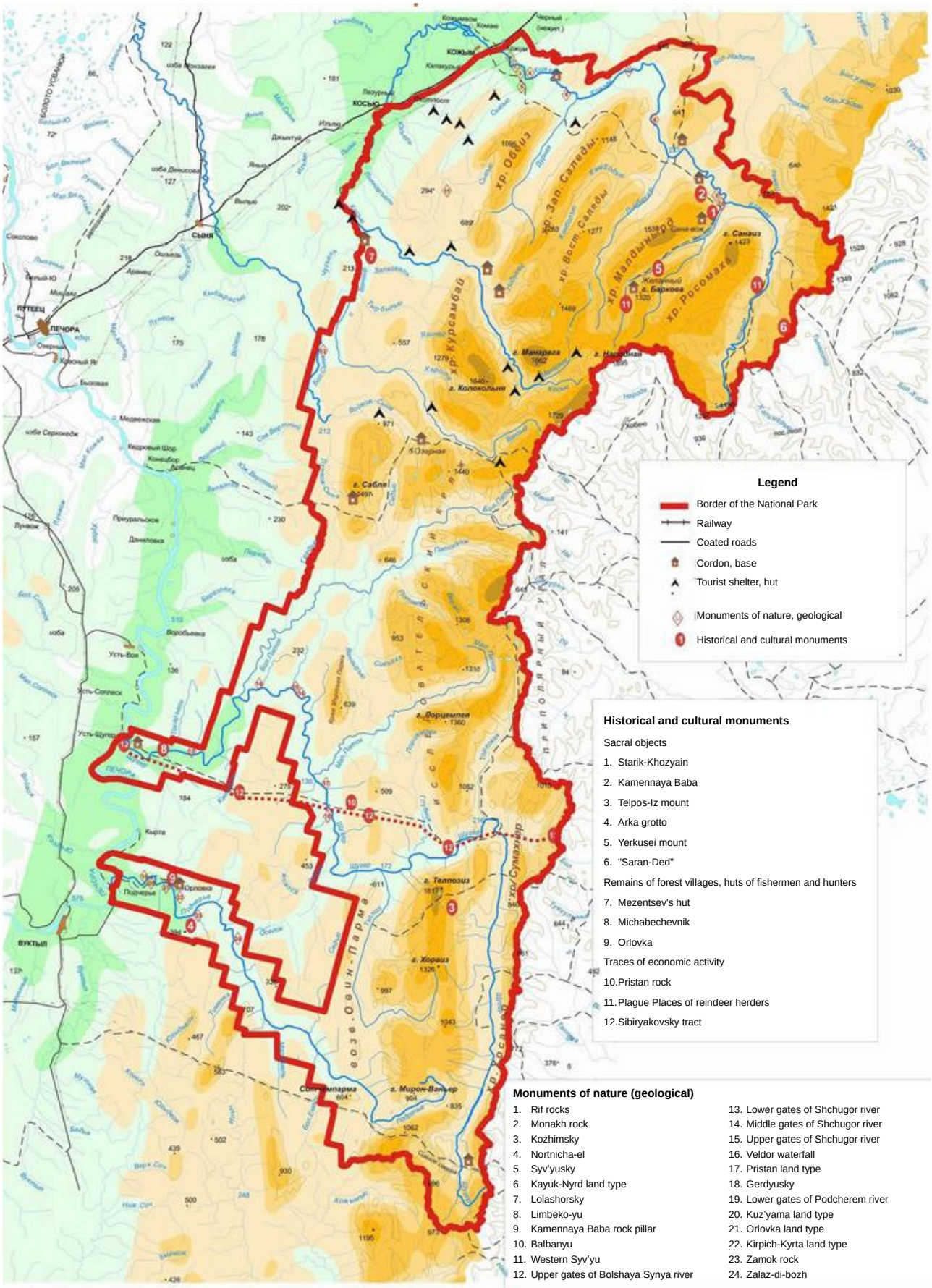

Figure 3. Map chart of Yugyd Va National Park

Zoning scheme of Yugyd Va National Park is given in Appendix 1.

The territory of the mountainous area of the Pechora-Ilych Reserve adjoins the National Park from the south. All of it represents a protected zone, within which the dotted areas for household farming on cordons are set aside, as well as a zone where visitors are permitted for a short time near world-famous stone rock pillars on the Manpupunyor plateau (Fig. 4).

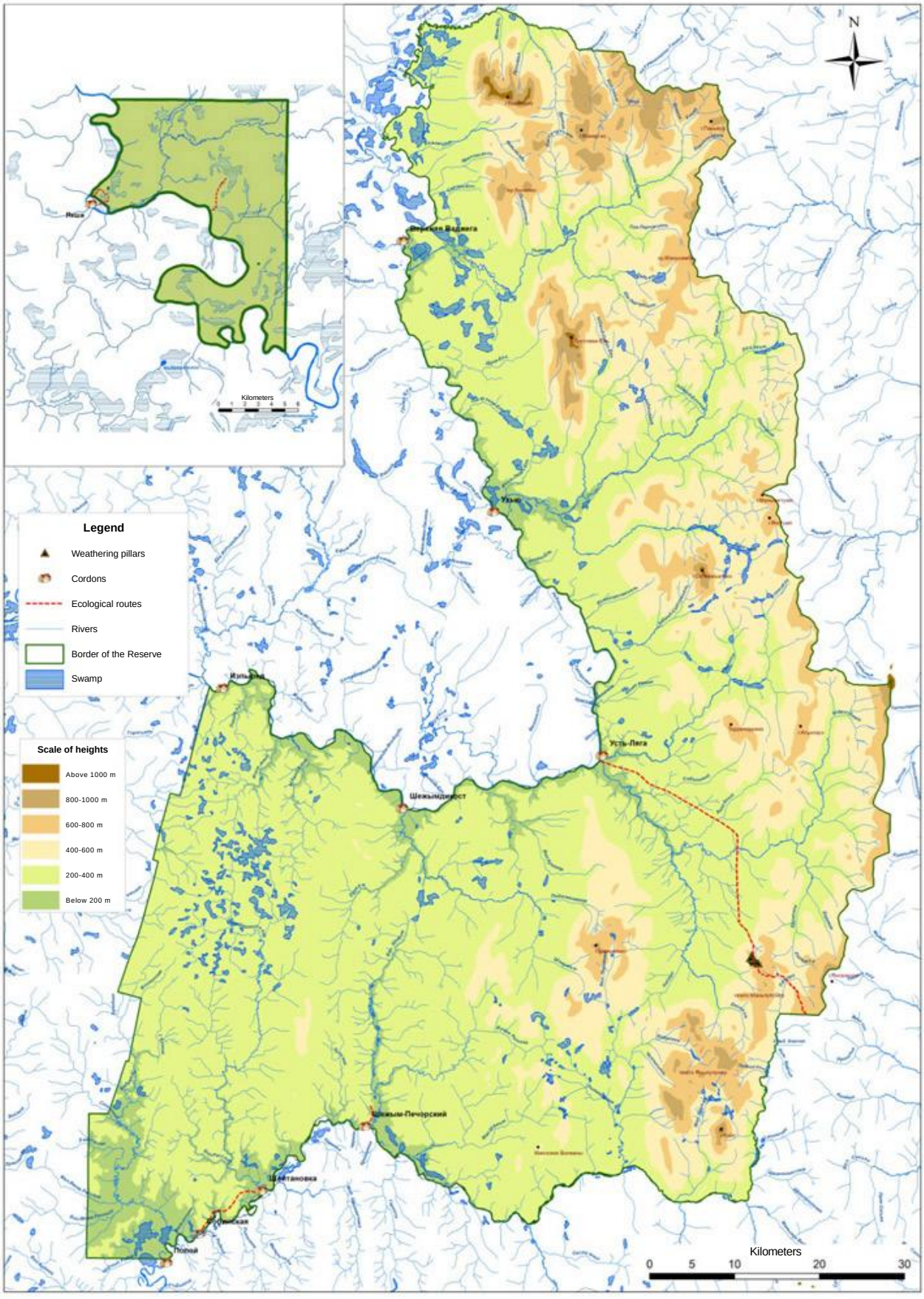

Figure 4. Map chart of Pechora-Ilych Reserve

55 km to the west of the mountainous area in the plain zone there is a pine wood, much smaller in area. Here, in Yaksha village the office of the Reserve is located.

Buffer zone of the Reserve, which extends to the border with the Perm Region adjoins the mountain area from the south. Uninsky and Pechora River Site natural wildlife sanctuaries of the republican subordination are situated on the buffer zone territory (Fig. 5).

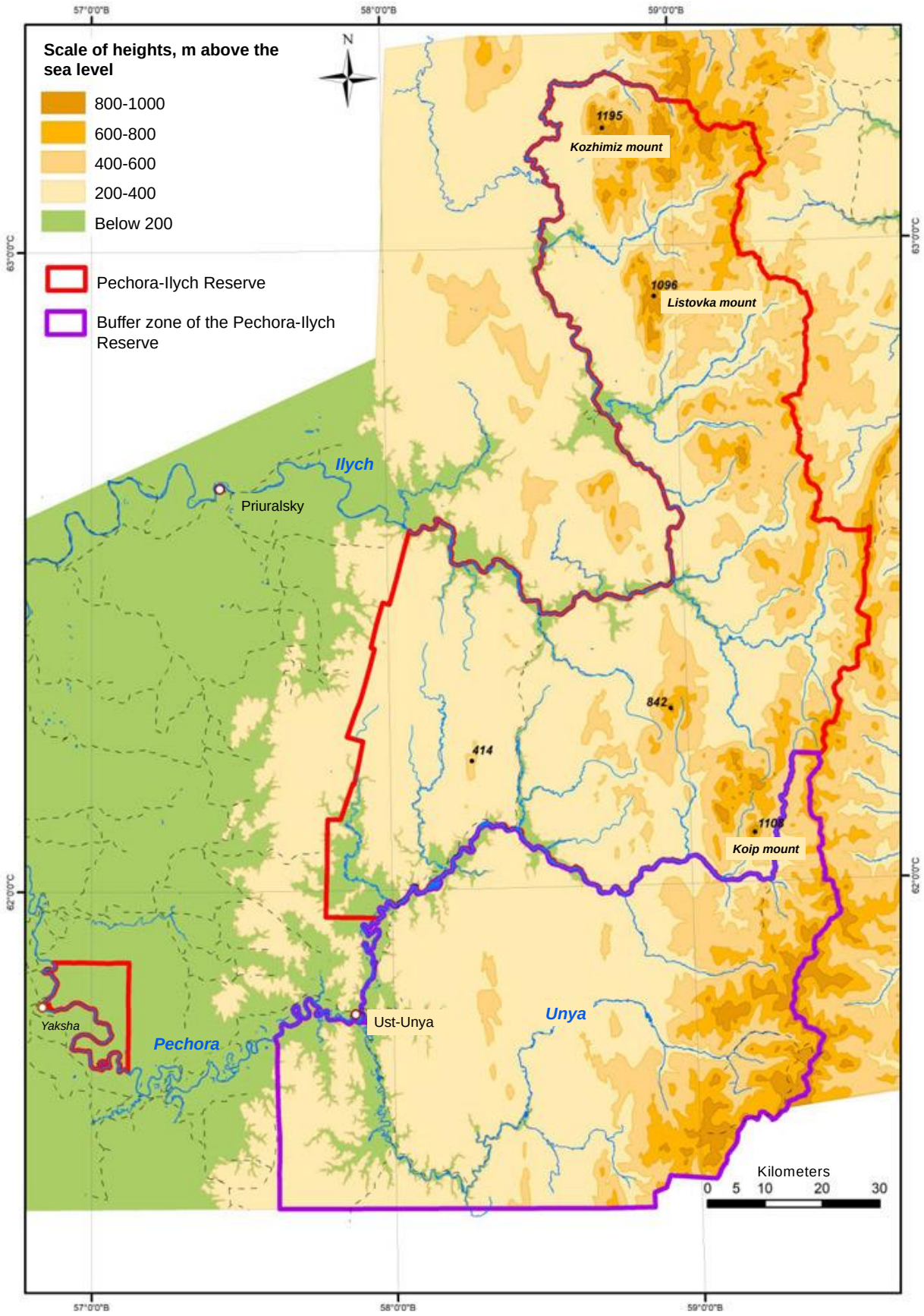

Figure 5. Map chart of the location of clusters of the Pechora-Ilych Reserve and its buffer zone

Features of the reserve duty of different functional zones are described in Appendix 1. The main features are shown in Table 14.

Table 14

Features of functional zones

Zone	Zoning purpose	Allowed	Prohibited
Reserve zone (for the National Park, Reserve and Pechora River Site wildlife sanctuary)	Conservation and study of natural complexes and sites in the natural flow of natural processes and phenomena. (The Reserve also has a zone of special scientific importance and absolute rest)	Study without violating the integrity of natural sites and complexes, conducting environmental monitoring, conducting environment-oriented and fire prevention measures, forest management and land management	All types of economic activity* and recreational use of the territory, except for the wildlife sanctuary territory
Specially protected area (for National Park)	Provision of conditions for conservation and restoration of valuable natural complexes and sites under strictly regulated visits	Carrying out Research, carrying out environment-oriented, biotechnical and fire prevention activities, forest management and land management; carrying out activities aimed at maintaining the number of natural habitats of rare and endangered species of flora and fauna; organization and arrangement of educational and excursion ecological routes, arrangement and equipment of camping places for overnight accommodations is permitted on the specially designated sites	Any economic activity*; stay of citizens outside specially designated routes; carrying out actions that cause concern to wild animals; amateur and sports hunting and fishing; picking mushrooms, berries, nuts and other wild plants, haymaking, construction and operation of hotels, stopping points, camping sites
Recreation zone (for National Park)	Organization of recreation in natural conditions	Forestry and fire prevention measures to increase the value of landscapes and restore disturbed natural and historical and cultural complexes and sites; picking berries, mushrooms, nuts and other wild plants; amateur and sport fishing by permits. Complex land improvement	Rest and accommodation outside of the designated places*
Zone of economic purpose (for the Park and Reserve)	Implementation of economic activities necessary to ensure the functioning of Specially Protected Natural Territories	Fire prevention and biotechnical measures; haymaking and grazing; picking berries, mushrooms, nuts and other wild plants; amateur and sport fishing; construction of stationary facilities of tourist service, necessary facilities of cultural, everyday, information services and communications, as well as facilities of administrative and economic infrastructure	All types of activities specified in the Federal Law on Specially Protected Natural Territories
Zone of traditional nature management (National Park, buffer zone)	To preserve the culture and traditional nature management, recreational use	Traditional non-destructive nature management of the natural complex	All types of activities specified in the Federal Law on Specially Protected Natural Territories

* - an asterisk indicates an addition to the standard list of prohibited activities in the territory of Specially Protected Natural Territories (Appendix 1)

Security zones of the Park and Reserve, buffer zone and its wildlife sanctuaries and natural monuments are Specially Protected Natural Territories of the republican level, without withdrawal of land from their owners. The duty of protected territories, wildlife sanctuaries and buffer zone limits the rights of land owners in their territory, but does not transfer the right to manage these lands to the administrations of the Park and Reserve or the Center for Specially Protected Natural Territories. The duties of protected territories are regulated by the "Decree on the Creation of a Protected Territory" and the Provision on a protected territory. Activities of land owners within the borders of protected and buffer zones established as regional Specially Protected Natural Territories are coordinated with the Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi. Some types of activity in the territory controlled by the Reserve and Park are coordinated with their administrations.

A detailed description of the territorial management, zoning and functioning of the protected territories included in the Site is given in Appendix 1.

Territory protection

9 district forestries are organized to ensure the duty of special protection of the National Park territory. Inspectorate staff includes 19 people.

9 cordons along the Reserve perimeter and a protection point on the eastern border of the Reserve near the Pechora river source were built to protect the Reserve. In addition, there are two operational groups with a total of 8 inspectors.

The buffer zone territory is guarded by the Verkhne-Pechora District Forestry, the Fish Inspection and the Department of Specially Protected Natural Territories of the Center for Specially Protected Natural Territories. At the same time, there is not a single inspector specially assigned to the buffer zone. All of them are watching the lands of the entire southeast of the Komi.

The territory is mainly protected through the raids and watches at the control and security posts in the Park and at the Manpupunyor site in the Reserve. In the Park at the moment, there are three control and security posts, two of which have seasonal and one has a year round watch, watch in the Reserve as all-the-year-round. In addition, operational groups have been created in the Reserve and at the Center for Specially Protected Natural Territories. Operative groups visit the territory during the periods and seasons of special protection and planned works (spawning, fire-dangerous period, registration works, etc.), and on the basis of information received from the places.

Recruitment to the protection service is carried out on a contractual basis with passing the probation period for the newly employed inspectors. Technical training with an inspection team is regularly conducted. A system of bonuses for specified violations is established.

State inspectors conduct explanatory work and cases on violations of the special protection duty of the Specially Protected Natural Territories, participate in environmental education and creation of tourist infrastructure. The list of basic duties of state inspectors also includes works on forest fire prevention and control, registration works; they are supplemented with biotechnical measures in the Park.

According to joint action plans, employees of the Ministry of Internal Affairs of the Republic of Komi are involved in patrolling the Site territory.

Monitoring and research activities

Work on the protection of flora and fauna is one of the priority tasks of the activity of Reserve and National Park. They organized scientific departments whose task is to organize and conduct research and monitoring of the state of natural complexes, including the Nature Records program.

The following activities are carried out in the Park and in the buffer zone of the Reserve: forest health monitoring and biotechnical measures to improve habitat conditions and stabilize the number of common and rare species of animals.

Autumn and winter route censuses of animals are carried out in all model territories of the Site.

An important part of the scientific work is the involvement of scientists from universities and institutes in research. Scientists from 6 scientific organizations worked in the territory of the Reserve in 2016, scientists from 3 scientific organizations – in the territory of the National Park. Constant partners in the research of the Reserve and National Park are employees of the Komi Scientific Center of the Ural Branch of the Russian Academy of Sciences. Agreements on scientific and technical cooperation were concluded with it and other institutes.

Employees of scientific departments actively assist students during production and pre-graduation practices. In 2016 11 students underwent a training in the Reserve, 27 – in the National Park.

Ecological and educational activity

Environmental education and enlightenment is one of the main activities in the National Park and in the Reserve. Its purposes are:

- formation of favorable attitude towards Specially Protected Natural Territories in visitors,
- distraction of visitors from visiting special protected zones,
- informing people and increasing their environment-oriented literacy.

For this purpose, special departments are organized in the National Park and the Reserve.

Specialists of the departments conduct work based on the infrastructure of the Specially Protected Natural Territories in visitors, as well as conduct activities outside the Specially Protected Natural Territories in visitors: in educational institutions, clubs, houses of culture and sports, using mass media.

A visit-center with a museum in Vuktyl city, a visit-center in Pechora city, visit-centers and information points in the cities of Syktyvkar, Pechora, Inta, in Podcherye and Lugovoy villages have been created in the National Park. In the Reserve in the village of Yaksha there is a museum of nature and a visit center on the elk farm. There are 7 ecological routes in the Reserve and 13 ecological trails in the National Park. During the period of 2010-2015, the number of visitors to the museum and visit centers of the Park (including participation in mass actions outside its territory) amounted to 35-58 thousand people a year, about 500 people visited the museum in the Reserve. Potential of ecotrails and visitor centers with regard to their capacity is used by about two thirds.

Organization of new visit centers and ecological trails is currently relevant only for the buffer zone of the Reserve and its elk farm, since it is advisable in places where employees who are able to conduct excursions and classes are constantly present, and visitors stay. Visit centers are already organized in other parts of the National Park and the Reserve in key locations and only improvement of their expositions and new forms of work with visitors are required. In the vicinity of distant attractive points, it is necessary to install information stands that provide detailed information about the sites. The creation of virtual excursions is relevant.

Staff of the environmental education departments conduct thematic classes and give lectures on the ecological trails and in the visit centers. Carrying out environmental activities for cities can be regular. For visit centers, the expansion of the assortment of supporting information materials and souvenirs, as well as regular updating of expositions, organization and conduction of thematic exhibitions and ecological holidays related to memorable dates, is relevant.

Employees of environmental education departments conduct many travelling activities in nearby educational institutions, houses of culture and libraries. Employees of the Reserve and National Park annually conduct more than 20 environmental lessons and thematic talks timed to

ecological holidays and 9-12 open lessons and ecological holidays with schoolchildren and residents of Vuktyl, Inta cities, Troitsko-Pechorsk urban village, Podcherye village and Yaksha village.

The Reserve and the National Park concluded contracts for the sale of products in book and souvenir shops in various cities of the Republic. However, its release is hampered by the constant shortage of funds.

Dissemination of information about the Specially Protected Natural Territories and the formation of their positive image is facilitated by working with the mass media. In recent years, the number of articles and reports on the work of the Specially Protected Natural Territories in the central, republican and local print media has been increasing. Work with the republican television, the "Yurgan" channel, and radio stations such as "Komi Gor", "Russian Radio in Komi", has been established. A significant role in the dissemination of information took on the Internet: "Komiinform" and "Business news in Komi" information agencies, official sites of the Specially Protected Natural Territories and social groups.

During the holidays, the National Park and the Reserve organized children's ecological camps and expeditions. In recent years, every summer 5-7 children's ecological camps and expeditions and 1 camp are held in the National Park, and up to two shifts of children's ecological camps per year in the Reserve.

Development of environmental education is aimed at increasing the flow of visitors to museums and visit centers and the increase in the number of participants in the actions, is associated with the renewal of expositions, the introduction of interactive expositions and tours through the Specially Protected Natural Territories, the organization of folk-crafts clubs and school forestries.

Tourism and recreation

Provision of tourist services is the main source of own funds in the National Park and the Reserve. So, in 2016 tourist services brought the Park 65% of their total volume.

The Park and the Reserve independently provide visitors with the following services: providing services for tourist camps, shelters, guest houses and bath houses, transfer to the route beginning, other transportation services, escorting groups of visitors by guides, boat and camping tackle rentals, vehicle (motor boats, cutters, motor transport, snowmobile and air-cushion vehicle) rental.

The main types of tourism that have become widespread on the Site territory: water, pedestrian and water, pedestrian, ski, environmental and educational. Travel on snowmobile transport is gaining popularity.

The Park territory is currently visited by 6-7 thousand people, the Reserve – by 1.5 thousand, the sites of its manor – by 1.5 thousand people, the buffer zone – by 1.5 thousand visitors per year.

Potential recreational capacity of routes in the Park is estimated to be significantly higher, in the Reserve – close to optimal, in the buffer zone – below the potentially possible. Given the creation of the necessary infrastructure, environmentally friendly capacity of routes can be substantially increased. Regulation of the flow of visitors in the buffer zone, first of all, requires the organization of control stations.

To minimize the impacts that are harmful to nature, the following are required: remediation of disturbed areas, measures to eliminate pollution of routes, special programs for waste

management, arrangement of decks and bridges in places with a high risk of degradation development.

Tourists in the Specially Protected Natural Territories stimulate the development of service sectors of districts and create additional jobs for the local population. According to our estimates, in 2014, district budgets received about 32 million rubles[26] of taxes from business that provides services to the travellers of the Specially Protected Natural Territories.

Preservation of historical and cultural sites

In the National Park and the Reserve staff there are no specialists professionally involved in the historical and cultural heritage. Therefore, the study and popularization of knowledge about historical and cultural sites is carried out in cooperation with historians, archaeologists, journalists, with the involvement of employees of libraries and museums, schoolchildren and students, and primarily residents of the adjacent territories.

Almost all sacred and archaeological sites are identified and outlined on the territory. Special attention is given to their preservation. An infrastructure is created to minimize the risk of their destruction: gangways, stairs, scenery spots, signs, toilets, information signs, helicopter platforms are being built and arranged. Change in the state of sites is estimated as a result of comparing the data of annual observations.

Implementation of programs related to the preservation of cultural heritage – the revival of villages, the preservation of traditional local folk crafts – has been started. Search for traditional knowledge holders living in villages and demonstrating them is one of the tasks that will be given great attention in the near future.

Both the Specially Protected Natural Territories and the local population are working to revive historical settlements and inventory in the territory of the National Park and in the buffer zone of the Reserve. Visitors are shown traditional way of life, household and craft items.

Interaction and coordination between interested organizations

Employees of many organizations are involved in the Site territory, in the plots and in the structures connected with it (table 15).

Table 15

Organizations interested in co-management of the World Natural Heritage Site

Sector	Name of participant	Degree of participation and interest in the protection of the Timber Complex Department Site territory	Degree of interest in the operation of the Timber Complex Department Site resources	Degree of involvement in the management process of the Timber Complex Department Site	Degree of involvement in the operation of the Timber Complex Department Site resources
	Ministry of Natural Resources and Environment of the Russian Federation	High	Average	High	Low
	Administration of the Reserve	High	Low	High	Average
	Administration of the National	High	High	High	High

[26] Business plans: of the National Park, Reserve and Unhinsky Wildlife Sanctuary

Sector	Name of participant	Degree of participation and interest in the protection of the Timber Complex Department Site territory	Degree of interest in the operation of the Timber Complex Department Site resources	Degree of involvement in the management process of the Timber Complex Department Site	Degree of involvement in the operation of the Timber Complex Department Site resources
Public sector	Park				
	Ministry of Industry, Natural Resources, Energy and Transport of the Republic of Komi	Low	High	Low	Low
	Administration of the Komsomol Forestry and Verkhne-Pechorskoye District Forestry	High	Low	Average	Low
	Center for Specially Protected Natural Territories of the Republic of Komi (governing body for the regional Specially Protected Natural Territories)	High	Low	High	Low
	Ministry of Finance, Ministry of Economic Development (Republic of Komi), Ministry of Education and Culture	Low	Average	Low	Low
	Municipal administrations	Low	High	Low	Average/Low
	Supervisory authorities (Rosprirodnadzor, Ministry of the Russian Federation for Civil Defense, Emergency Management and Natural Disasters Response and others)	High	Low	Low	Low
Private sector	Outside advisors	High	High	Low	Low
	Industry	Low	High	Low	High
	Funds	Average	Average	Low	Low
	Local non-governmental (non-profit) organizations	Average	Average	Low	Average
	Business (travel firm)	Average	High	Low	Average
	Public Council under the Ministry of Industry of the Republic of Komi	High	Low	Average	Low
	Local communities	Low	High	Low	Average
	Universities	High	Low	Low	Low
	Research institutes	High	Low	Low	Low
	International funds and organizations	Average	Low	Low	Low

Coordination between managing structures and interested organizations occurs through the agreements between the Park, the Reserve and the Center for Specially Protected Natural Territories of the Republic of Komi and Agreements with other parties (Fig. 6).

The National Park and the Reserve coordinate plans for protected and duty activities, scientific and educational activities, conduct joint raids and scientific expeditions. If necessary, plans to protect natural complexes are coordinated with the Ministry of Internal Affairs of the Republic of Komi and implemented with the joint participation of the Park employees and the

Ministry of Internal Affairs employees. Interaction with law enforcement agencies in the buffer zone of the Reserve is limited.

Scientists from the Komi Science Center, other research institutes and universities are invited to conduct Research on the territory of the National Park, the Reserve and its buffer zone. Bilateral and multilateral agreements are concluded with them.

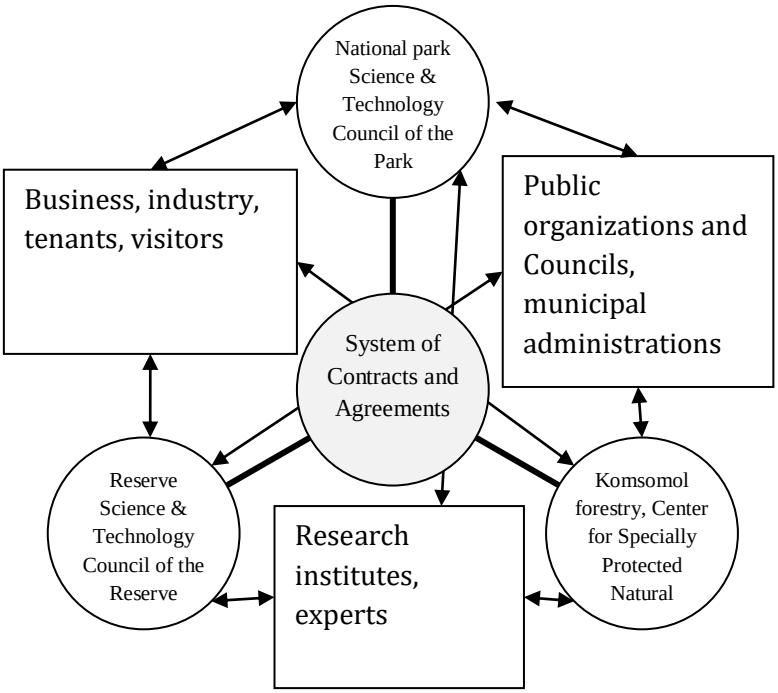

Figure 6. Structure of interaction between the main organizations interested in co-management of the Virgin Komi Forests World Heritage Site

In the immediate vicinity of the Site borders are industrial enterprises, which require special duties of monitoring pollutions and other potentially harmful impacts.

The following industrial facilities are in the immediate vicinity of the National Park borders: water intake facility providing drinking water to the city of Vuktyl ("Aquaservice" LLC); "Comissar" LLC, engaged in the development of a quartzite-sandstone deposit; "Kozhim Exploration and Production Enterprise" CJSC – development of "Zhelannoye" gangue quartz deposit. The Park territory is crossed by the gas pipeline served by "Gazprom transgaz Ukhta" LLC and the machine-and-tractor passway to the Zhelannoe facility.

Construction of the Cellulose and Cardboard Mill is planned near the Reserve, near the Troitsko-Pechorsk urban village. There are small logging enterprises in the vicinity of the Reserve borders.

The heads of enterprises systematically conduct talks about the necessary measures of environmental safety, special excursions and classes are held for the employees. In the long view in order to preserve the World Natural Heritage it is expected to conclude agreements on cooperation with them.

Assessment of management effectiveness

Since the activities carried out in the Site territory are aimed at preserving natural complexes in a natural state, the following indicators can serve as an indicator of the Site management effectiveness:

1. Negative dynamics of the area of forest fires,
2. Decrease in the level of pollution of water and soil,
3. Decrease in the level of poaching,
4. Reduction of the area of disturbed landscapes,
5. Reduction of the amount of garbage in the territory.

Sustainability of the initiative to preserve natural complexes are of great importance. This requires public support. It is the basis for the actions of authorities that ensure an effective legal and regulatory framework. The amount of extrabudgetary funds received by the National Park and the Reserve depends also on the attitude of visitors. The growth of public support can be judged by the following processes:

6. Growth in the number of visitors,
7. Increase in the number of documented reviews about the Site,
8. Increase in revenue from customer service and voluntary donations.

In general, management of the National Park and the Reserve is very effective. This is evidenced by the good condition of the entire natural complex, the absence of acute conflicts and hotbeds of tension with the local population, an understanding of purposes and specifics of the activities of the Specially Protected Natural Territories in entrepreneurs. It is very important that the management of the Site to be no less effective in the future.

Medium-term prospects for the Site development are associated with the arrangement of the buffer zone of the Reserve and the active involvement of residents in its territory, and forestry workers in the service of tourists.

It is also important to further develop the infrastructure for servicing visitors in the National Park, as well as to attract students and scientists to study the virgin ecosystems in the Reserve, National Park and buffer zone of the Reserve more deeply.

Increasing the flow of visitors also requires improving the territory protection, new measures for environmental education, creating a more comfortable infrastructure.

Up to the present time, the individual Provisions on the wildlife sanctuary included in the World Heritage Site are not approved by the Government of the Republic of Komi. This creates certain difficulties in the legitimization of tourism development activities on their territory.

The success of all this work depends not only on the will, energy and qualifications of the staff directly working at the World Heritage Site, but also on how far the financial, organizational and legal obstacles can be overcome (Table 16).

Table 16

The main obstacles to management effectiveness of the World Heritage Site

Obstacle	**Ways to overcome**	**Level of decision making**	**Probability of overcoming in the planning period**
Legislative obstacles			
Rent, amount of fines and claims are not received on the accounts of Specially Protected Natural Territories	Saving money from leases (only the Park), amounts of fines and claims for damages at the disposal of Specially Protected Natural Territories Approval of lease rules that do not contain excessive ecological and financial constraints; transfer of leased property to a territory neighbouring with Specially Protected Natural	Ministry of Natural Resources and Environment of the Russian Federation	Low

Obstacle	Ways to overcome	Level of decision making	Probability of overcoming in the planning period
	Territories	Park; Reserve	High
Impossibility of introducing local hunting and fishing rules with restrictions that are less stringent than global rules	Permission to establish local rules, provided that it is proved that these rules have a positive biological effect (for example, repeal of a total fishing ban leads to an increase in the number of grayling and restoration of a balanced age structure in its populations)	Ministry of Natural Resources and Environment of the Russian Federation	Average
Charity for the protection of nature is not a basis for tax concession	Amendments to the legislation	Government of the Russian Federation	Little
Absence of a mechanism for receiving and distributing payments for ecosystem services	Types of payments Persuasion of consumers of services in the need for voluntary contributions	Government of the Russian Federation	Average
Adequate environment-oriented duty on territories neighbouring with Specially Protected Natural Territories is not completely legitimate	Alignment of the Provisions on the protection and buffer zones in line with the current legislation	Government of the Russian Federation, Government of the Republic of Komi	High
Financial obstacles			
Deficit of budget financing of the current activities of Specially Protected Natural Territories is 25% or more	Participation in federal and regional government programs for tourism development; attraction of donor funds; implementation of low-cost devices and technologies; cost saving; development of concession mechanisms; sale of services (accommodation, transportation, tour guide services, etc.); sale of goods (souvenirs, maps, guide-books, tackle, etc.); tackle rental	Park; Reserve; forestry	High
Critical deficit of financing the staff of the territory protection and other functions of Specially Protected Natural Territories[27]	An increase in the number of staff is required: - the staff of the park in twice **minimally**, respectively, the wages fund will grow by 2 times, material and technical support – by 25% - the staff of the reserve in 1.5 times	Ministry of Natural Resources and Environment of the Russian Federation; Park; Reserve	Average
The deficit of funds for the development of profitable programs: the Park has 50% of annual needs, the Reserve has 25%	Assessment of progress and adjustment of business plans of Specially Protected Natural Territories; Search and attraction of investors and donors	Park; Reserve	Average
Shortage of charitable donations	Search and attraction of donors, sponsors and art patrons	Park; Reserve	Average

[27] The project of organization and management of forestry of Yugyd Va National Park, pub.: Moscow, 1998-1999 (volume 1, book 1, page 209, Table 7.14.1) (calculated, according to the norms), the staff of the National Park is provided in the amount of 329 people. Currently, the staff of the Park is 60 people; it is optimally to increase the number of employees to 160 people, at least to 120, for the park to perform its functions.

Obstacle	Ways to overcome	Level of decision making	Probability of overcoming in the planning period
Lack of experience in the use of new financial mechanisms, in particular, fees for entry into the territory of Specially Protected Natural Territories*[28]	Development of individual calculation methods for each Specially Protected Natural Territory; the creation of an infrastructure for charging fees and the diversification of fee charging mechanisms	Park	High
Inadequate financing for the development of infrastructure for tourism and environmental education	Audit of priorities for business planning, feasibility studies for branches, routes, sites	Park; Reserve	High
Institutional, structural, information and qualification obstacles			
Individual provisions on the wildlife sanctuaries included in the World Heritage Site are not approved	Approve individual provisions	Government of the Republic of Komi	High
It requires a revision of the area and location of the Park protection zone and the expansion of the protection zone on the eastern border of the Park and Reserve and western border of the Reserve	Adjustment of the borders of the Park protection zone and the adoption of the Provisions on it; Reservation of sites of the eastern slope as the protection zone and the creation of a protection zone Creation of a protection (buffer) zone of the Reserve	Ministry of Natural Resources and Environment of the Russian Federation, Government of the Republic of Komi and Khanty-Mansi Autonomous Okrug of the Tyumen region.	Low
Inadequate material and technical base for the territory protection	Renewal of means of transport and communication; development of methods of video recording and remote monitoring	Park; Reserve	High
Inadequate qualification of protection personnel	Internships of the employees in other Specially Protected Natural Territories; training in advanced studies courses; regular technical studies	Park; Reserve	High
Anthropogenic degradation in places of congestion of visitors	Designing and implementation of the complex of works on protection and reclamation	Park; Reserve	High
Inadequate material and technical base of the environmental education departments	Planned renewal of materials and expositions	Park; Reserve	High
Inadequate qualification of employees in environmental education and services	Internships of the employees in other Specially Protected Natural Territories and ecological centers and museums;	Park; Reserve, forestry	High

[28] the entry fee to the territory of Specially Protected Natural Territories is legally established by the Federal Law No. 406-FZ "On Amendments to the Federal Law "On Specially Protected Natural Territories" and Certain Legislative Acts of the Russian Federation" dated December 28, 2013. The procedure for charging entry fees is determined by the Order No. 174 of the Ministry of Natural Resources of the Russian Federation "On Approval of the Procedure for Determining the Fees Collected from Physical Persons to Visit the Territories of National Parks for Tourism and Rest" dated April 8, 2015. According to paragraph 3 of the Order of the Ministry of Natural Resources of the Russian Federation No. 174 dated April 8, 2015, the institution independently "determines the amount of fee" for entry.

Obstacle	Ways to overcome	Level of decision making	Probability of overcoming in the planning period
	regular technical studies, exchange of experience		
Inadequate development of tourist infrastructure	Feasibility study of infrastructure projects, Creation of infrastructure, incl. with the active involvement of donor funds and the work of volunteers	Park; Reserve, forestry	High
Federal Specially Protected Natural Territories do not have the opportunity to participate in regional programs on tourism and nature protection	Work in partnership with the Specially Protected Natural Territories of the republican subordination and (or) environmental non-profit organisations	Park; Reserve	High

Among the problems that can be solved only at the level of the Government of the Russian Federation or the Ministry of Natural Resources and Environment of the Russian Federation the most relevant are the introduction of new rules for the allocation of funds entering National Parks from tenants, as well as the competence to introduce local hunting and fishing rules in territories controlled by the Specially Protected Natural Territories.

If most of the funds from tenants remain in the National Park and in the Reserve, the Specially Protected Natural Territories will attract a greater number of tenants, which will improve the effectiveness of work with visitors.

Introduction of local fishing rules will lead to the fact that local residents will not be forced to violate global bans that are ineffective with respect to the preservation of fish resources, but which bring subsistence and criminal income.

Volume of donor assistance will increase significantly if a new law on tax concession is adopted for those who transfer funds to charitable and environmental purposes. Most other problems can be solved by own efforts and in a relatively short time.

V. ACTION PLAN

General Provisions

Activities of the Specially Protected Natural Territories are regulated by the Constitution of the Russian Federation, the Federal Law "On the Specially Protected Natural Territories" dated

February 15, 1995, statutory regulations, orders of the Ministry of Natural Resources and Environment of the Russian Federation, local statutory regulations, as well as individual Provisions on the Specially Protected Natural Territories and their Charters.

Activities of the National Park are regulated by the Charter of the Yugyd Va National Park FSBI and the Provision[29] according to which the National Park is an environment-oriented, ecological and educational and research institution which territory is intended for use in environment-oriented, educational, scientific, cultural purposes and for regulated tourism and recreation.

Activity of the Reserve is determined by the Charter and Provision on the Pechora-Ilych State Natural Biosphere Reserve FSBI[30]. It was established on May 4, 1930 and is an environment-oriented, research and environment and education institution of federal significance, aimed at preserving and studying the natural course of natural processes and phenomena, the genetic fund of plant and animal life, the certain species and communities of plants and animals, typical and unique ecological systems of the Northern Urals.

Activities of the wildlife sanctuaries and the buffer zone of the Reserve having republican subordination are also determined by the Provisions on them or by other title documents.

Organization date of the wildlife sanctuaries and the buffer zone is indicated in Table 17.

Table 17.

Establishment (organization) dates of Specially Protected Natural Territories of the republican level included in the Virgin Komi Forests World Natural Heritage Site

Name of the Specially Protected Natural Territory	Organization date
Protected zone of the national park	April 23, 1994
Uninsky complex wildlife sanctuary	April 28, 1977
Pechora River Site, Ichthyological wildlife sanctuary	September 26, 1989
Buffer zone of the reserve	February 19, 1992
Chameiny ples, natural monument	March 29, 1984
Uninskaya cave, natural monument	March 5, 1973
Protection (buffer) zone of the Reserve, including: protection zone of the elk farm	is being designed

Tasks that are assigned to the Specially Protected Natural Territories are given in Table 18.

Table 18.

Tasks of the World Heritage Site Cluster

National park	**Pechora-Ilych Reserve**	**Buffer zone, wildlife sanctuaries and natural monuments**
Ecological and historical and cultural programs		
- Preservation of natural complexes, unique and reference natural areas and sites;	- Protection of natural territories in order to preserve biological diversity and maintain protected natural complexes and	- preservation of natural complexes (Uninsky wildlife sanctuary, buffer zone),

[29] The Charter of the National Park dated May 19, 2011 (as amended on April 11, 2012, No.103), the Provisions on the Yugyd Va National Park, approved by Order of the Ministry of Natural Resources and Environment of Russia No. 534 of November 20, 2013

[30] the Reserve area and current borders are determined by the Decree of the Council of Ministers of the Russian Soviet Federated Socialistic Republic No. 164-R dated January 14, 1959, the Provision on the Reserve is approved by the order of the Ministry of Natural Resources and Environment of the Russian Federation No. 302 dated June 15, 2017.

National park	Pechora-Ilych Reserve	Buffer zone, wildlife sanctuaries and natural monuments
- preservation of historical and cultural sites, - development and introduction of scientific methods of nature protection and environmental education; - state environmental monitoring; - restoration of disturbed natural and historical and cultural complexes and sites	sites in a natural state; - organization and conduction of scientific research, including keeping the Nature Records; - environmental monitoring; - participation in the state ecological review of projects and layouts for the placement of economic and other facilities; - assistance in training scientific personnel and specialists in the field of environmental protection	- preservation of unique and reference natural areas and sites (Chameiny ples and Uninskaya cave nature monuments – geological and geomorphological monuments), - preservation of sites of fauna and their habitat (Pechora River Site ichthyological wildlife sanctuary)
Educational and tourist programs, sustainable nature management		
- Environmental education of the population; - creating conditions for regulated tourism and recreation	- environmental education and development of cognitive tourism; - testing and introduction of the methods of rational nature management on the territory of the biosphere polygon of the Reserve that do not destroy the surrounding environment and do not exhaust biological resources and monitoring	- conducting of the biosphere polygon of rational nature management on the territory, - any activity that does not violate the natural state and development of natural complexes

Specific tasks for specific Specially Protected Natural Territories for the nearest time period are determined by the State task.

In accordance with the purposes and directions of action, tasks and activities are grouped into programs. Each program of the Specially Protected Natural Territories is a management task.

The programs can be implemented by the Specially Protected Natural Territories (or at the initiative of Specially Protected Natural Territories – by other interested parties) at the expense of Specially Protected Natural Territories or raised funds.

To assess the effectiveness of each program and activity implementation, a set of indicators is created for periodic assessment of results and progress.

The programs are grouped into operational, medium-term and strategic plans, indicating the activities, responsible executors (groups of executors, departments) and necessary material resources.

The budgeting system for priorities is to cope with the task of timely adjusting the operational plans[31].

Taking into account that the Site activity in the sphere of tourism and recreation[32] stimulates the development of the service sector of districts with a turnover of 143.2 million rubles[33] per year[34]

[31] Priority-based budgeting is necessary to improve the management of Specially Protected Natural Territories. It is based on an operative analysis of information on financial needs and gaps of each of the programs of Specially Protected Natural Territories, and the location of this program in the line of strategic priorities. With this approach, the Specially Protected Natural Territories identify and rank important programs and activities in terms of urgency and strategic importance. Resources are allocated in accordance with the ranking. This Management Plan uses a simple scheme for assessing the priorities of the programs of Specially Protected Natural Territories through discussions among the staff of Specially Protected Natural Territories at the meetings of the Science & Technology Councils (Tables 20 and 21)

[32] With an approximate assessment of the value *of ecosystem services* of the Specially Protected Natural Territories, that are components of a World Heritage Site, in the amount of more than 2 billion rubles/year (according to: Market analysis and identification of parties interested in the ecosystem services of the group of specially protected natural

and creates additional jobs for the local population, the management plan assumes integration with the plans of the districts.

The list of programs and their structures are given in Table 19.

Table 19

Composition and structure of programs for the implementation of the action plan

Program	Territory	Subprograms (activities)			
Effective management	Reserve	Administration	Technical support	Fundraising and investments	
	National Park*	Administration	Technical support	Fundraising and investments	
	Buffer zone**	Protection	Regulation of nature management	Fundraising and investment for the purposes of protection and sustainable development	
Conservation of natural complexes in natural state	Reserve	Fire fighting arrangements	Information support of the duty and prevention		Marking of borders and functional zones
	National Park*	Fire fighting arrangements	Biotechnical activities	Forest protection and conservation activities	Marking of the Park borders and its functional zones
	Buffer Zone	Fire fighting arrangements	Marking of the Site borders	Forest protection and conservation activities	Designation and protection of nature monuments
Detection and suppression of violations of environment-oriented legislation	Reserve	Operational protection service and patrolling			Cordon protection service
	National Park*	Ground patrolling	Patrolling of the water area of water bodies	Air patrolling	Fixed territory protection
	Buffer Zone	Operational protection service and patrolling			Cordon protection service
Improvement of the protection system	Reserve	Reorganization of the cordon service	Training of inspectors	Establishment of protection zones and introduction of a special duty for the zones of assistance	
	National Park*	Protection infrastructure	Training of inspectors	Improvement of the control and protection system	Establishment of buffer and protection zones
	Buffer Zone	Organization of protection service	Training of inspectors	Protection infrastructure	
Research works	Reserve	Research	Environmental expertise	Publication and distribution of materials	
	National Park*	Scientific research	Mapping the constituent natural complexes	Preparation and publication of printed works	Development of recommendations
	Buffer Zone	Testing of sustainable nature management	Monitoring of the nature management impact on the environment state		

territories of the Republic of Komi. FSBI of Science of the Institute of Social, Economic and Energy Problems of the North of the Komi Science Center of the Ural Branch of the Russian Academy of Sciences, 2012, http://undp-komi.org

[33] Calculation - Appendix 4

[34] Estimation of incomes of transport and trading companies neighbouring with the Park, incomes of local population, etc., showed their income from the flow of tourists on the territory of the Specially Protected Natural Territories amount to 142.3 million rubles, from which budgets of different levels receive about 32 million rubles per year, while the income of the Specially Protected Natural Territories from the flow of tourists to their territory amounted to 6.02 million rubles (2016).

Program	Territory	Subprograms (activities)			
Environmental monitoring	Reserve	Measurement of environmental parameters	Long-term series of observations	Popularization of knowledge about nature and forest schools	Student practices
	National Park*	Measurement of environmental parameters	Long-term series of observations	Popularization of knowledge about nature and forest schools	Student practices
	Buffer Zone	Measurement of environmental parameters		Organization of continuous observations	
Environmental education	Reserve	Development of museum and replenishment of expositions	Printed and souvenir products	Visit center and forest schools	Training products and actions
	National Park*	Museum and exhibition activity	Work with the mass media and publishing	Work with schoolchildren	Ecological and educational activities
	Buffer Zone	Printed and souvenir products			
Development of regulated tourism and recreation	Reserve	Ecotourism development	Infrastructure of the elk farm	Tourism infrastructure	Advertisement
	National Park*	Creation and arrangement of ecological trails and tourist routes	Recreational arrangement of Specially Protected Natural Territories	Organization of cognitive tourism	Advertisement
	Buffer Zone	Recreational arrangement of Specially Protected Natural Territories	Creation and arrangement of ecological trails and tourist routes		Advertisement
Preservation and restoration of historical and cultural complexes and sites	Reserve	Certification of heritage sites			
	National Park*	Restoration of disturbed historical and cultural complexes and sites		Certification of heritage sites	Development of recommendations
	Buffer Zone	Collection of evidence and sites of sustainable nature management and beliefs			
Restoration of disturbed natural complexes	Reserve	Inventory of disturbed territories		Reclamation of disturbed sites	
	National Park*	Garbage removal from the territory	Inventory of disturbed territories	Reclamation of disturbed sites	
	Buffer Zone	Garbage removal from the territory	Inventory of disturbed territories	Reclamation of disturbed sites	
Actions to preserve and maintain the traditional way of life and culture	Reserve	Scientific and methodological support of traditional nature management of the population			Financial mechanisms
	National Park*	Support of traditional nature management of local population	Operation of historical and cultural sites	Support of initiatives of local residents	Activities of experimental nursery-gardens and farms and processing of non-wood forest products
	Buffer zone***	Support of initiatives of local residents		Model territories of sustainable nature management	

*-the National Park program takes into account the activities of its partners in the territory of the protection zone.
**-wildlife sanctuaries and nature monuments are included in the buffer zone.

***-programs for the support of traditional lifestyles are proposed to be managed through the lease of territories and external investments

****-the "management" program requires the allocation of its activities in a separate program and separate accounting for assessing the effectiveness of management and to find methods for reducing costs for the implementation of this set of works; management effectiveness is assessed on the basis of estimates of implementation of the planned indicators of all Site Programs.

Priority programs were identified applying the practice of ranking the programs of Specially Protected Natural Territories (which showed good results in the world practice in the conditions of constant inadequate financing of Specially Protected Natural Territories).

The results of ranking on the basis of discussion on scientific and technical councils are given in Tables 20 and 21.

Table 20.

Ranking of the Reserve programs[35]

Priority	Activity/project/event	Share of answers[36], %	
		Necessary to implement	Can be implemented
Statutory activities of the Reserve, environmental programs			
1	Protection of the Reserve – systematic raids	100	-[37]
2	Stationary protection and provision of accommodation (for staff and tourists) in cordons	100	-
3	Scientific research by own efforts	86	14
4	Scientific research with the involvement of institutions (providing expeditions, collecting material)	57	43
5	Children's ecological camps	57	43
6	"Reserve" School program Komi schools	43	57
Statutory activities of the Reserve, brining income			
1	Environmental education on the basis of elk farm, museum, Yaksha cluster – forest schools	57	43
2	Environmental education on the basis of elk farm, museum, ecological trails – one-day excursions	43	57
3	Scientific tourism (scientists, students and amateurs)	43	57
4	Conferences	29	71
5	Training schools: inspectors of other Specially Protected Natural Territories	29	57
Potentially profitable activities of the Reserve and activities that save costs			
1	Creation of a vehicle park for tourist services	71	43
2	Elk grazing lands: formation of environment for cost reduction	71	29
3	Rafting on non-motorized vessels on Ilych river – infrastructure and maintenance	43	71
4	Ecological routes to the Chameiny ples (Unya)	43	43

[35] Ranking of programs with a single purpose – increasing the income of Specially Protected Natural Territories is carried out according to the methods of business planning of Specially Protected Natural Territories, according to the balance of categories – ease of implementation of the measure in relation to the amount of income from its release. Ranking of protection, environmental and educational programs in the business planning of Specially Protected Natural Territories is not applied

[36] The difference in the sum of answers shows the third variant of answers – "there is no need for an event", the graph of the third answer is omitted in view of using the survey for the purposes of ranking priority programs

[37] - (blank) – absence of such type of answers

Priority	Activity/project/event	Share of answers[36], %	
		Necessary to implement	Can be implemented
5	Rafting on non-motorized vessels on Unya – infrastructure and maintenance	29	86
6	Transport services: water transport	29	71
7	Interactive museum: video excursions to the Reserve (wildlife)	29	71
8	Rental: boats, snowmobiles, cars	29	57
9	Service and support of tourists by stationary security	29	43
	VIP accommodation and meals at the manor of the Reserve (farm)	29	29
	Excursion with escorts to the Jordanian Log	14	43
Activities that do not bring income to the Reserve, but support the local population and[38]:			
1	Souvenir products manufactured by the local population for sale to tourists	71	29
2	Accompaniment of tourists to the sites of the Reserve by the local population	57	29
3	Creation of a special group of guides from among the local population for servicing tourists	43	57
4	Accompaniment of tourists to the sites of the buffer zone by the local population	43	29
5	Traditional products: hunting and fishing tackle (skis, boats, etc.)	43	14
6	Meals for tourists at the stations and manors of the Reserve, on the road	29	57
7	Development of the labor market for the local population to reduce the level of poaching (in general):	29	29
8	Accompaniment of pedestrians and car tourists from the Sverdlovsk region to Manpupunyor	29	29
9	Creation of a guarded vehicle parking lot on the Poyasovoy Kamen for auto-, mototourists to Manpupunyor	29	29
10	Specially organized tourism: photo tours (landscape, animals)	14	71
11	Walking route to Ebeliz	14	57
12	Preparation of mushrooms – drying, packaging and sale	14	43
13	Preparation of wild medicinal plants – drying, packaging and sale	14	29
14	Crop estates of medicinal plants, drying, packaging and sale	14	-

Table 21

Ranking of the National Park programs

Priority	Activity/project/event	Share of answers, %	
		Necessary to implement	Can be implemented
Statutory activities of the Park, environmental programs			
1	Protection of the Park, systematic raids	100	-

[38]Creating jobs for the population, as well as: measures to combat poaching (substitution of poaching, licensing of nature management), access to the Specially Protected Natural Territories for persons with limited opportunities and means, charity, preservation of cultural traditions, testing of sustainable nature management (other international obligations)

2	Scientific research with the involvement of institutions (providing expeditions, collecting material)	88	25
3	Protection of the Park and provision of accommodation (for staff and tourists) in cordons – stationary protection	88	13
4	"National Park" School program Komi schools	50	38
5	Scientific research by own efforts	38	63
6	Training seminars for the Park staff	13	0
Statutory activities of the Park, bringing income and reducing costs			
1	Rafting on non-motorized vessels on Shchugor river – infrastructure and maintenance	75	25
2	Rafting on non-motorized vessels on Podcherem river – infrastructure and maintenance	75	25
3	Rafting on non-motorized vessels on Kozhim river – infrastructure and maintenance	75	25
4	Walking routes in the Kozhim River area	75	25
5	Rafting on non-motorized vessels on Kos'yu river – infrastructure and maintenance	75	25
6	Transport services: water transport	75	13
7	Walking routes in the Podcherem River area	63	38
8	Environmental education on recreation bases: forest schools, children's camps	63	38
9	Environmental education: one-day excursions, Podcherye, an open-air museum, event tourism	63	25
10	Souvenir products for sale to tourists	50	50
	Training schools: for inspectors of other Specially Protected Natural Territories	50	13
	Scientific tourism (scientists, students and amateurs)	25	75
	Conferences	25	63
	Training schools for guides and tour guides for other Specially Protected Natural Territories	13	50
Potentially profitable Park activities and cost-saving activities			
1	Interactive museum – video excursions around the Park (wildlife)	88	13
2	Walking routes in the Shchugor River area	75	25
3	Walking routes in the Kos'yu River area	63	50
4	Creation of a vehicle park for tourist services	50	50
5	Bird watchers	38	75
6	Rental: boats, snowmobiles, cars	50	38
7	Accompaniment of pedestrians and car tourists (seasonal guides)	38	63
8	Creation of a special group of guides for the tourist services	25	75
9	Specially organized tourism: photo tours (landscape, animals)	25	75
	Creation of a guarded vehicle parking lot in Podcherye (for routes: Shchugor and Podcherem)	25	63
	VIP accommodation and meals on bases	13	75
Activities that do not bring income to the Park, support the local population			
1	Development of the labor market for the local population to reduce the level of poaching (in general)	38	63
2	Controlled fishing tourism on river sites of the Park to replace poaching	38	50
3	Traditional products: hunting and fishing tackle (skis, boats, etc.)	25	50
4	Meals for tourists in stations and on bases, on the road (coffeehouses, bakery, boxed lunches, sale of semi-finished products)	25	38
5	Service and support of tourists by stationary security	25	38
6	Accompaniment to the Park sites (by local population)	25	25
7	Preparation of mushrooms – drying, packaging and sale	13	63
8	Fishing tours outside the Park	13	50

	Hunting tourism outside the Park	13	50
	Crop estates of medicinal plants, drying, packaging and sale	13	50
	Preparation of wild medicinal plants – drying, packaging and sale	13	50
	Development of animal transport as an alternative to motor and motorcycle transport	13	38

V.1.PROGRAMS

PROGRAM I
"Implementation of Measures for the Conservation of Natural Complexes in Natural State"

Management task 1. Fire-fighting measures are aimed at reducing the areas of plant fires, their rapid identification and extinguishment, as well as the prevention of anthropogenic fires through prevention. The task is relevant, as the Site territory has a single massif of forests and forest fires can threaten significant areas. The class of natural fire hazard in most of the territory is low. The main threat of fires is anthropogenic. The main threat of fires on the pine wood site of the Reserve and in the land type of the Pereprava National Park is natural.

The task includes the following activities:

1. Maintenance, renovation and repair of fire lines. The activity is aimed at eliminating the threats of anthropogenic fires from roads, fires, shelters, huts, as well as to create barriers to the fire spread. Expenses for the activities are made up of transportation costs and labor remuneration for the creation and renovation of lines, the cost of machinery. Indicator is the length of the active fire lines in relation to the identified need for them, according to regulations or actual requirements. An example of calculating indicators is given in Table 22.

Table 22

An example of calculating indicators of the Site provision with fire lines

Activities	Standard, meters/site or area	Need, m	Available, m	Indicator (share of need, %)
Fire lines around settlements, recreation bases and cordons	2000/ 1 site on the average	25000	20000	80
Fire lines around guest houses	1000/ 1 site	30000	15000	50
Fire lines around recreation areas, fire-pits and picnic places	50/ 1 site	5000	5000	100
Fire lines along the roads in forests of class 1 of natural fire danger	2000/ 1 km of roads	1000	1000	100
Fire lines in the forest massifs of class 1 of natural fire danger	1000 per 1000 hectares	3000	3000	100
Renewal (clearing) of fire lines (every three years), removal of fallen trees	33% of the available, per year	14000 per year	14000 per year	100

2. Installation and maintenance of fire-fighting banners, stands, issue of leaflets and fire-fighting agitation. Activity relates to preventive measures, informs about the rules for making bonfires, contains contacts for operative communication with the duty officer and is aimed at eliminating the threat of anthropogenic fires. Expenses for activities are made up of the cost of agitation (stands, leaflets, etc.), the cost of delivery and installation of stationary agitation. Indicator is the number of stands at all points of entry and throughout the routes in threatened areas. The number of leaflets is calculated based on the number of groups visiting the territory.

3. Air patrolling of the territory is aimed at prompt detection of forest fires for their prompt localization and liquidation. The indicator is the area of the detected fire in relation to the area of the extinguished fire.

4. Maintenance, acquisition, completing and repair of fire-chemical station equipment and fire-fighting boards and creation of material stocks (overalls, special tools, first-aid kits and food products). Increase in staff of the fire-chemical stations. The activity is aimed at effectively extinguishing forest fires and reducing risks for employees during extinguishing. Indicator is the completeness of serviceable equipment.

5. Extinguishing forest fires is a complex of activities, consisting of the delivery of teams and equipment to the place of fire, localization, extinguishing and protection of the burnt out site. Expenses are made up of transportation costs, food costs and labor remuneration, depreciation of equipment. Indicator is the delivery time of the team and the time of fire localization from the moment of delivery of the team in relation to the length of the fire edge.

6. Education, training of personnel to extinguish forest fires, including medical examinations, obtaining permits, licenses, and systematic trainings. The activity is aimed at increasing the effectiveness and safety of the work of forest fire extinguishing team. Indicator is the number of study hours, the number of training hours with the involvement of specialists.

7. Clearing of clearings, trails, borders and roads of fire prevention (forestry) purpose. The activity is aimed at providing access to forest areas of high class of natural fire danger. Indicators are the increase in the length of cleared trails suitable for the passage of light vehicles and pedestrian movement of teams.

Management task 2.Forest protection and conservation activities are aimed at the rapid identification and outlining the areas of forest sites infected by pests and diseases. The task is relevant, since the existing massif of overmature forests is subject to systematic windfall and pest damage.

The task includes the following activities:

1. Selective sanitary felling (not conducted in the protected zone and in the Reserve territory) is aimed at the prevention of forest diseases and the elimination of focuses of forest pests, wood is utilized as fuel for tourist camping places. Expenses of all activities of this task are made up of transportation costs and labor remuneration and depreciation of equipment. Indicator is the ratio of the area of sanitary felling to the area of demand for them, identified as a result of a forest pathology research.

2. Cleaning of the forest from littering is used in the National Park and eliminates the danger of injury to visitors; it is the main way of storing firewood. Indicator is the ratio of cleared areas to the area of windfalls and windbreaks in places of mass visits.

3. Current forest pathology research reveals sources of forest diseases and focuses of forest pests. Indicator is the scope of work (area of the surveyed sites, length of the transects).

4. Forest management and land management includes measures to assess current changes in the forest fund and registration of ownership rights to land plots necessary for the implementation of the Site management tasks. Indicator is filling up the need for works of this kind.

Management task 3. Biotechnical activities are aimed at monitoring populations of common and rare species, stabilizing the number of rare species and improving their habitat conditions, and creating concentrations of animals for their demonstration to visitors. Do not take place in the protected zone of the Park and in the Reserve (except for censuses).

1. Winter route census is designed to assess the status of populations of wintering species and the dynamics of their numbers.

2. Autumn censuses are designed to assess the reproduction indexes of populations.

3. Arrangement of salt gardens and self-feeding stations, feeding waters creates a concentration of animals for their demonstration to visitors, satisfies the need for mineral substances, allows the introduction of medicines, supports populations of common species serving as feed ones for rare species.

4. Arrangement of bird boxes, remises and shelters increases the density of birds and animals, including rare species, and improves the conditions of their habitats.

Expenses of activities of this task are made up of transportation costs, labor remuneration and costs of materials, depreciation of equipment. Indicator of performance is the number of kilometers covered by the censuses (area of the census sector), the number of installed shelters, bird boxes, salt gardens, the area of self-feeding stations and remises.

Management task 4: Activities on the arrangement of external borders and borders of functional zones of the Site. Designed to inform visitors about the borders and duty of the Site and its functional zones, about natural attractions, places of interest, location of infrastructure, rules of conduct on the territory, and liability for violations.

1. The banners inform visitors and population about the borders and duty of the territory of the Site and its functional zones. Established on the borders of the Specially Protected Natural Territories and zones, in accordance with regulations and in points of entry/exit to/from the territory, on tourist routes, walking trails and rafting rivers.

2. Information boards carry information on the duty of the Specially Protected Natural Territories and functional zones, liability for violations, about rare species, sights.

3. Information signs inform visitors about natural and historical, cultural and infrastructural sites and contribute to the safety of visitors.

Expenses include transportation costs, labor remuneration and costs of materials, depreciation of equipment. Indicator is the ratio of the number of information facilities to: a) standards, b) need for them.

Table 23

Program I. "Implementation of Measures for the Conservation of Natural Complexes in Natural State"

Management task	Activities	Scope and expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
1. Fire protection measures	1.1. Maintenance, renovation and repair of fire lines	46 km per year/ reduction of threats of forest fires developing from roads, sources of open fire (bonfires) and heated buildings	06/2018	07/2018	707
			06/2019	07/2019	778
			06/2020	07/2020	856
			06/2021	07/2021	942
			06/2022	07/2022	1036
	1.2. Installation and maintenance of fire-fighting stands (issue of leaflets and fire-fighting agitation)	20 stands per year (1000 and more copies of leaflets per year)/ prevention of forest fires, informing visitors about measures to prevent forest fires	06/2018	06/2018	455
			06/2019	06/2019	500
			06/2020	06/2020	550
			06/2021	06/2021	605
			06/2022	06/2022	665
	1.3. Air patrolling of the territory	110 and more flying hours/ prompt detection of forest fires	07/2018	08/2018	3231
			07/2019	08/2019	3554
			07/2020	08/2020	3910
			07/2021	08/2021	4301
			07/2022	08/2022	4731
	1.4. Maintenance, acquisition, completion and repair of fire-chemical station equipment and fire-fighting boards, creation of material stocks	Completeness of fire-extinguishing means, material stocks, maintenance of inventory in operating condition and provision of access to it	04/2018	08/2018	According to the needs
			04/2019	08/2019	
			04/2020	08/2020	
			04/2021	08/2021	
			04/2022	08/2022	
	1.5. Extinguishing forest fires	Reduction of areas covered by forest fires, reduction of areas of subsequent reclamation of sites	07/2018	08/2018	Subventions of the Federal Budget
			07/2019	08/2019	
			07/2020	08/2020	
			07/2021	08/2021	
			07/2022	08/2022	
	1.6. Education, training of personnel for extinguishing forest fires, medical boards, licenses and trainings		04/2018	06/2018	166
			04/2019	06/2019	182
			04/2020	06/2020	200
			04/2021	06/2021	220
			04/2022	06/2022	242
	1.7. Clearing of clearings, trails, borders	80 km per year/ access to forest sites of high natural	06/2018	07/2018	532

Management task	Activities	Scope and expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
	and roads of fire prevention (forestry) purpose	fire hazard	06/2019	07/2019	586
			06/2020	07/2020	644
			06/2021	07/2021	708
			06/2022	07/2022	779
2. Forest protection and conservation activities	2.1. Selective sanitary felling: area / volume	Felling in the volume of 300 m³/ prevention of forest diseases and elimination of focuses of forest pests	04/2018	06/2018	1126
			04/2019	06/2019	1238
			04/2020	06/2020	1362
			04/2021	06/2021	1498
			04/2022	06/2022	1648
	2.2. Cleaning the forest from littering: area / volume	Cleaned sites: 230 m³ / focuses of forest pests have been eliminated	06/2018	06/2018	1507
			06/2019	06/2019	1658
			06/2020	06/2020	1824
			06/2021	06/2021	2006
			06/2022	06/2022	2207
	2.3. Current forest pathology research, according to the forest management regulations	20,000 and more hectares have been surveyed/ sources of forest diseases and focuses of forest pests have been identified	06/2018	10/2018	3294
			06/2019	10/2019	3294
			06/2020	10/2020	3623
			06/2021	10/2021	3623
			06/2022	10/2022	3986
	2.4. Forest management and land management	Measures to assess current changes in the forest fund and registration of ownership rights for land plots	01/2018	12/2018	0
			01/2019	12/2019	0
			01/2020	12/2020	0
			01/2021	12/2021	0
			01/2022	12/2022	0
3. Biotechnical activities	3.1. Winter route census	1300 km per year/assessment of indicators of the status of populations of wintering species	01/2018	03/2018	400
			01/2019	03/2019	440
			01/2020	03/2020	484
			01/2021	03/2021	532
			01/2022	03/2022	585
	3.2. Autumn censuses	1200 km per year/assessment of indicators of reproduction of populations	08/2018	10/2018	266
			08/2019	10/2019	292
			08/2020	10/2020	322
			08/2021	10/2021	354
			08/2022	10/2022	390

Management task	Activities	Scope and expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
	3.3. Arrangement of salt gardens and self-feeding stations, feeding waters	From 70 pcs and 1.4 tons of salt per year/ creation of animal concentrations for their demonstration to visitors	08/2018	08/2018	275
			08/2019	08/2019	303
			08/2020	08/2020	333
			08/2021	08/2021	367
			08/2022	08/2022	403
	3.4. Arrangement of bird boxes, remises and shelters	From 60 pcs and 1 ha per year/ increase in the density of birds and animals, including rare species — stabilization of the number of rare species and improvement of their habitat conditions	06/2018	06/2018	260
			06/2019	06/2019	286
			06/2020	06/2020	314
			06/2021	06/2021	346
			06/2022	06/2022	380
4. Activities to identify the external borders and borders of functional zones in kind	4.1. Installation of banners	Installation of 96 banners/ informing visitors and population about the borders and duty of the Site	06/2018	06/2018	1218
			06/2019	06/2019	1340
			06/2020	06/2020	1474
			06/2021	06/2021	1621
			06/2022	06/2022	1783
	4.2. Installation of information boards	Installation of 6 boards/ Informing visitors about the Park duty, responsibility for violations	06/2018	06/2018	103
			06/2019	06/2019	113
			06/2020	06/2020	125
			06/2021	06/2021	138
			06/2022	06/2022	151
	4.3. Installation of information signs and signposts	Installation of 3 and more information signs, from 12 and more signposts	06/2018	06/2018	151
			06/2019	06/2019	167
			06/2020	06/2020	183
			06/2021	06/2021	202
			06/2022	06/2022	222
TOTAL costs for the program, thousand rubles			**01/2018**	**12/2018**	**13691**
			01/2019	**12/2019**	**14731**
			01/2020	**12/2020**	**16204**
			01/2021	**12/2021**	**17463**
			01/2022	**12/2022**	**19208**

PROGRAM II
"Ensuring the protection of natural complexes and sites, conservation of biological and landscape diversity"

Management task 1: Ground patrolling is aimed at identifying and suppressing violations of the special protection duty and detecting cases of poaching outside controlled routes and stationary posts. The task is primarily related to the protection of valuable species of fish and hoofed species of animals, which are the main objects of poaching. The main sites of control are the local population and pedestrian visitors. Activities are carried out by the forces of operational groups and inspectors at the Reserve cordons.

The task consists of two types of activities:

1. Pedestrian patrolling is aimed at identifying cases of duty violations and cases of poaching in areas not accessible to motor vehicles, water and other types of transport (and carried out by pedestrian violators). Expenses for activities are made up of transportation costs (delivery to the beginning of the patrol route and evacuation) and labor remuneration, including field allowance. Indicator is the index of patrolling effectiveness – the ratio of identified violations to labor costs (for 10-100 man days and/or 10-100 km of the pedestrian patrol route).
2. Patrolling of the Timber Complex Department Site territory with cars, motorcycles and other types of transport is aimed at identifying cases of duty violations and cases of poaching in areas accessible to transport and detection of cases of poaching using transport. Indicator is the index of mechanized patrolling effectiveness – the ratio of identified violations to labor costs (for 10 man days and/or 100 km of the patrol route).

The activities are associated with prevention, which includes the distribution of leaflets with rules of conduct among the visitors, the interviews with visitors and the dissemination of information about detected violations in the mass media.

Management task 2: Patrolling of the water area of water bodies is aimed at identifying and suppressing violations of the duty and cases of poaching in water areas accessible to water transport. The task is connected with the protection of valuable species of fish and the suppression of hunting with boats. Control of visits to the territory is carried out, including, from boats, as the rivers serve as the main transport arteries for more than 70% of tourists, rafting on non-motorized vessels. Activities are carried out by the forces of operational groups and inspectors at the Reserve cordons.

Activity:

1. Patrolling of river and lake water areas is aimed at identifying cases of duty violations and cases of poaching on sites accessible to water transport. Expenses of activities are made up of transportation costs, labor remuneration and depreciation of equipment. Indicator is the index of patrolling effectiveness – the ratio of identified violations to labor costs (for 10 man days and/or 100 km of the patrol route).

Management task 3: Air patrolling is aimed at identifying and suppressing violations of the duty and cases of poaching in isolated sites that are inaccessible to other types of transport from the territory of the Republic of Komi (including the eastern border). The task is relevant for all Specially Protected Natural Territories that make up the World Heritage Site, due to the considerable extent of their borders and the threat of poachers penetrating from the territory of Tyumen and Sverdlovsk regions.

Activity:

1. Air patrolling is carried out during the threatened periods of the year and are aimed at identifying cases of duty violations and cases of poaching on sites inaccessible to other transport and located at the entry points from the eastern borders of the Specially Protected Natural Territories. Expenses of activities are made up of transportation costs and labor remuneration. Indicator is the index of patrolling effectiveness – the ratio of identified violations to labor costs (for 1 man days and/or 1000 km of the patrol route).

2. Exploring the possibility and introduction of technology for remote tracking of the territory with the help of drones. Indicator is the index of patrolling effectiveness – the ratio of identified violations to costs after the technology introduction.

Management task 4: Technical support of the protection department. It is aimed at equiping the protection department (including operational groups) with technical means. The task is relevant due to the large areas of patrolling, the heavy working conditions of the inspectorate, the vastness, remoteness and inaccessibility of the Site territory and the improvement of means of transport belonging to violators.

The activity includes:

1. Technical equipment of the protection department, maintenance and repair of equipment, renewal of technical means (including vehicles; communication means; means of fixing violations; overalls, weapons, etc.). Expenses for the activity are made up of the cost of acquisition, keeping (storage), preventive maintenance, consumable materials and repair of equipment and technical means. Indicator is the (full) provision of the whole protection staff with sets of technical means. Indirect indicators can be the following: improvement of protection indicators and evidence base quality, growth of indicators of safety performance of protection officers.

Management task 5: Maintenance of protection and control stations (PCS), posts and cordons is aimed at providing the protection department with buildings at the entry points and exit to/from the territory and intermediate constructions on patrol routes. The task is relevant in view of the limited number of entry points to the territory (river outfalls and motor-and-tractor passways), which is why almost the entire flow of visitors can be controlled by stationary posts. Maintenance of intermediate stopping points for protection personnel is caused by the requirements of safety and labor protection during their raids for the territory protection.

The activity includes:

1. Construction, repair and annual maintenance, keeping and provision of PCS, posts and cordons at the entries and exits from the territory of each Specially Protected Natural Territories and intermediate protection points. Expenses include the cost of constructing, equiping the structures. Indicators are: a) provision of the protection personnel with the stopping points (1 building per 8-10 km of walking route and 20-30 km of patrol route for transport); b) provision of the entry-exit stationary protection with supporting points (ratio of the number of protection posts in relation to the need for them); c) length of the watch cycle per year at stationary posts, d) number of visitors monitored in relation to their flow, e) indexes of safety employee work can serve as an indirect indicator.

Management task 6: Training of protection inspectors. It contributes to the improvement of their competencies and the effectiveness of the territory protection. The activity highlights the issues of legal support for control and inspection activities, execution of documentation, and tactics of operational work, and includes the exchange of experience.

The activity includes:

1. Continuous training of inspectors during seminars, courses, technical trainings, trainings, cross raids, exchange of experience between Specially Protected Natural Territories, joint raids with power structures and others. Indicators are: hours (days) of training by each of the methods and coverage of staff with training. The main indicator can be the quality of materials for violators[39]

[39] For example: a) the number of paid administrative fines in relation to the decisions made; b) the number of protocols with damage taken by the prosecutor's office and others (depending on existing protection practices and protection agencies, as well as features of specific Specially Protected Natural Territories)

Management task 7: Identification of contamination cases as a result of the activities of nature users. The task is relevant due to the fact that in case of emergencies at industrial, linear facilities and leased sites, the threat to natural complexes can be significant. The activity encourages users to comply with established norms and rules. Monitoring and fixing of contaminants will allow timely detection of contamination, taking measures to eliminate it and reasonably presenting claims for damage caused to the territory and wildlife.

The activity includes:

1. Maintenance of the posts (points, sites) of constant control of industrial enterprises, linear structures and tenants in operating condition; periodic sampling, assessment and fixing of contaminants. The activity is carried out using the potential of research organizations. Indicators are the number of samples and the frequency of their selection, the coverage of all threatened directions (sites). Detection of cases of contamination and violations and prompt reaction to them.

Management task 8: Functioning of protection and control stations (PCS) and cordons is aimed at ensuring constant control over visitors and ensuring their safety.

The activity includes:

1. Constant watch of inspectors at PCSs at entry-exit points to/from the territory of Specially Protected Natural Territories and control over the flow of visitors. Expenses include the labor remuneration for inspectors. Indicators are: a) the length of the period of watch (per year) at stationary posts, b) the reduction in the number of malicious violations (the ratio of claims with environmental damage to the number of protocols)[40].

Management task 9: Prevention of violations, includes the continuous implementation of preventive measures (actions) in the mass media, on TV and radio, on the Internet, lectures, conversations. The activity is aimed at forming the correct conduct of visitors and reducing the damage to the Site nature. Activities are carried out, including by the forces of the inspectorate.

The activity includes:

1. Publication of the results of raids and the information on violations of rules of conduct of visitors and responsibility for violations, clarification of the correct (responsible) conduct of visitors in nature. Indicators are: a) the number of preventive publications, b) the dynamics of the number of violations.

In general, the listed activities are assessed as priority. Implementation of the set of activities implies an increase in the level of social protection of state inspectors, increase in the level of their professional training and the possibility of increasing their labor remuneration.

[40] For regional Specially Protected Natural Territories, the indicator may be the number of monitored visitors in relation to their flow, and others.

Table 24

Program II. "Detection and suppression of violations of environment-oriented legislation"

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	Total
1. Ground patrolling in order to detect and suppress violations of the duty using video surveillance and early warning systems	1.1. Pedestrian patrolling	**9,300** km/ indicators of violation detection per man*d, km	01/2018	12/2018	3839
			01/2019	12/2019	4222
			01/2020	12/2020	4645
			01/2021	12/2021	5109
			01/2022	12/2022	5620
	1.2. Patrolling on motor transport	**45,000 km**/ indicators of violation detection per man*d, km	01/2018	12/2018	9747
			01/2019	12/2019	10722
			01/2020	12/2020	11794
			01/2021	12/2021	12974
			01/2022	12/2022	14271
2. Patrolling of the water area of water bodies in order to identify and suppress violations of the duty of Specially Protected Natural Territories	2.1. Patrolling of river, lake water areas within the borders of Specially Protected Natural Territories and its protected zone	**12,500 man/d + 20,000 km**/ indicators of violation detection per man*d, km	01/2018	12/2018	8659
			01/2019	12/2019	9525
			01/2020	12/2020	10477
			01/2021	12/2021	11525
			01/2022	12/2022	12677
3. Air patrolling in order to identify and suppress violations of the duty of Specially Protected Natural Territories	3.1. Flying around the Site territory	**30 and more flying hours** / indicators of violation detection at km, years/hour	01/2018	12/2018	905
			01/2019	12/2019	995
			01/2020	12/2020	1095
			01/2021	12/2021	1205
			01/2022	12/2022	1325
	3.2. Introduction of the technology of flying around the territory by drones	Reducing the expenses of identified violations	01/2018	12/2018	950
			01/2019	12/2019	950
			01/2020	12/2020	400
			01/2021	12/2021	400
			01/2022	12/2022	300
4. Technical support of the protection department	4.1. Technical equipment of the protection department, maintenance and repair, renewal of technical means	Providing the protection staff with technical means; Improvement of indicators of protection and evidence base quality; Growth of employee safety indicators	01/2018	12/2018	1500
			01/2019	12/2019	1650
			01/2020	12/2020	1815
			01/2021	12/2021	1997
			01/2022	12/2022	2197
5. Maintenance of protection and	5.1. Construction, repair, maintenance and	Providing the protection staff with stopping points	01/2018	12/2018	5037

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	Total
control stations (PCS) and cordons	keeping of PCSs and cordons	and supporting points of the entry-exit stationary protection; Growth of employee safety indicators.	01/2019	12/2019	5541
			01/2020	12/2020	6095
			01/2021	12/2021	3000
			01/2022	12/2022	3300
6. Training of inspectors	6.1. Training of inspectors during seminars, courses, technical training and cross raids, exchange of experience between Specially Protected Natural Territories	Improving the quality of materials for violators, improving the working conditions of staff and safety	01/2018	12/2018	248
			01/2019	12/2019	272
			01/2020	12/2020	300
			01/2021	12/2021	330
			01/2022	12/2022	363
7. Control over the activity of nature users	7.1. Functioning of posts (points, sites) of constant contamination control near industrial enterprises, settlements, line constructions and tenants.	Number of samples. Monitoring and revealing the contamination cases. Reduction of contamination and violation cases. Compliance with established norms and rules by the users.	01/2018	12/2018	670
			01/2019	12/2019	737
			01/2020	12/2020	811
			01/2021	12/2021	892
			01/2022	12/2022	981
8. Functioning of protection and control stations (PCS) and cordons	8.1. Providing constant control of entry and exit points to/from the territory. Ensuring the safety of visitors.	Increase up to 5% points per year. Control of entry-exit points to/from the territory; Reduction of the number of malicious violations and prevention; Constant monitoring of the flow of visitors.	01/2018	12/2018	1597
			01/2019	12/2019	1757
			01/2020	12/2020	1933
			01/2021	12/2021	2126
			01/2022	12/2022	2339
9. Prevention of offenses	9.1. Carrying out of preventive measures in mass media, on TV and radio, on the Internet.	Publication of the results of raids and the information on violations of rules of conduct of visitors and responsibility; Promotion of the correct conduct of visitors	01/2018	12/2018	100
			01/2019	12/2019	110
			01/2020	12/2020	121
			01/2021	12/2021	133
			01/2022	12/2022	146
TOTAL costs for the program, thousand rubles			**01/2018**	**12/2018**	**33252**
			01/2019	**12/2019**	**36481**
			01/2020	**12/2020**	**39486**
			01/2021	**12/2021**	**39691**
			01/2022	**12/2022**	**43419**

PROGRAM III
"Implementation of work on environmental education"

Management task 1: museum and exhibition activity. The task consists of activities to create and maintain museums of natural and cultural heritage (dioramas, outdoor expositions, virtual routes and other types of facilities), creation and maintenance of information centers for visitors. Includes continuous renewal of expositions of museums and information centers and holding specialized exhibitions.

The task is to develop the services sector and to create the correct conduct of visitors, to preserve and popularize the natural and cultural heritage, to develop excursion activities and popularize information about nature and natural processes, to develop museum expositions to improve the quality of information, to develop virtual excursions for the people with disabilities and living on a budget, and a more complete (exhaustive) submission of material.

Expenses include the cost of expositions, the maintenance of museums, the holding of exhibitions and the labor remuneration of tour guides.

Activities contribute to the growth of the number of visitors to museums and exhibitions.

Indicators: growth of the Specially Protected Natural Territories' income from these activities, stable or positive dynamics of the number of visitors).

Management task 2: work with mass media. Includes activities for the publication of scientific and popular articles in printed publications; television and radio appearances of the employees of the Specially Protected Natural Territories of the Timber Complex Department Site, maintenance of the Web site

The task is implemented with the purpose: a) to form a positive image, b) to form the correct conduct of visitors in the territory, c) to promote the services of the Site, d) can be used to attract voluntary contributions (donations) for the implementation of specific programs and feedback to visitors.

Activities can increase the number of the Park visitors loyal to restrictions and prohibitions (indicator 1), increase the number of volunteers (indicator 2), and can also increase the income of the Park *by attracting charitable contributions* (indicator 3).

Management task 3: advertising and publishing activities and souvenirs. Includes the issue of brochures and booklets; posters, calendars, sets of postcards; other promotional products, including guidebooks, map charts, tracks (routes of the Specially Protected Natural Territories for navigators), video films and souvenirs, as well as virtual excursions.

The task is implemented with the purpose: a) promotion of the Site services, b) formation of a positive image of the Site, c) formation of the correct conduct of visitors. Expenses include the cost of replicating and the price of its distribution.

Organization of production of souvenirs by the local population is able to increase the income of the population and its loyalty to restrictions on the nature management in the territory of Specially Protected Natural Territories.

Activities contribute to the growth of the income of Specially Protected Natural Territories (indicator 1), increase in the number of loyal visitors (indicator 2), (as well as comments) on the web-sites of Specially Protected Natural Territories.

Management task 4: work with schoolchildren. Includes children's environmental camps and expeditions, organization and activities of school clubs, including craft schools and school forestries, excursions for children.

The task is implemented with the purposes of environmental education and enlightenment, recreation and health improvement of children, formation of a proper attitude to the nature and the Park, and training. Activities contribute to the formation of a positive image of the Park and the correct conduct of children and adolescents in nature, the development of new skills.

Expenses include the cost of activities, equipment, food, handout materials, prize funds, labor remuneration of the specialists involved, cost of the infrastructure specially created for camps (trails, passages, recreation areas).

Indicators are the number of activities and the number of man days for each activity.

Management task 5: carrying out of mass ecological-educational activities, timed to ecological holidays and actions, including Day of the Ecologist; Day of the Forest Worker; Day of Birds; "March of Parks" and others. The task involves carrying out educational activities outside the field and tourist season for the continuity of environmental education and employment of the staff of the environmental education department.

The task is implemented for the purpose of ecological education, enlightenment and training. Activities contribute to the participation of children and adolescents and adults in census work, in assistance activities to wintering birds and other activities that form an ecological consciousness and careful handling of nature and its objects. Expenses include the cost of activities and handout materials, prize funds, and labor remuneration of the specialists involved.

Indicators are the number of activities and the number of participants in each activity.

Management task 6: training guides and tour guides.

The task is implemented by holding seminars for guides (tuor guides) from among the local population and employees of the Specially Protected Natural Territories of the Site on the basis of their ecological routes.

The purpose of the activities is to improve the quality of visitor services, and as a result, the growth of income of the Specially Protected Natural Territories (Indicator 1) and environment (Indicator 2 – creation of jobs in the tourism industry and services) and reduction of costs of the Specially Protected Natural Territories (Indicator 3) through the work of seasonal workers and workers employed on a part-time basis.

Management task 7: arrangement and description of ecological routes. The task involves the description of ecological routes, their arrangement and registration on the ground, organization of viewing platforms, scenery spots, signposts and visual agitation, illustrative and handout materials.

The task is implemented for the purpose of increasing the income of Specially Protected Natural Territories of the Site by developing additional types of services, as well as for the purpose of environmental education.

Indicators are the number of routes and the dynamics of their growth (Indicator 1) and the number of visitors of each (Indicator 2). Assessment and improvement of routes is based on the reviews from visitors.

Management task 8: participation in programs for the development of cognitive (ecological) tourism is realized by the participation of the Specially Protected Natural Territories of the Timber Complex Department Site in federal / republican / municipal / donor cognitive tourism programs.

The task is implemented for the purpose of attracting investments in the development of cognitive programs of the Specially Protected Natural Territories.

Indicators are the volume of attracted investments and donor funds (Indicator 1) in relation to the number of applications filed (Indicator 2).

Management task 9: development of a "Course of the Specially Protected Natural Territories" for schools. It presupposes interaction with educational institutions, realized by conducting lessons and competitions of ecological themes in schools, assistance to educational institutions in preparing materials for environmental education and demonstration materials about the Specially Protected Natural Territories of the Site.

The task is implemented in order to create a positive image of the Specially Protected Natural Territories, to solidify interest in the Specially Protected Natural Territories in the environment of students, to form proper conduct in nature.

Indicators are a) the number of activities, b) the number of newly prepared original materials, c) the number of handout materials.

Management task 10: volunteer programs. They are implemented with an individual purpose for each activity (for example – garbage collection from past periods in the territory of Specially Protected Natural Territories, construction of buildings, assistance in servicing visitors, etc.).

The task is implemented in order to reduce the costs of Specially Protected Natural Territories, as well as environmental education of volunteers. Public actions are carried out in settlements to clean natural sites of garbage and arrange places for mass recreation of citizens to form the correct conduct of holidaymakers in nature. Activities in the form of expeditions are conducted on the territory of Specially Protected Natural Territories.

Indicators are the number of activities and the number of participants of each activity, as well as the natural indicators of activities (the amount of collected garbage, the number of built sites for mass recreation, etc.).

Management task 11: development of the material and technical base of the departments of environmental education, tourism and recreation

It is a purchase of office equipment and software products, photo and video materials, as well as the creation (installation) of virtual guides and excursions.

Activities are implemented to improve the opportunities and services of the departments of environmental education and to increase the effectiveness of environmental education.

Table 25

Program III. "Implementation of work on environmental education"

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	
1. Museum and exhibition activity	1.1. Creation and maintenance of natural and cultural heritage museums	Creation of 1 museum, expositions, the maintenance of museums; preservation and popularization of natural and cultural heritage, excursion activities	01/2018	12/2018	1900
			01/2019	12/2019	2090
			01/2020	12/2020	2299
			01/2021	12/2021	1700
			01/2022	12/2022	1870
	1.2. Creation, maintenance and development of information centers for visitors	Creation and development of a common information center (for the Timber Complex Department Site) and a visit center of the elk farm. Development of services and the formation of correct conduct of visitors	01/2018	12/2018	403
			01/2019	12/2019	443
			01/2020	12/2020	487
			01/2021	12/2021	536
			01/2022	12/2022	589
	1.3. Maintenance of existing information centers for visitors	Functioning of 5 information centers/ popularization of information about the Timber Complex Department Site, training of visitors to correct conduct, virtual excursions, sale of printed and souvenir products.	01/2018	12/2018	315
			01/2019	12/2019	356
			01/2020	12/2020	390
			01/2021	12/2021	439
			01/2022	12/2022	493
	1.4. Equipment of five existing information centers with barrier-free environment and special exhibits	5 centers are accessible for visitors with disabilities	01/2018	12/2018	90
			01/2019	12/2019	90
			01/2020	12/2020	100
			01/2021	12/2021	100
			01/2022	12/2022	100
	1.5. Renewal of the expositions of museums and information centers	Renewal (acquisition) of exhibits/ development of museum exposition to improve the quality of information	01/2018	12/2018	540
			01/2019	12/2019	594
			01/2020	12/2020	653
			01/2021	12/2021	719
			01/2022	12/2022	791
	1.6. Holding specialized exhibitions	Holding 24 exhibitions per year	01/2018	12/2018	629
			01/2019	12/2019	692
			01/2020	12/2020	761
			01/2021	12/2021	837
			01/2022	12/2022	921
2. Work with the mass media	2.1. Publications of popular scientific and	Publication of 52 articles per year. Popularization of	01/2018	12/2018	829

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	
	propaganda articles in printed publications	knowledge about nature, rules of correct conduct in nature, promotion of services of the Specially Protected Natural Territories	01/2019	12/2019	912
			01/2020	12/2020	1003
			01/2021	12/2021	1103
			01/2022	12/2022	1214
	2.2. Television and radio appearances of the employees of the Specially Protected Natural Territories	Television appearances – 7 and radio appearances – 5 interviews a year. Popularization of the correct conduct in nature and promotion of services of the Specially Protected Natural Territories	01/2018	12/2018	47
			01/2019	12/2019	52
			01/2020	12/2020	57
			01/2021	12/2021	62
			01/2022	12/2022	69
	2.3. Issue (participation in the issue) of periodical printed publications	3 issues a year, the total circulation is 20 thousand copies. Popularization of information about nature and correct conduct in the Specially Protected Natural Territories, promotion of services	01/2018	12/2018	385
			01/2019	12/2019	424
			01/2020	12/2020	466
			01/2021	12/2021	513
			01/2022	12/2022	564
	2.6. Maintenance and keeping of Web sites on the Internet	Popularization of the Site, promotion of services of the Specially Protected Natural Territories, formation of a proper attitude to nature and feedback from visitors, surveys and marketing activities	01/2018	12/2018	0
			01/2019	12/2019	0
			01/2020	12/2020	0
			01/2021	12/2021	0
			01/2022	12/2022	0
3. Advertising and publishing activities	3.1. Issue of brochures and booklets; posters, calendars, postcards; guidebooks, virtual excursions and maps; video films.	Brochures and booklets, souvenirs, posters, calendars, other promotional products – 8-10 thousand copies, video production – 1-2 clips. Creation of positive image and promotion of services of the Specially Protected Natural Territories	01/2018	12/2018	1843
			01/2019	12/2019	2027
			01/2020	12/2020	2229
			01/2021	12/2021	2452
			01/2022	12/2022	2698
4. Work with schoolchildren	4.1. Conducting children's ecological camps and expeditions; conducting clubs and school forestries, excursions	Environmental education, enlightenment, health improvement, formation of correct attitude to nature and the Specially Protected Natural Territories, professional orientation, volunteering	01/2018	12/2018	1031
			01/2019	12/2019	1134
			01/2020	12/2020	1248
			01/2021	12/2021	1372
			01/2022	12/2022	1510
5. Carrying out of actions, timed to ecological holidays and actions	5.1. Day of the Ecologist; Day of the Forest Worker; Day of Birds; "March of Parks" and other activities	The total number of participants is up to 3.5 thousand participants/ environmental education, enlightenment, formation of a positive image of the Park	01/2018	12/2018	1272
			01/2019	12/2019	1400
			01/2020	12/2020	1540
			01/2021	12/2021	1694
			01/2022	12/2022	1863

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	
6. Training tour guides and guides	6.1. Conducting seminars for guides and tour guides from among the local population, training employees	Organization of 1 seminar a year for guides. Improving the quality of service and safety of visitors	05/2018	05/2018	160
			05/2019	05/2019	176
			05/2020	05/2020	193
			05/2021	05/2021	212
			05/2022	05/2022	234
7. Arrangement and description of ecological routes	7.1. Description of routes, their arrangement and registration on the ground	Description and arrangement of 2 routes	05/2018	08/2018	333
			05/2019	08/2019	366
			05/2020	08/2020	403
			05/2021	08/2021	443
			05/2022	08/2022	488
8. Participation in cognitive (ecological) tourism programs	8.1. Participation in republican / municipal / federal / donor cognitive tourism programs	Participation in competitions (municipal, regional, all-Union, donor competitions) on tourism development/ attraction of investments, creation of a positive image of the Site	01/2018	12/2018	200
			01/2019	12/2019	220
			01/2020	12/2020	242
			01/2021	12/2021	266
			01/2022	12/2022	293
9. Interaction with educational institutions	9.1. Carrying out the lessons and competitions of ecological subjects, assistance to educational institutions	Assistance to educational institutions/ creation of a positive image of the Site, consolidation of interest in Specially Protected Natural Territories, vocational guidance, formation of the correct conduct in nature	01/2018	12/2018	200
			01/2019	12/2019	220
			01/2020	12/2020	242
			01/2021	12/2021	266
			01/2022	12/2022	293
10. Volunteer programs	10.1. Carrying out actions to arrange natural sites, garbage removal on mass routes	Formation of the correct conduct of holidaymakers in nature, saving costs, arranging places of concentration of visitors	05/2018	08/2018	200
			05/2019	08/2019	220
			05/2020	08/2020	242
			05/2021	08/2021	266
			05/2022	08/2022	293
11. Development of the material and technical base of the Department of Ecological Tourism and Recreation and Organization of Tourism Activities and Environmental Education	11.1. Acquisition of office equipment and software products, creation of virtual guidebooks	Provision of departments with office equipment and software products, installation of virtual guidebooks	01/2018	12/2018	133
			01/2019	12/2019	146
			01/2020	12/2020	161
			01/2021	12/2021	177
			01/2022	12/2022	195
TOTAL costs for the program, thousand rubles			01/2018	12/2018	**8310**
			01/2019	12/2019	**9142**
			01/2020	12/2020	**10054**

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	
			01/2021	12/2021	**10229**
			01/2022	12/2022	**11256**

Program IV
"Implementation of research works aimed at developing and implementing scientific methods for conserving biological diversity and maintaining natural complexes and sites in a natural state. Performance of work in the field of environmental monitoring. Environmental expertise"

Overall purpose of the program is information and scientific support of the process of management and planning of activities for making informed decisions and replenishing scientific knowledge.

The main tasks of the program: inventory of natural and historical and cultural complexes and site; improvement of the management information base; research of the dynamics of natural and social processes in the territory of Specially Protected Natural Territories, support for research of the natural complex by third-party scientific and educational organizations.

Management task 1: inventory of components of natural complexes, objects of flora and fauna, conducting censuses, assessing the impact on natural complexes and developing activities to preserve the objects under study. Expenses are made up of labor remuneration and the cost of field works, equipment and consumable materials.
Indicators are labor remuneration, number of topics[41].

Management task 2: preparation **and publication of** printed works. Includes the **preparation and publication** of monographs and thematic collections (incl.: registration) of scientific articles in foreign and all-Russian journals; in regional journals; scientific articles and theses in thematic collections in order to disseminate the results of research on natural complexes and sites.
Indicators are the number of publications, the impact factor of the journal, the status of the publishing house[42].

Management task 3: Environmental monitoring. Includes measurement of environmental parameters and maintenance of multi-year series of observations.
Indicator is the number of parameter assessments[43].

Management task 4: development of recommendations for the conservation of natural complexes and rational use of natural resources, environmental expertise of projects for the development of adjacent territories. It includes the development of recommendations for improving the protection of the territory and the preservation of its natural complexes.
Indicators are the number of recommendations, the proportion among them used in making managerial decisions. An indirect indicator is the positive effect of scientifically based activities.

Management task 5: support for the study of the natural complex by third-party scientific and educational organizations. It includes the search for co-executors of scientific and training and research projects on the Site territory and participation in their implementation on the terms of partnership.
Indicators are the number and status of partners, the number and status of publications, the amount of funds received from third-party organizations.

Expenses for activities include: the creation of the necessary material and technical base for scientific activities, the costs of implementing activities, labor remuneration of specialists, the costs of processing the materials received, preparation and publication of monographs, collections, reports and scientific articles, and the costs for participation in conferences.

[41] Indirect is the quality and completeness of the conclusions.
[42] Foreign; Russian; regional.
[43] Quality of the results obtained – if objective assessment is possible

Table 26

Program IV. "Implementation of research works aimed at developing and implementing scientific methods for conserving biological diversity and maintaining natural complexes and sites in a natural state"

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
1. Research in the field of biodiversity conservation	1.1. Development of scientific topics; conducting censuses	Development of 12 scientific topics; inventory, mapping/ study and inventory of the objects of flora and fauna, rare and endangered species	01/2018	12/2018	10075
			01/2019	12/2019	11082
			01/2020	12/2020	12190
			01/2021	12/2021	13409
			01/2022	12/2022	14750
2. Preparation and publication of printed works	2.1. Preparation of manuscripts for monographs and thematic collections, participation in conferences and seminars	Monographs and collections; scientific articles in foreign and all-Russian journals; in regional journals; scientific articles and theses in thematic collections and popularization of science	01/2018	12/2018	344
			01/2019	12/2019	379
			01/2020	12/2020	416
			01/2021	12/2021	458
			01/2022	12/2022	503
3. Environmental monitoring,	3.1. Obtaining blocks of data on the state of nature, analyzing data, bringing conclusions to the attention of specialists	Data and conclusions for correcting the action program	01/2018	12/2018	157
			01/2019	12/2019	180
			01/2020	12/2020	185
			01/2021	12/2021	203
			01/2022	12/2022	223
4. Development of recommendations and environmental expertise	4.1. Development of recommendations for site management, participation in environmental expertise	Improving the management of the site and its adjacent enterprises	01/2018	12/2018	70
			01/2019	12/2019	80
			01/2020	12/2020	90
			01/2021	12/2021	100
			01/2022	12/2022	110
5. Assistance to the third-party researchers and students	5.1. Involvement of third-party universities and scientists, participation in joint Research	At least 4 organizations. Raising the scientific level of research and education of specialists, receiving funds in the budgets of the Reserve and National Park	01/2018	12/2018	60
			01/2019	12/2019	80
			01/2020	12/2020	90
			01/2021	12/2021	100
			01/2022	12/2022	110
TOTAL costs for the program, thousand rubles			**01/2018**	**12/2018**	**10706**
			01/2019	**12/2019**	**11791**
			01/2020	**12/2020**	**12971**
			01/2021	**12/2021**	**14270**
			01/2022	**12/2022**	**15696**

Program V
"Performance of works on preservation and restoration of natural and historical and cultural complexes and sites"

Purpose of the program: preservation of sites of historical and cultural heritage.

The main tasks of the program: identification, inventory, study, restoration, protection, use of historical and cultural and natural sites of Specially Protected Natural Territories for scientific and cognitive purposes.

A separate task is the preservation of various forms of traditional cultural heritage with the involvement of bearers of cultural traditions and traditions of sustainable nature management.

Management task 1: restoration of disturbed natural and historical and cultural complexes and sites. It includes carrying out conservation, restoration and repair works at the sites of historical and cultural heritage, restoration and maintenance of the state of cultural and landscape complexes on the basis of scientific recommendations.
Indicators are: a) the number of restored sites and complexes, b) the number of restored sites.

Management task 2: identification, mapping and certification of sites of historical and cultural heritage, assessment of their condition, assessment of the need for their restoration.
Indicators are: a) the number of identified and certified sites.

Management task 3: development of recommendations for the conservation of natural sites and sites of historical and cultural heritage.
Indicators are: a) the number of recommendations (in the form of executed document or publication), b) the number of feasibility studies, plans, estimates.

Management task 4: restoration of disturbed natural sites of the Specially Protected Natural Territories.
Indicators are: a) the area of the restored sites, incl. in relation to the total area of sites requiring reclamation.

Expenses for activities include: the cost of identification, inspection and activities for the certification of historical and cultural sites; the cost of conducting conservation, restoration and repair works on historical and cultural sites; cost of works on reclamation of disturbed natural territories.

Table 27

Program V. "Performance of works on preservation and restoration of historical and cultural complexes and sites"

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
1. Restoration of disturbed natural and historical and cultural complexes and sites	1.1. Conducting conservation, restoration and repair works at the sites of historical and cultural heritage	Restoration of sites – restoration and preservation of (priority) sites on the basis of Research and recommendations. At least 3 sites	01/2018	12/2018	834
			01/2019	12/2019	917
			01/2020	12/2020	1009
			01/2021	12/2021	1109
			01/2022	12/2022	1220
2. Mapping and certification of the sites of historical and cultural heritage	2.1. Identification, mapping and certification of the sites of historical and cultural heritage	Site certificate – census and evaluation of sites for restoration and preservation purposes. At least 14 certificates	01/2018	12/2018	247
			01/2019	12/2019	272
			01/2020	12/2020	299
			01/2021	12/2021	329
			01/2022	12/2022	362
3. Development of recommendations for the conservation of sites	3.1. Development of recommendations for the conservation of natural, historical and cultural monuments	Assessment of expenses of the activities to restore and reserve the sites	01/2018	12/2018	250
			01/2019	12/2019	275
			01/2020	12/2020	302
			01/2021	12/2021	332
			01/2022	12/2022	365
4. Restoration of the disturbed sites of Specially Protected Natural Territories	4.1. Reclamation of disturbed sites of the Specially Protected Natural Territories	Reduction of the area of disturbed sites, increase of the recreational attractiveness of the Timber Complex Department Site territory. At least 2 hectares	01/2018	12/2018	2000
			01/2019	12/2019	2200
			01/2020	12/2020	2420
			01/2021	12/2021	2662
			01/2022	12/2022	2928
TOTAL costs for the program, thousand rubles			**01/2018**	**12/2018**	**3331**
			01/2019	**12/2019**	**3664**
			01/2020	**12/2020**	**4030**
			01/2021	**12/2021**	**4432**
			01/2022	**12/2022**	**4875**

Program VI
"Landscaping works for the development of regulated tourism, recreation and environmental education activities"

Purpose of the program: creation of comfortable conditions for extreme and cognitive tourism, recreation and environmental education.

The Specially Protected Natural Territories included in the Site have infrastructure on 30 routes (on 21 routes in the snowless period and on 9 winter ones), with a total length of about 4000 km. The need for infrastructure to create comfortable conditions for visitors is satisfied by 50% in the National Park, by 75% in the Reserve and by 10% in its buffer zone. Table 28 shows the characteristics of routes and their preference.

Table 28

Arranged tourist routes around the World Heritage Site territory

		Water	Pedestrian	Pedestrian and water	Ski	Oversnow	City break	Total
Number of routes, pcs	National Park	3	4	7	6	2	10	21
	Reserve	2	4	-	-	2	3	6
	buffer zone	2	-	1	-	-	1	3
	total	7	8	8	6	4	14	30
Length of routes, km	National Park	762	563	1101	592	315	-	3303
	Reserve	240	45	-	-	15	-	300
	buffer zone	220	-	120	-	-	-	340
	Total	1222	608	1221	592	330	-	3973
Preferred routes (sites) by visitors, 2015, %		41	15	12	Less than 1%	Less than 1%	31	100

67 residential buildings (57 in the Park, 3 in the buffer zone, 7 in the Reserve) are equipped to accommodate visitors and reduce the number of spontaneous camping places.

In addition to the comfortable infrastructure, the routes of the National Park on 78 well-equipped camping places are equipped with: 81 gazebos, 104 equipped fire-pits, 86 garbage collectors, 76 toilets, 44 ramps to the water and gangways, bridges and passages. 5 intermediate camping places, 7 forest huts are situated on the routes of the Reserve. 3 gazebos are equipped in the buffer zone territory, the local population maintain 8-10 forest huts.

Management task 1: creation and arrangement of excursion ecological trails and tourist routes. Includes: arrangement of new and maintenance of existing excursion and ecological paths in operating condition; development, improvement and certification of tourist routes; creation of gangways, bridges, passages, stairs, scenery spots, recreation areas, etc.
Indicators are: the number of a) new sightseeing routes, b) equipped trails, c) new tourist products, d) visitor flow.

Management task 2: recreational arrangement includes: creation, equipment, repair and maintenance of places for tent camping; organization of car parks, maintenance of guest houses and stopping points.
Indicators are: a) the number of equipped recreation areas and tent camping places, b) the cost of maintenance, repair and operation of guest houses and other infrastructure facilities

Management task 3: promotion of tourist and excursion products (development, preparation and publication of information materials for visitors: map charts, descriptions of routes, etc.; participation in tourist exhibitions and fairs, ecological excursions for visitors by prepared guides and tour guides.
Indicators are: a) the number of excursions and the number of visitors; b) income from excursion services; c) the number of promotional products and circulation; d) participation in tourist exhibitions (fairs)

Management task 4: waste management. It includes a set of measures: installation of garbage collectors; garbage collection, removal and disposal; installation of toilets, septic tanks; prevention of contamination; implementation of volunteer programs; removal of old industrial garbage and its disposal.
Indicators are: a) the number of garbage collectors, toilets in relation to the need for them[44]; b) the amount of garbage removed and disposed, the area of sites of the National Park and wildlife sanctuaries cleared of industrial waste.

Expenses for activities include: the cost of equipment, repair and maintenance of excursion trails, recreation places and picnic places, maintenance of tent camping places, car parks, the cost of maintenance of guest houses and stopping points. The cost of promoting the products of Specially Protected Natural Territories and organized ecological excursions. The cost of complex activities for waste management.

Management task 5: support of traditional nature management of the local population and its initiatives. Includes: a) collection, systematization and storage of monuments and evidence of sustainable nature management, monuments of folklore and culture; b) popularization of traditional nature management, which does not create environmental problems.
Activities contribute to: preservation of monuments and sites of traditional nature management; their popularization; development of ethnic types of tourism; increase in incomes of local population and its loyalty to the Specially Protected Natural Territories.
Indicators are: a) the number of monuments and evidences of sustainable nature management, monuments of folklore and culture, b) the number of activities based on them and the number of participants.

Expenses for activities include: the cost of identifying, collecting, systematizing and storing monuments and evidences of sustainable nature management, monuments of folklore and culture, conducting clubs of folk crafts, folklore festivals, producing souvenirs and items of traditional life.

[44] Assessment of the need for facilities: garbage collectors – due to the presence of spontaneous disposal dumps; toilets – due to the number of camping places and visitor polls – Appendix 4

Table 29

Program VI. "Implementation of activities for the organization and development of regulated tourism and environmental education"

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
1. Creation and arrangement of ecological trails and tourist routes	1.1. Creation and arrangement of ecological trails	8 km/year of ecological trails	01/2018	12/2018	392
			01/2019	12/2019	431
			01/2020	12/2020	474
			01/2021	12/2021	521
			01/2022	12/2022	574
	1.2. Development, improvement and certification of tourist routes	3 routes per year, 5 certificates per year	01/2018	05/2018	765
			01/2019	05/2019	841
			01/2020	05/2020	925
			01/2021	05/2021	1018
			01/2022	05/2022	1119
	1.3. Creation and arrangement of viewing platforms	Improvement of viewing platforms (5-7 scenery spots) per year	05/2018	07/2018	249
			05/2019	07/2019	274
			05/2020	07/2020	301
			05/2021	07/2021	331
			05/2022	07/2022	364
2. Recreational arrangement of Specially Protected Natural Territories	2.1. Equipment, repair and maintenance of recreation areas and picnic places	Equipment of 20-30 recreation places per year, repair and maintenance of recreation places	05/2018	09/2018	500
			05/2019	09/2019	550
			05/2020	09/2020	605
			05/2021	09/2021	250
			05/2022	09/2022	300
	2.2. Equipment, repair, development and maintenance of places for tent camping	Equipment of up to 10 tent camping places per year and maintenance of up to 30 tent camping places	05/2018	09/2018	250
			05/2019	09/2019	275
			05/2020	09/2020	303
			05/2021	09/2021	333
			05/2022	09/2022	367
	2.3. Organization and operation of car parks (guarded parking lots)	Equipment of 1 guarded parking lot for 10-12 vehicles per year	05/2018	09/2018	67
			05/2019	09/2019	73
			05/2020	09/2020	81
			05/2021	09/2021	89
			05/2022	09/2022	98
	2.4. Maintenance of guest houses and stopping points	Maintenance, repair and operation of 64-67 guest houses and stopping points	05/2018	09/2018	2810
			05/2019	09/2019	3091
			05/2020	09/2020	3400

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles Total
			beginning	end	
			05/2021	09/2021	3740
			05/2022	09/2022	4114
3. Organization of cognitive tourism	3.1. Conducting excursions for visitors	Conducting excursions: for 3-4 thousand visitors per year	01/2018	12/2018	2198
			01/2019	12/2019	2417
			01/2020	12/2020	2659
			01/2021	12/2021	2925
			01/2022	12/2022	3217
	3.2. Preparation and publication of information materials for visitors: map charts, descriptions of routes, tracks and etc.	Publication of at least 2 printed publications per year with a circulation of 200-500 copies.	01/2018	12/2018	163
			01/2019	12/2019	180
			01/2020	12/2020	198
			01/2021	12/2021	218
			01/2022	12/2022	240
	3.3. Participation in tourist exhibitions and fairs	Annual participation in a tourist exhibition – fair)	01/2018	12/2018	150
			01/2019	12/2019	165
			01/2020	12/2020	182
			01/2021	12/2021	200
			01/2022	12/2022	220
4. Waste handling	4.1. Garbage collection, incl. previous periods; installation of garbage collectors, garbage removal and disposal; installation of toilets	Collection, removal and disposal of garbage and domestic waste, reduction of the elimination of unauthorized disposal dumps	05/2018	09/2018	1500
			05/2019	09/2019	1650
			05/2020	09/2020	1815
			05/2021	09/2021	1997
			05/2022	09/2022	2196
5. Support of traditional nature management of the local population and its initiatives	5.1. Collection, systematization, storage and demonstration of evidences of sustainable nature management, monuments of folklore	Development of ethnic types of tourism, increase of income of local population and its loyalty to the Specially Protected Natural Territories	01/2018	12/2018	399
			01/2019	12/2019	439
			01/2020	12/2020	483
			01/2021	12/2021	531
			01/2022	12/2022	584
TOTAL costs for the program, thousand rubles			**01/2018**	**12/2018**	**9443**
			01/2019	**12/2019**	**10386**
			01/2020	**12/2020**	**11426**
			01/2021	**12/2021**	**12153**
			01/2022	**12/2022**	**13393**

Program VII.
"Administration and financial and economic activities"

Purpose of the program: effective management of the Site.

Tasks of the program include the effective management of the finances of each Specially Protected Natural Territory: formation and maintenance of fixed assets, growth of the flow of own and attracted funds; formation of a policy for saving financial resources, rational use of fixed assets and commodities and materials, and improvement of the working conditions of employees.

Management task 1: financial and economic activities include: financial administration, maintenance, operation and repair of fixed assets; attraction of funds of budgets and donors, accounting and control.
Activities contribute to the effective management of finances and the rational use of fixed capital and commodities and materials.
Solution of the task will be facilitated by the creation of a coordinating body for the site, with a view to making prompt decisions, which are currently regulated by the system of Agreements between the Specially Protected Natural Territories.
Indicator is: a) an increase in the flow of funds (own and attracted) to the core activities of the Specially Protected Natural Territories, b) cost savings due to the interconnection of programs of the Specially Protected Natural Territories

Management task 2: cost saving through the introduction of energy-saving equipment and technologies, and other methods of economy.
Activities include: energy-saving technologies, solar energy, traditional transport and other strategies for reducing costs.
Activities contribute to an increase in the flow of funds to the programs of the Specially Protected Natural Territories of the Site as a whole.
Indicators are: a) an increase in the flow of funds to address priority tasks as a result of cost savings.

Management task 3: development and operation of infrastructure.
Activities include: construction of objects of tourist, service and administrative infrastructure.
Indicators are: a) an increase in the flow of funds from the service of visitors

Table 30

Program VII. "Administration and financial and economic activities"

Management task	Activities	Expected results	Implementation time		Cost per year, thousand rubles
			beginning	end	Total
1. Financial and economic activity	1.1. Administration, maintenance, operation and repair of fixed assets; attraction of donor funds	Effective financial management	01/2018	12/2018	10890
			01/2019	12/2019	11979
			01/2020	12/2020	13177
			01/2021	12/2021	14495
			01/2022	12/2022	15944
2. Cost saving	2.1. Introduction of energy-saving equipment and technologies	Cost savings by at least 20%	01/2018	12/2018	1000
			01/2019	12/2019	1100
			01/2020	12/2020	600
			01/2021	12/2021	550
			01/2022	12/2022	500
3. Construction of infrastructure	3.1. Construction of capital tourist and industrial infrastructure objects	Growth of own funds flow by at least 30%, improvement of working conditions for employees	01/2018	12/2018	13821
			01/2019	12/2019	15203
			01/2020	12/2020	16723
			01/2021	12/2021	18396
			01/2022	12/2022	20235
TOTAL costs for the program, thousand rubles			01/2018	12/2018	**25711**
			01/2019	12/2019	**28282**
			01/2020	12/2020	**30500**
			01/2021	12/2021	**33441**
			01/2022	12/2022	**36679**

VI. FINANCIAL COSTS

Table 31

Estimation of financial costs for implementation of the management plan[45]

Task No.	Result	Need for thousand of rubles					Source of financing*
		2018	2019	2020	2021	2022	
I	**Conservation of natural complexes**	**13691**	**14731**	**16204**	**17463**	**19208**	**FB, O**
I.1	Fire fighting arrangements	5091	5600	6160	6776	7454	FB, O
I.2	Protection of forests	5927	6190	6809	7127	7841	FB, O
I.3	Biotechnical activities	1201	1321	1453	1599	1758	FB
I.4	Borders and zoning	1472	1619	1781	1959	2155	FB
II	**Protection**	**33252**	**36481**	**39486**	**39691**	**43419**	**FB, O**
II.1	Ground patrolling	13586	14944	16439	18083	19891	FB
II.2	Patrolling of water areas	8659	9525	10477	11525	12677	FB
II.3	Air patrolling and alternatives	905	995	1095	1205	1325	FB, D
II.4	Technical support	1500	1650	1815	1997	2197	FB, O, D
II.5	Maintenance of control stations	5037	5541	6095	3000	3300	FB, O, D
II.6	Training of inspectors	248	272	300	330	363	FB, O
II.7	Control of nature users	670	737	811	892	981	FB, O
II.8	Functioning of cordons	1597	1757	1933	2126	2339	FB, O
II.9	Prevention of offenses	100	110	121	133	146	FB, O, D
III	**Implementation of work on environmental education**	**8310**	**9142**	**10054**	**10229**	**11256**	**FB, RB, O, D**
III.1	Museum and exhibition activity	3877	4265	4690	4331	4764	FB, O, D
III.2	Work with mass media	1261	1388	1526	1678	1847	FB, O, D
III.3	Advertising and publishing activities	1843	2027	2229	2452	2698	FB, O, D
III.4	Work with schoolchildren	1031	1134	1248	1372	1510	FB, O, D
III.5	Activities on environmental education	1272	1400	1540	1694	1863	FB, O, D
III.6	Training of employees and guides	160	176	193	212	234	FB, O
III.7	Arrangement of ecological routes	333	366	403	443	488	FB, O, D
III.8	Participation in ecotourism programs	200	220	242	266	293	FB, RB, O, D
III.9	Interaction with educational institutions	200	220	242	266	293	FB, O, D
III.10	Volunteer programs	200	220	242	266	293	FB, O, D
III.11	Development of material and technical base	133	146	161	177	195	FB, O, D
IV	**Research and development, environmental monitoring**	**10706**	**11791**	**12971**	**14270**	**15696**	**FB**
IV.1	Scientific research	10075	11082	12190	13409	14750	FB
IV.2	Publications	344	379	416	458	503	FB
IV.3	Environmental monitoring	157	180	185	203	223	FB
IV.4	Recommendations and environmental expertise	70	80	90	100	110	FB
IV.5	Assistance to third-party researchers	60	80	90	100	110	FB
V	**Conservation of natural complexes**	**3331**	**3664**	**4030**	**4432**	**4875**	**FB, O, D**
V.1	Restoration of disturbed complexes	834	917	1009	1109	1220	FB, O, D
V.2	Mapping and certification	247	272	299	329	362	FB
V.3	Development of recommendations	250	275	302	332	365	FB
V.4	Restoration of disturbed natural sites	2000	2200	2420	2662	2928	FB, O, D
VI	**Organization and development of regulated tourism**	**9443**	**10386**	**11426**	**12153**	**13393**	**FB, LB, O, D**
VI.1	Creation and arrangement of ecological trials of routes	1406	1546	1700	1870	2057	FB, O, D
VI.2	Recreational arrangement of Specially Protected Natural Territories	3627	3989	4389	4412	4879	FB, O, D
VI.3	Organization of cognitive tourism	2511	2762	3039	3343	3677	FB, O, D
VI.4	Waste handling	1500	1650	1815	1997	2196	FB, O, D
VI.5	Support of traditional nature management	399	439	483	531	584	LB, O, D
VII	**Administration and financial and economic activities**	**25711**	**28282**	**30500**	**33441**	**36679**	**FB, O**
VII.1	Financial and economic activity	10890	11979	13177	14495	15944	FB
VII.2	Cost saving	1000	1100	600	550	500	FB, O
VII.3	Construction of infrastructure	13821	15203	16723	18396	20235	FB, O, D
	Total	**104444**	**114477**	**124671**	**131679**	**144526**	
	Budget deficit	**25293.7**	**27500**	**30000**	**31500**	**34700**	

*- FB – federal budget, RB – regional budget, LB – local budget, O – own funds, D – donors.

[45] Financial information is given in Appendix 3, calculation of the first year budget deficit is in Chapter 7

VII. MONITORING THE IMPLEMENTATION OF THE MANAGEMENT PLAN

A number of natural indexes (indicators) included in the statistical reporting forms and measured annually are used as a means of assessing the effectiveness of the management of the Timber Complex Department Site.

Standard indicators (indexes):

1. To assess the implementation of the program "Ensuring the protection of natural complexes and sites, conservation of biological and landscape diversity":

- total area of forest fires;
- the number of protocols compiled;
- the amount of collected penalties and damages, cases transferred to the investigative bodies;
- the number of citizens/legal entities brought to administrative responsibility for environmental offenses by the officials of Specially Protected Natural Territories;
- the number of citizens/legal entities brought to civil responsibility for environmental offenses by the officials of Specially Protected Natural Territories;
- the number of species of flora and fauna included in the Red Book of Russia.

2. To evaluate the implementation of the research activity program:

- the number of scientific programs and topics under development;
- the number of ongoing perennial (more than 10 years) series of observations;
- the number of environmental parameters measured in the course of environmental monitoring conducted in the territory of Specially Protected Natural Territories;
- the number of scientific publications (by the staff of Specially Protected Natural Territories and by third-party researchers);
- the number of published monographs and collections of scientific articles;
- the number of students who have passed educational practice in the Specially Protected Natural Territories;
- the number of student course and degree works prepared on the basis of materials collected in the territory of Specially Protected Natural Territories.

3. To assess the implementation of the program of environmental education, tourism and recreation:

- the number of information centers (including museums)/ number of visitors;
- the number of activities/participants in the "March of Parks" action;
- the number of ecological camps/the number of participants;
- publishing of printed products;
- the number of excursion and tourist routes;
- the number of equipped recreation areas in the territory of Specially Protected Natural Territories;
- the number of organized groups/the number of visitors to the territory of Specially Protected Natural Territories.

4. To assess the implementation of the program "Preservation of historical and cultural heritage":

- the number of sites of historical and cultural heritage in the territory of Specially Protected Natural Territories;
- the number of sites of historical and cultural heritage, where restoration works are carried out;
- presence of projects of preservation and restoration of sites of history and culture in the territory of Specially Protected Natural Territories.

Indicator of the effective work of the Specially Protected Natural Territories is also the provision of structural units with the necessary machinery and equipment.

To assess the **implementation of the management plan** for the Timber Complex Department Site, a system of indicators was developed to assess the impact of each activity (Table 32), which required the expansion of a set of indicators.

Table 32

Main indexes (indicators) of the implementation of the management plan of the World Heritage Site

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
Program I: Implementation of Measures for the Conservation of Natural Complexes in Natural State		
I.1	**Fire prevention measures:**	
I.1.1	Maintenance, renovation and repair of fire lines. *Indicators:* 1. Manufacturing (in km), 2. renewal and maintenance (in km) of fire lines per year in relation to their total quantity; 3. The number of cases of forest fire development from roads, sources of open fire (bonfires) and heated buildings (in relation to previous periods) *The analysis consists in determining the priority locations for fire lines, the optimal length depending on the type of buildings or objects, and the choice of their location depending on the natural fire hazard and forest growth conditions for the optimization of costs*	June-July
I.1.2.a	Installation and maintenance of fire-fighting stands. *Indicators:* 1. installation (in pieces) of stands per year, 2. repair and renewal (in pieces) of previously installed stands	June
I.1.2.b	Issue of leaflets and fire prevention agitation. *Indicators:* 1. Production (per copy) of fire prevention leaflets per year	June
I.1.3	Air patrolling of the territory of Specially Protected Natural Territories. *Indicators:* 1. Flying around the territory (in the number of flight hours). 2. Ratio of the area of localized fires to the area of detected forest fires. *The analysis concerns the optimization of routes and the frequency of flights.*	July-August
I.1.4	Maintenance, acquisition, completion and repair of fire-chemical station equipment and fire-fighting boards and creation of material stocks for the period of fire hazardous situation. *Indicator:* 1. Assessment of dependence of the area of forest fires on the capital-labor ratio of the teams for their extinguishing.	April-August
I.1.5	Extinguishing forest fires *Indicators:* 1. Area of forest fires. *Organization of labor and optimal composition of the teams are analyzed.*	July-August
I.1.6	Education and training of personnel to extinguish forest fires. *Indicators:* 1. Area of forest fires, 2. Labor productivity – the speed of fire localization a in relation to the extent of its edge. *The analysis concerns the review of fire extinguishing activities for training and future organization of labor and optimization of composition of teams.*	April-June
I.1.7	Clearing of clearings, trails, borders and roads of fire prevention (forestry) purpose *Indicators:* 1. Cleaning (in km) of transport routes per year.	June
The main argument for attracting investments in activities to protect forests from fires is the assessment of biodiversity loss as a result of each fire – this assessment (of each fire) allows to compare investments in activities with damage to the Specially Protected Natural Territories; **The main way to save costs for activities** is the assessment of effectiveness of activities in relation to the cost of fire extinguishing – allows to calculate the effectiveness of replacing some activities with others and saving costs on redundant activities.		

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
I.2	**Forest protection and conservation activities:**	
I.2.1	Selective sanitary fellings *Indicators*: 1. The area of felling (in ha) per year; 2. The volume of cutover and recovered wood (in m³) per year. *Dynamics of the reduction in the forest site area affected by pests is analyzed depending on the intensity of previous felling (% of the need for felling).*	March-October
I.2.2	Cleaning the forest from littering: *Indicators:* 1. The area cleared of littering (in ha) per year; 2. The volume of recovered dead-fallen wood and windfall trees (in m³) per year.	June-October
I.2.3	Current forest pathology research: *Indicators:* 1. Surveyed area (in ha) per year; 2. Labor costs (per man*days) per year	June-October
The main way to save costs for activities is to sell wood as firewood for shelters and to attract volunteers		
I.3	**Biotechnical activities**	
I.3.1	Winter route census: *Indicators:* 1. Double passage of routes (in km) per year; 2. Indicators of censuses for 16 species of mammals and birds; 3. Long-term dynamics of census indicators by species. *Primary documentation for determining its reliability is analyzed*	January-March
I.3.2	Autumn censuses: *Indicators:* 1. Passage of routes (in km) per year; 2. Indicators of bird census, including rare species; 3. Indicators of reproduction (record of broods) and their long-term dynamics. 4. Long-term dynamics of autumn census indicators by species. *Indicators of abundance of rare species are analyzed to determine the causes of increase/decrease in census indicators*	August-September
I.3.3	Arrangement of salt gardens and self-feeding stations: *Indicators:* 1. Arrangement of feeding waters (in ha); 2. Arrangement of salt gardens (in pcs and tons of mineral feeding) per year. 3. Creation of artificial concentrations of animals (according to the frequency of occurrences) for their demonstration to visitors (*The frequency of animal occurrences according to the diaries of observations of inspectors is analyzed*).	August
I.3.4	Arrangement of bird boxes, remises and shelters: *Indicators:* 1. Arrangement (in pcs) of bird boxes (shelters) per year; 2. Arrangement (in ha) of remises per year. 3. Increase in the density of nestling birds, including rare species (*summer-autumn censuses are analyzed in relation to sites without shelter and remises*); 4. Stabilization of the number of rare species and improvement of their habitat conditions (and increase in the number of populations of their victims – for birds of prey) (*The diaries of observations of inspectors and the results of special summer-autumn and autumn censuses are analyzed*)	June
I.4	**Activities to identify the external borders and borders of functional zones in kind**	
I.4.1	Installation of banners *Indicators:* 1. Installation (in pcs) of new banners per year; 2. Total number of banners (pcs); 3. Number of banners per 1 km: borders, 10 km of trails and 100 km of roads.	June
I.4.2	Installation of information boards *Indicators:* 1. Installation (in pcs) of new information boards per year; 2. Total number of information boards (pcs); 3. Number of information boards per 1 km: (accessible sites) of the border, trails and roads. 4. Presence of information boards at each entry to the territory, in each place of residence (stop) of visitors.	June
I.4.3	Installation of information signs and signposts *Indicators:* 1. Installation (pcs) of information signs and (pcs) of signposts per year; 2. The total number of information signs and signposts in relation to the need for them (pcs/pcs).	June
Program II. Detection and suppression of violations of environment-oriented legislation		

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
II.1	**Ground patrolling in order to identify and suppress the duty violations**	
II.1.1	Pedestrian patrolling of the territory of Specially Protected Natural Territories. *Indicators:* *1.* Labor costs (per man*days) per year. 2. The route of patrolling (in km) per year. 3. Indicators of violation detection – (the number of violations detected per 10 man*d, per 10 km), 4. Dynamics of detection indicators. *The terms and periods of patrolling in relation to their effectiveness and the ratio of the period and the route to the types of violations and results* and identified threats to Specially Protected Natural Territories *are analyzed*	January-December
II.1.2	Patrolling of the Specially Protected Natural Territories on motor vehicles. *Indicators:* 1. Labor costs (per man*days) per year. 2. The route of patrolling (in km) per year. 3. Indicators of detection – the number of violations detected per 10 man*d, per 100 km. 4. Dynamics of detection indicators *The terms and periods of patrolling are analyzed in relation to their: a) effectiveness and b) costs for them, c) ratio of the periods of patrolling to the types of violations d) identified threats to Specially Protected Natural Territories*	January-December
II.2	**Patrolling of the water area of water bodies**	
II.2.1	Patrolling of the river, lake water areas within the borders of the Specially Protected Natural Territories, protection, buffer zones and wildlife sanctuaries *Indicators:* 1. Labor costs (per man*days) per year. 2. The route of patrolling (in km) per year. 3. Indicators of detection – the number of violations detected per 10 man*d, per 100 km. 4. Dynamics of detection indicators The terms and periods of patrolling are analyzed in relation to their: a) effectiveness and b) costs, c) ratio of the periods of patrolling to the types of violations, d) identified threats to Specially Protected Natural Territories A separate analysis for each of the specially protected sites: of threats-results	January-December
II.3	**Air patrolling**	
II.3.1	Flying around of the Specially Protected Natural Territories, protection and buffer zones in order to identify and suppress violations of the duty of Specially Protected Natural Territories on the sites unavailable to other transport *Indicators:* 1) Number of flight hours per year – (in f.h.). The terms and periods of air patrolling are analyzed in relation to their: identified threats to the Specially Protected Natural Territories and effectiveness in different periods of the year; and alternatives to air protection are also explored	January-December
II.4	**Technical support of the protection department**	
II.4.1	Technical equipment of the protection department *Indicators:* 1. Provision the protection staff with technical means (by types of technical means) total/ for 1 inspector/ for an operational group.	January-December
II.5	**Maintenance of protection and control stations (PCS) and cordons**	
II.5.1	Construction, repair, maintenance and keeping of PCSs and cordons. *Indicators:* 1. Providing the protection staff with stopping points and supporting points of the entry-exit stationary protection (a. Number of protection points in relation to the entry-exit points to/from the territory, b. Of them – all-the-year-round action). 2. Provision of the protection staff with intermediate stops during patrolling (Number of stops for 10-100 km of the route of patrolling).	January-December
II.6	**Training of inspectors**	
II.6.1	Training of inspectors *Indicators:* 1. Improving the quality of materials for violators (number of cases of recovery of damage from the total number of claims, the number of paid fines from the total number of resolutions). 2. Introduction of new types, forms, methods of protection with an analysis of their effectiveness. The quality of materials and % of recovered fines and claim amounts are analyzed	January-December

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
II.7	**Control over the activities of nature users**	
II.7.1	Functioning of the posts (points, sites) of constant control of industrial enterprises, linear structures and tenants; periodic sampling and assessment of contaminants. *Indicators:* 1. Number and frequency of sampling of regular samples. 2. Ratio of the number of control samples to regular samples. Continuity of the selection, number of the control samples and dynamics of changes in the samples (positive or negative) are assessed	January-December
The main argument for attracting investments in activities to control nature users, whose actions may threaten Specially Protected Natural Territories, is to estimate losses to biodiversity as a result of emissions and pollution; continuous monitoring allows to avoid it in the early stages of pollution development and to prevent critical consequences from possible accidents; **The main way to save costs for activities (and now the implementation of the activities) is** to attract donor funds.		
II.8	**Functioning of protection and control stations (PCS) and cordons**	
II.8.1	Providing constant control of entry and exit points to/from the Park territory. Ensuring the safety of visitors. *Indicators:* 1. Quantitative assessment of visitor flow control – (% of the total flow). 2. Reduction in the number of malicious violations – dynamics of the number of violations with damage and the average amount of damage per violation (in rubles). The periods of duty are analyzed in relation to: a) the effectiveness of violation detection b) the costs c) the coverage of the monitored visitors at the entry/exit (the total flow %)	January-December
II.9	Prevention of offenses and a positive image of the Natural Heritage Site of the Timber Complex Department	
II.9.1	Carrying out of preventive measures in mass media, on TV and radio, on the Internet. *Indicators:* 1. Publication of the results of raids and information about violations, rules of conduct of visitors and responsibility (number of publications, pcs/year). 2. Activity of feedback with visitors, volunteers, readers (number of returns of questionnaires, pcs). The audience coverage (thousand people, X period / actions, activities/ news) and activity feedback with visitors are estimated (% of returned questionnaires)	January-December
Program III. Implementation of work on environmental education		
III.1	**Museum and exhibition activity**	
III.1.1	Creation and maintenance of natural and cultural heritage museums. *Indicators:* 1. Creation of museums/ total number of operating museums and expositions. 2. Dynamics of the number of visitors. 3. Income (revenue) from museum activities (rubles). The audience coverage (thousand people) and the dynamics of expenses/incomes of this type of activity are estimated.	January-December
III.1.2	Creation of information center for visitors. *Indicators:* 1. Creation of a center, 2. Number of visitors (person/year)	January-June
III.1.3	Maintenance and functioning of information centers for visitors, including virtual ones *Indicators:* 1. Costs for the operation of centers. 2. Number of visitors used the services of centers. 3. Quantity and names of goods (and services) sold through the centers (by types of goods: vouchers, souvenirs, guidebooks, maps, etc., services, including virtual centers and virtual excursions). 4. Income (revenue) from the activities of centers. 5. Feedback: the number of completed questionnaires (examination papers), messages on the Internet resources of centers. The audience coverage (thousand people – for all types of information) and the dynamics of expenses/incomes of this set of activities are estimated.	January-December
III.1.4	Renewal of the expositions of museums and information centers *Indicators:* 1. The number of storage units of all / new / renewal storage units in relation to their total number, the number of new expositions in relation to the total number.	January-December
III.1.5	Holding specialized exhibitions *Indicators:*	January-December

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
	1. Number of exhibitions held: in information centers/museums of each Specially Protected Natural Territory / Number of visitors. 2. Participation of expositions of the Specially Protected Natural Territories in travelling exhibitions/ Number of visitors to exposition of each Specially Protected Natural Territory. The audience coverage (thousand people) and the dynamics of expenses/incomes (from the sale of products of the Specially Protected Natural Territories at exhibitions) are estimated.	
III.2	**Work with the mass media**	
III.2.1	Publications of popular scientific and propaganda articles in printed publications *Indicators:* 1. Number of publications in pcs and their volume, in p. (by types – with the purpose: popularization of knowledge about nature (educational), formation of correct conduct on nature (environment-oriented), promotion of services of the Specially Protected Natural Territories (marketing). *The audience coverage is estimated (thousand people).*	January-December
III.2.2	Television and radio appearances of the employees of the Specially Protected Natural Territories *Indicators:* 1. The number of TV appearances. 2. The number of radio appearances and interviews. The audience coverage is estimated (thousand people).	January-December
III.2.3	Issue (participation in the issue) of periodical printed publications *Indicators:* 1. The number of issues of periodical printed publications. 2. Circulation of each edition. 3. The volume of each publication (printed sheets/ pages)	January-December
III.2.4	Maintenance of a Web site and promotion of services of the Specially Protected Natural Territories on the Internet *Indicators:* 1. Labor costs (man/day). Feedback activity can be assessed (number of comments, questions, requests /subject to ordering services via electronic means of communication). Each Specially Protected Natural Territory and each resource are analyzed.	January-December
III.3	**Advertising and publishing activities**	
III.3.1	Issue of brochures and booklets; posters, calendars, souvenirs, sets of postcards; other promotional products, including guidebooks and maps, virtual excursions (electronic excursions/applications, video excursions, tracks with descriptions), video films. *Indicators:* 1. The number of printed publications and their circulation. 2. The number of other publications and their circulation (by types). 3. Income of the Specially Protected Natural Territories from the sale of printed (and other – by types) products (rubles). The audience coverage (thousand people), the turnover rate of the product and the revenue are estimated (revenue – (minus) – the expenses for production and distribution).	January-December
The main argument for attracting investments in the publication of brochures and other products of the Specially Protected Natural Territories is the moral education of children, the dissemination of information on the Specially Protected Natural Territories and their duties, the formation of correct conduct of visitor, and marketing. **The main way to increase the volume of products and its variety is** to attract donor funds.		
III.4	Work with schoolchildren	
III.4.1	Conducting children's ecological camps and expeditions; Organization and activities of school clubs and forestries; Conducting school excursions *Indicators:* 1. The number of children's camps/ participated, persons. 2. The number of children's expeditions/ participated, persons. 3. The number of clubs/ constantly participating, persons/ total visited, person per year. 4. The number of recreational activities/ participated, persons. The audience coverage (thousand people) and the dynamics of expenses (incomes if any) of this type of activity are estimated.	January-December
The main argument for attracting investments in children's camps and other educational activities is the moral education of children, the formation of the right conduct in nature in the new generation, the training of skills, the organization of summer recreation for children in conjunction with training, the vocational guidance. **The main way to increase the number of activities** is to attract donor funds – "investing in an environmentally friendly future".		
III.5	**Carrying out of actions, timed to ecological holidays and actions**	

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
III.5.1	Organizing and conducting mass ecological and educational activities (Day of the Ecologist; Day of the Forest Worker; Day of Birds; "March of Parks" and others) *Indicators:* 1. The number of activities. 2. The number of participants. The audience coverage (thousand people) and the dynamics of expenses of this type of activity are estimated, 3. The number of publications about the activities.	January-December
III.6	**Training of employees and guides**	
III.6.1	Conducting seminars for guides, training employees on the basis of ecological routes *Indicators:* 1. The number of seminars/ the number of participants passed training *and received a certificate*. 2. Ratio of the number of trained to the number of working guides (accompanying tourists). 3. The number of positive reviews of visitors from the total number of visitors received a guide service (simplified examination papers are required). Dynamics of expenses of the Specially Protected Natural Territories and revenues of the Specially Protected Natural Territories, saving of costs of the Specially Protected Natural Territories/ if any / from the sale of the product "without services of the Specially Protected Natural Territories" to tourists, that is, with the support of external guides, are analyzed.	May
The main argument for accompanying all tourists by guides is the formation of the correct conduct of tourists in nature, the safety of tourists, the exclusion of cases of poaching; training skills, increasing the income of the local population and growing interest of the tourists to products of the Specially Protected Natural Territories. **The main way to train more guides is** to attract donor funds.		
III.7	**Arrangement and description of ecological routes**	
III.7.1	Description of ecological routes, correction of descriptions, arrangement of routes, their registration on the ground, organization of viewing platforms, signposts *and* ***visual agitation, handout materials***. *Indicators:* 1. The number of routes/ their length in km. 2. Presence of viewing platforms, signposts and recreation areas on the existing ecological routes/ total/ on the average/ per 10 km /% of the need for them. The number of visitors to each route and the dynamics of the revenues of the Specially Protected Natural Territories and the environment from the excursion activities for each route are analyzed.	May-July
III.8	**Participation in cognitive (ecological) tourism programs**	
III.8.1	Participation in republican / municipal / federal / donor cognitive (ecological) tourism programs *Indicators:* 1. Presence of applications – **finished** descriptions of programs (projects) – pcs, for the amount, thousand rubles. 2. Participation in competitions (municipal, regional, all-union, donor competitions) for the development of tourism – once. 3. Attracting foreign investment in programs, pieces/thousand rubles. 4. Implementation of programs (projects) – achievement of the planned results (an individual assessment of the effectiveness of each project is given).	January-December
III.9	**Interaction with educational institutions**	
III.9.1	Conducting lessons and competitions of ecological subjects, assistance to educational institutions in preparation of the materials for environmental education, creation of special courses (training programs) about the Specially Protected Natural Territories. *Indicators:* 1. The number of lessons (competitions) conducted. 2. The number of environmental education materials (courses) sent to the educational institutions. *The audience coverage and activity costs are analyzed*	January-December
The main argument for attracting investments in educational activities is the moral education of children, the formation of ideas about the native nature in a new generation, the popularization of research results, the vocational guidance. **The main way of carrying out the activities** is to attract funds from the Ministry of Education, the relevant ministry and donors – "investing in an environmentally friendly future".		
III.10	**Volunteer programs**	
III.10.1	Carrying out actions on clearing the natural sites from garbage, arrangement of places for the mass recreation *Indicators:* 1. The number of public actions on clearing the areas of mass recreation of citizens from	May-August

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
	garbage. 2. The number of notes covering the actions in print media. *The audience coverage, the publicity of the action, the costs of activity and the natural indicators of the work results (number of facilities, such as volume, weight of garbage removed, etc.)*	
III.11	**Development of the material and technical base of the Department of Ecological Tourism and Recreation and Organization of Tourism Activities and Environmental Education**	
III.11.1	Acquisition of office equipment and software products *Indicators:* 1. Provision of environmental education departments with office equipment, software products (number of items) in relation to the need for them. 2. Creation of virtual guidebooks (applications, tracks). The capital-labor ratio (rubles/employee of the department of each Specially Protected Natural Territory) is estimated	January-December
Program IV. Implementation of research works aimed at developing and implementing scientific methods for conserving biological diversity and maintaining natural complexes and sites in a natural state, and performance of works in the field of environmental monitoring and environmental expertise		
IV.1	**Research in the field of conservation of biological diversity, environmental monitoring**	
IV.1.1	Development of scientific topics; Field works; Inventory of the components of natural complexes; landscape, vegetation and other mapping; measurement of environmental parameters, maintenance of long-term series of observations, etc. *Indicators:* 1. The number of scientific topics (list). 2. Field works – labor costs, man*d. 3. Inventory – the number of groups of natural sites. 4. Census works – labor costs. 5. The number of developments (including activities to conserve the natural sites and species). 6. The number of parameters, units. 7. The number of measurements (records) per year/ per each parameter, units	January-December
IV.2	**Preparation and publication of printed works**	
IV.2.1	Preparation and publication of monographs and thematic collections; scientific articles in foreign and all-Russian journals; in regional journals; scientific articles and theses in thematic collections *Indicators:* 1. The number of publications by types (list). 2. Circulation in the copy of each type. 3. Participation in conferences and seminars (number of days, number of participants).	January-December
IV.3	**Development of recommendations for the conservation of natural complexes and rational use of natural resources; and environmental expertise**	
IV.3.1	Development of recommendations on improving the protection of the territory and preserving its natural complexes; on the protection of rare plant and animal species; other recommendations *Indicators:* 1. The number of approved (published) recommendations. 2. The number of implemented activities (list).	January-December
Program V. Performance of works on preservation and restoration of natural and historical and cultural complexes and sites		
V.1	**Restoration of disturbed natural and historical and cultural complexes and sites**	
V.1.1	Carrying out conservation, restoration and repair works at the sites of historical and cultural heritage, restoration and maintenance of cultural and landscape complexes in the traditional state 1. Restoration of sites and complexes (list). 2. Total labor costs, man*days Analyzed: a) costs of restoration and b) fixed costs per year for each site. Income of the Specially Protected Natural Territories from each site and Number of visitors to each site.	January-December
V.2	**Mapping and certification of natural sites and sites of historical and cultural heritage**	
V.2.1	Identification, mapping and certification of the sites of historical and cultural heritage *Indicators:* 1. The number of certified sites per year. 2. The number of certified sites, total in relation to the available (identified).	January-December
V.3	**Development of recommendations for the conservation of natural sites and sites of historical and cultural heritage**	
V.3.1	Development of recommendations for the conservation of natural, historical and cultural	January-

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
	monuments *Indicator:* 1. The number of recommendations (approved, published), the list	December
V.4	**Restoration of the disturbed sites of Specially Protected Natural Territories**	
V.4.1	Reclamation of disturbed areas (sites) of the Specially Protected Natural Territories *Indicators:* 1. The area in need of reclamation, 2. The area of sites reconstructed over the year (by means of reclamation). 3. The ratio of the reconstructed sites, total, ha, in relation to the areas in need of reclamation. The activity costs are estimated at: 1 hectare, for 1 man/day for forestries (branches) and types of disturbed sites.	January-December
Program VI. Implementation of activities in the field of organization and development of regulated tourism, recreation and excursion services for visitors		
VI.1	**Creation and arrangement of ecological trails and tourist routes**	
VI.1.1	Creation and arrangement of (excursion) ecological trails *Indicators:* 1. The number of well-maintained trails in the current year: total pieces/ total km/ objects of improvement, total pieces. 2. The number of tourist products – total. 3. Number of visitors per year on each trail *The cost of arrangement and fixed costs per trail per year, as well as the income of Specially Protected Natural Territories from each object are analyzed.*	January-December
VI.1.2	Development, improvement and certification of tourist routes *Indicators:* 1. The number of routes developed per year, pieces/km. 2. The number of certified routes per year, pieces/km. 3. The number of visitors per year on each route, dynamics of visits to routes	January-December
VI.1.3	Creation and arrangement of viewing platforms, scenery spots *Indicators:* 1. The number of landscaped areas per year. 2. Total landscaped areas on the excursion routes, pieces/pieces per km of the route Costs for arrangement and maintenance of the sites are analyzed	May-September
VI.2	**Recreational arrangement of Specially Protected Natural Territories**	
VI.2.1	Equipment, repair and maintenance of recreation areas (picnic places) *Indicators:* 1. The number of recreation areas put into operation in the current year. 2. The number of repaired recreation areas per year/costs, thousand rubles. 3. Assessment of the load on recreation areas (=thousand man*days per year/number of recreation areas/load per each) The cost of arrangement and annual maintenance of each site are analyzed	May-September
VI.2.2	Equipment, repair, development and maintenance of places for tent camping *Indicators:* 1. The number of equipped tent camping places per year/total. 2. Assessment of the load on tent camping places (= thousand man*days per year/number of camping places). 3. The number of identified places of unauthorized camping places in total. The costs of arrangement and maintenance of each site and the attendance of each tent camping place for the construction of a comfortable infrastructure in these places are analyzed.	May-September
VI.2.3	Organization of car parks (guarded parking lots) *Indicators:* 1. The number of equipped protected camping places per year / total / capacity of camping: equipped per year / total. 2. The number of visitors used camping places, per year The cost of arrangement and maintenance of each site and the income of Specially Protected Natural Territories from each site are analyzed, as well as an increase in the flow of car tourists.	May-September
VI.2.4	Maintenance of guest houses and stopping points *Indicators:* 1. The number of exploited guest houses (stopping points): total / number of beds / maintenance costs, thousand rubles. 2. Repair of guest houses (stopping points): total / costs, thousand rubles. 3. Assessment of annual load of guest houses (stopping points): thousand man*days per year. 4. The income for each stopping point per year (thousand rubles) The costs of arrangement and annual maintenance of each site and the income of Specially Protected Natural Territories from each site are analyzed	January, May-September

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
VI.3	**Organization of cognitive tourism**	
VI.3.1	Conducting excursions for visitors *Indicators:* 1. The number of excursions per year. 2. The number of excursionists per year. 3. Income from the conducted excursions – thousand rubles/per year. The costs and income of the Specially Protected Natural Territories from this type of activity of each and every site are analyzed	January-December
VI.3.2	Preparation and publication of information materials for visitors: map charts, descriptions of routes, etc. *Indicators:* 1. The number of published materials for visitors, by types: circulation, copy/ of them sold, including free of charge, pieces. 2. Income, thousand rubles / year The costs and income of the Specially Protected Natural Territories (by product types) are analyzed.	January-December
VI.3.3	Participation in tourist exhibitions and fairs *Indicators:* 1. The number of exhibitions (fairs) in which the staff took part / participation costs, thousand rubles/ assessment of the number of fair visitors, thousand people. 2. The number of goods and products of the Specially Protected Natural Territories sold at fairs (exhibitions) total by types, pieces / income, thousand rubles. The costs (for each activity and type of products) and the income of the Specially Protected Natural Territories (by product types), the number of those *who bought a voucher* for these events are analyzed.	January-December
VI.4	**Waste handling**	
VI.4.1	Garbage collection from previous periods; installation of garbage collectors, removal and disposal of garbage; installation of toilets, pollution prevention *Indicators:* 1. The amount of garbage removed and disposed, tons / costs of removal and disposal, thousand rubles. 2. The number of installed and equipped sanitation facilities (water intakes, toilets, septic tanks, garbage collectors, etc.) per year / total availability of facilities by types, total, pieces. 3. The number of identified unauthorized places: disposal dumps, accumulation of garbage, other wastes, pieces per year/ tons of waste in unauthorized places per year. The costs (for each activity) are analyzed.	May-September
VI.5	**Support of traditional nature management by local population and their initiatives and testing of sustainable nature management.**	
VI.5.1	Collection, systematization and popularization of traditional nature management – as the basis of *centuries-old* ecosystem resilience. Collection of the best inexhaustible practices of nature management. Approbation of means, methods and organized areas of sustainable nature management – "model territories" *Indicators:* 1. The number of articles in the media and online publications about traditional nature management/ about best practices in sustainable nature management. 2. The number of monuments of traditional nature management in the museums of the Specially Protected Natural Territories: storage units per year/ total. 3. Assessment of demand for tourism on the basis of traditional nature management/including ethno-tourism, hunting, fishing, rural tourism, etc./ - total number of respondents, persons.	January-December
The main argument for attracting investments in traditional nature management (testing sustainable nature management) is the preservation of national cultures that live in traditional nature management. **The main way of carrying out the activities** is to attract funds from the relevant ministry and donors – "investing in nature and cilture".		
Program VII. "Administration and financial and economic activities"		
VII.1	**Financial and economic activity**	
VII.1.1	Administration, maintenance, operation and repair of fixed assets; attraction of budget and donor funds *Indicators:* 1. Performance indicators, 2. Expenses by types of work. 3. Attracted investments (donations), number of projects in relation to applications submitted/ thousand rubles.	January-December
VII.2	**Cost saving**	

Task No.	Name of the activity and index (indicator) of performance and analysis of the results	Implement ation term
VII.2.1	Introduction of energy-saving equipment and technologies *Indicators:* 1. Introduction of energy-saving technologies: decrease in costs in thousand rubles/year by types: solar energy, traditional transport and others. 2. Decrease in costs, total, thousand rubles/year. The costs (for each activity and type of equipment) and decrease in costs of the Specially Protected Natural Territories (by types of activity and equipment) are analyzed.	January-December
VII.3	**Construction of infrastructure**	
VII.3.1	Construction of objects of tourist, service and administrative infrastructure *Indicators:* 1. Infrastructure development in natural indicators, the list – number by types per year/ area in sq.m. per year/total. 2. Growth in the flow of own funds in thousand rubles including in the dynamics (in relation to the previous periods). The costs, incl. permanent (for each site) and the income of the Specially Protected Natural Territories (from each site, excluding the administrative infrastructure) are analyzed.	January-December

A comprehensive monitoring program is used to assess the state of the natural environment and populations (Table 33).

Table 33

Comprehensive monitoring program.

Observation object	Measured indicator	Method of measurement (census, observation)	Terms, interval and frequency of measurements (censuses, observations)	Quantity (volume) of measurements (samples) per year.	Number of indicators (measurement data)
Winter number of large mammals	Number of individuals	Census in places of winter concentration, aerial census, winter route census	January-March, April	Double passage on 80-100 routes, 650 km in total and aerial censuses	Number (indicator of census) of 4 species of large mammals.
Winter number of mammals and birds	Census indicator*10 km of route, visual occurrences of game birds for 10 km of route	Winter route census	November-March	Winter route census: Double passage on 80-100 routes, 650 km in total -other methods	Census indicator for 8 dominant species of mammals and 4 species of wintering birds
Autumn number of birds	Number of individuals, number of broods	Autumn census	September	Double and (or) single passage of the route, 650 km in total	Number of species, broods, indicator of reproduction of populations
State of water, incl. snow cover	Contaminant content in water samples	Sampling from constant monitoring posts, control measurements.	January-December or during periods of greatest load and threats	12 and more samples per year per an industrial enterprise, at least 3 samples per year per route	Concentration (%, mg/l, etc.) of contaminants in water samples and others
Pollution and disturbance of soil conditions	Area, hectares	Fixation (photo, contour, map-chart) of disturbed sites	Snowless period	All identified sites, including reclaimed ones	Area of contaminated and disturbed sites, state of renewal of cover and vegetation

A periodical on-site survey of each site visited and an assessment of indicators given in Table 34 were proposed to assess the integrity of landscapes and geological sites. The indicators are

intended for analyzing the dynamics of the state of each geological object, making the managerial decisions and calculating the costs of construction, reclamation and other activities. The assessment proposed for water bodies is given in Table 35.

Table 34

An assessment card for the state of visited geological objects.

	Assessment of the object state and analysis Date: ……..20…	Unit of Measurement	Indicator
Name of geological object ...	Traces of visits	ha	
	Erosion of slopes	ha	
	Erosion of slopes	sq.m.	
	Littering of the territory	ha	
	Littering of the territory	t	
	Unauthorized trails	lin m	
	Damaged vegetation	ha	
	Damaged vegetation	pcs	
	Adventitious plant species	number	
	Adventitious plant species	ha	
	Spontaneous camping places	pcs	
	Spontaneous camping places	sq.m.	
	Erosion of coastline	m	
	Erosion of coastline	sq.m.	
	Erosion of access roads	sq.m.	
	Erosion of access roads	km	
	Damage to the object	sq.m.	
	Damage to the object	ha	
	Places of solid waste storage, available, volume	cu.m.	
	Places of solid waste storage, required, volume	cu.m.	
	Garbage is removed	t	
	Garbage removal is required	t	
	On-site garbage destruction, is carried out	t	
	Reclamation of disturbed sites, is carried out	sq.m.	
	Reclamation of disturbed sites, is required	sq.m.	
Conclusion: research **is required** / continuous monitoring is required / access restriction is required – load reduction / object closure is required (underline as appropriate).			

Table 35

An assessment card for the state of visited water objects

	Assessment of the water object state and analysis Date: ……..20…	Unit of Measurement	Indicator
Name of water object ...	Traces of visits	ha	
	Traces of industrial impact	ha	
	Erosion of banks	ha	
	Erosion of banks	sq.m.	
	Littering of the territory	ha	
	Littering of the territory	t	
	Unauthorized trails	lin m	
	Damaged vegetation	ha	
	Damaged vegetation	pcs	
	Spontaneous camping places	pcs	
	Spontaneous camping places	sq.m.	
	Erosion of access roads	sq.m.	
	Erosion of access roads	km	
	Places of solid waste storage, available, volume	cu.m.	
	Places of solid waste storage, required, volume	cu.m.	
	Garbage is removed	t	
	Garbage removal is required	t	

	Assessment of the water object state and analysis Date: ……..20…	Unit of Measurement	Indicator
	On-site garbage destruction, is carried out	t	
	Reclamation of disturbed sites, is carried out	sq.m.	
	Reclamation of disturbed sites, is required	sq.m.	
Conclusion: research **is required** / continuous monitoring is required / access restriction is required – load reduction / object closure is required (underline as appropriate).			

The same form of the card as for the geological objects indicating the number of the specific point on the trail can be applied to assess the tourist trails. The card is illustrated with a photograph of the disturbed site from a constant point of shooting.

The same card is filled for each kilometer of the trail to assess the trails in the intervals between stops.

VIII. OPERATIONAL PLAN FOR THE FIRST YEAR IMPLEMENTATION

Operational plan for the implementation of the first year includes an assessment of the needs for program implementation (Table 36) and an assessment of the financing gap (Table 37).

Table 36

Operational plan for the implementation, 2018

Management task	Activities	Scope of work	Implementation time		Cost, thousand rubles.
			beginning	end	
Program I. Implementation of measures for the conservation of natural complexes in natural state, including:					**13691**
1. Fire protection measures	1.1. Maintenance, renovation and repair of fire lines	46 km	06/2018	07/2018	707
	1.2. Installation and maintenance of fire-fighting stands	20 stands /1000 copies of leaflets	06/2018	06/2018	455
	1.3. Air patrolling of the territory	110 and more flying hours	07/2018	08/2018	3231
	1.4. Maintenance, acquisition of fire-chemical stations	100% of inventory	04/2018	08/2018	0
	1.5. Extinguishing forest fires		07/2018	08/2018	Subventions
	1.6. Education, training of personnel to extinguish forest fires		04/2018	06/2018	166
	1.7. Clearing of clearings and roads for fire prevention	80 km	06/2018	07/2018	532
2. Forest protection and conservation activities	2.1. Selective sanitary felling: area / volume	300 m³	04/2018	06/2018	1126
	2.2. Cleaning the forest from littering: area / volume	230 m³	06/2018	06/2018	1507
	2.3. Current forest pathology research	20,000 ha	06/2018	10/2018	3294
	2.4. Forest management and land management	Registration of property rights	01/2018	12/2018	0
3. Biotechnical activities	3.1. Winter route census	1,300 km	01/2018	03/2018	400
	3.2. Autumn censuses	1,200 km per year	08/2018	10/2018	266
	3.3. Arrangement of salt gardens and self-feeding stations, feeding waters	70 and more pcs and 1.4 tons of feeding	08/2018	08/2018	275
	3.4. Arrangement of bird boxes, remises and shelters	60 and more pcs and 1 ha	06/2018	06/2018	260
4. Activities for the detections of borders	4.1. Installation of banners	96 banners	06/2018	06/2018	1218
	4.2. Installation of information boards	6 and more boards	06/2018	06/2018	103
	4.3. Installation of information signs and signposts	3 signs, 12 signposts	06/2018	06/2018	151
Program II. "Detection and suppression of violations of environment-oriented legislation", incl.:					**32302**
1. Ground patrolling	1.1. Pedestrian patrolling	9,300 km	01/2018	12/2018	3839
	1.2. Patrolling on motor transport	45,000 km	01/2018	12/2018	9747
2. Water areas	2.1. Patrolling of the river, lake water areas	12,500 man/d + 20,000 km	01/2018	12/2018	8659
3. Air patrolling	3.1. Flying around the Site territory	30 and more flying hours	01/2018	12/2018	905
4. Technical support	4.1. Technical equipment of the protection department, maintenance and repair	100%	01/2018	12/2018	1500
5.	5.1. Construction, repair, maintenance and	+5% of the need	01/2018	12/2018	5037

Management task	Activities	Scope of work	Implementation time		Cost, thousand rubles.
			beginning	end	
Maintenance of PCSs	keeping of PCSs and cordons	per year			
6. Training	6.1. Training of inspectors	On a permanent basis	01/2018	12/2018	248
7. Control	7.1. Constant control of nature users	On a permanent basis	01/2018	12/2018	670
8. Cordons	8.1. Constant control and safety of visitors.	On a permanent basis	01/2018	12/2018	1597
9. Prevention	9.1. Carrying out of preventive activities in mass media	On a permanent basis	01/2018	12/2018	100
"Implementation of work on environmental education", including:					**8310**
1. Museum and exhibition activity	1.1. Creation and maintenance of museums		01/2018	12/2018	1900
	1.2. Creation of information center for visitors		01/2018	12/2018	403
	1.3. Maintenance of information centers for visitors	5 centers	01/2018	12/2018	405
	1.4. Renewal of the expositions of museums and information centers		01/2018	12/2018	540
	1.5. Holding specialized exhibitions	Holding 24 exhibitions	01/2018	12/2018	629
2. Work with the mass media	2.1. Publications of popular scientific and propaganda articles	Publication of 52 articles per year	01/2018	12/2018	829
	2.2. Television and radio appearances of the employees of Park	TV – 7 and radio – 5 interviews	01/2018	12/2018	47
	2.3. Issue (participation in the issue) of periodical printed publications	Total circulation is 3-20 thousand copies	01/2018	12/2018	385
	2.6. Maintenance of a Web site on the Internet		01/2018	12/2018	0
3. Advertising	3.1. Issue of brochures and booklets of other promotional products	8-10 thousand copies	01/2018	12/2018	1843
4. Schoolchildren	4.1. Holding children's ecological camps and expeditions		01/2018	12/2018	1031
5. Environmental education	5.1. Day of the Ecologist; Day of the Forest Worker; Day of Birds; "March of Parks"	up to 3.5 thousand participants	01/2018	12/2018	1272
6. Training of guides	6.1. Conducting seminars for guides and tour guides	Organization of 1 seminar for 20 guides	05/2018	05/2018	160
7. Arrangement of ecological routes	7.1. Description of ecological routes and their arrangement	1 route per year	05/2018	08/2018	333
8. Participation in contests	8.1. Participation in donor cognitive tourism programs		01/2018	12/2018	200
9. Interaction	9.1. Conducting lessons and competitions of ecological subjects	School course on the Specially Protected Natural Territories	01/2018	12/2018	200
10. Volunteering	10.1. Carrying out actions on clearing natural objects from garbage	Public actions	05/2018	08/2018	200
11. Development of material and technical	11.1. To create virtual guidebooks		01/2018	12/2018	133

Management task	Activities	Scope of work	Implementation time		Cost, thousand rubles.
			beginning	end	
base					
Program IV. "Implementation of research works aimed at developing and implementing scientific methods for conserving biological diversity and maintaining natural complexes and sites in a natural state", including:					**10646**
1. Research	1.1. Development of scientific topics, inventory	scientific 12 topics	01/2018	12/2018	10075
2. Publications	2.1. Preparation and issue of monographs and subject collections		01/2018	12/2018	344
3. Monitoring	3.1. Monitoring, environmental expertise and recommendations		01/2018	12/2018	227
Program V. "Performance of works on preservation and restoration of natural and historical and cultural complexes and sites", including:					**3331**
1. Restoration	1.1. Restoration of historical and cultural heritage	Restoration of 5-10% of heritage	01/2018	12/2018	834
2. Certification	2.1. Certification of historical and cultural heritage sites		01/2018	12/2018	247
3. Recommendations	3.1. Development of recommendations for the conservation of monuments	Assessment of costs of activities	01/2018	12/2018	250
Restoration	Reclamation of disturbed sites of the Specially Protected Natural Territories	5% of the need	01/2018	12/2018	2000
Program VI. "Implementation of activities in the field of organization and development of regulated tourism and recreation and environmental education activities", including:					**9443**
1. Ecological trials	1.1. Creation and arrangement of ecological excursion trails	8 km	01/2018	12/2018	392
	1.2. Certification of tourist routes		01/2018	05/2018	765
	1.3. Creation and arrangement of viewing platforms	5-7	05/2018	07/2018	249
2. Recreational arrangement of Specially Protected Natural Territories	2.1. Equipment, repair and maintenance of recreation areas	20-30 recreation areas	05/2018	09/2018	500
	2.2. Equipment of places for tent camping	10 places for tent camping	05/2018	09/2018	250
	2.3. Organization and operation of car parks	1 parking lot for 10-12 cars	05/2018	09/2018	67
	2.4. Maintenance of guest houses and stopping points	Maintenance of 64-67 houses	05/2018	09/2018	2810
3. Organization of cognitive tourism	3.1. Conducting excursions for visitors	3-4 thousand visitors	01/2018	12/2018	2198
	3.2. Preparation and publication of information materials	200-500 and more copies	01/2018	12/2018	163
	3.3. Participation in tourist exhibitions and fairs	1 exhibition	01/2018	12/2018	150
4. Wastes in the Specially Protected Natural Territories	4.1. Garbage collection, installation of garbage collectors, solid waste landfills, removal		05/2018	09/2018	1500
5. Support of local population	5.1. Support of traditional nature management	Preservation of culture	01/2018	12/2018	399
Program VII. "Administration and financial and economic activities", including:					**25711**
1. Administration	1.1. Administration, maintenance of fixed assets	Effective management	01/2018	12/2018	10890
2. Cost saving	2.1. Introduction of energy-saving equipment and technologies		01/2018	12/2018	1000

Management task	Activities	Scope of work	Implementation time		Cost, thousand rubles.
			beginning	end	
3. Infrastructure	3.1. Construction of capital infrastructure facilities		01/2018	12/2018	13821
Implementation of programs of Specially Protected Natural Territories included in the facility, in total:					**103434**

Table 37

Deficit in financing the first year activities (2018).

Task	The year preceding the planning, thousand rubles	The need for basic financing[46] in 2018, thousand rubles.	Deficit of the base scenario in 2018, thousand rubles	Assessment of the needs of the optimal scenario[47] in 2018, thousand rubles.
Activities for the conservation of natural complexes in natural state	8176	13691	5515	20000
Detection and suppression of violations of environment-oriented legislation	23159.9	32302	9142.1	35000
Implementation of work on environmental education	8074	8310	236	10000
Implementation of research works	9158.8	10646	1487.2	15000
Conservation and restoration of natural and historical and cultural complexes	0	3331	3331	5000
Organization and development of regulated tourism and recreation	18809	19443	634	67100
Administration, financial and economic activities (and technical support)	30762.5	35711	4948.5	40000
In total for the programs of the Timber Complex Department Site, incl.:	98140.3	123434	25293.7	192100

Deficit in financing the activities is defined by a technique of business planning of the Specially Protected Natural Territories [48]. Priority programs of the base scenario of the financing of the Specially Protected Natural Territories were taken into account.

A price increase index and projected indicators of official resources were used for the assessment of the needs[49]. The development of the buffer zone of the Reserve, without creating its own staff of the buffer zone and its governing body, participates in the assessment of the needs of

[46] *The basic (minimum) level of financing the Specially Protected Natural Territories* takes into account the costs necessary to manage the main programs for conservation of the Specially Protected Natural Territories to support the functions of its ecosystems and to stop their degradation.

[47] *The optimal level of financing the programs of the Specially Protected Natural Territories* guarantees an adequate level of financing for all programs of the Specially Protected Natural Territories that ensures optimal ecosystem functioning: ecosystems do not degrade or their condition improves.

[48] Business planning of the Specially Protected Natural Territories, 2014

[49] http://komi.gks.ru/

the optimal scenario and in its implementation; the costs of developing the buffer zone were not taken into account in calculating the base scenario.

Figure 6 graphically shows the financing gap for each of the scenarios for the Site development.

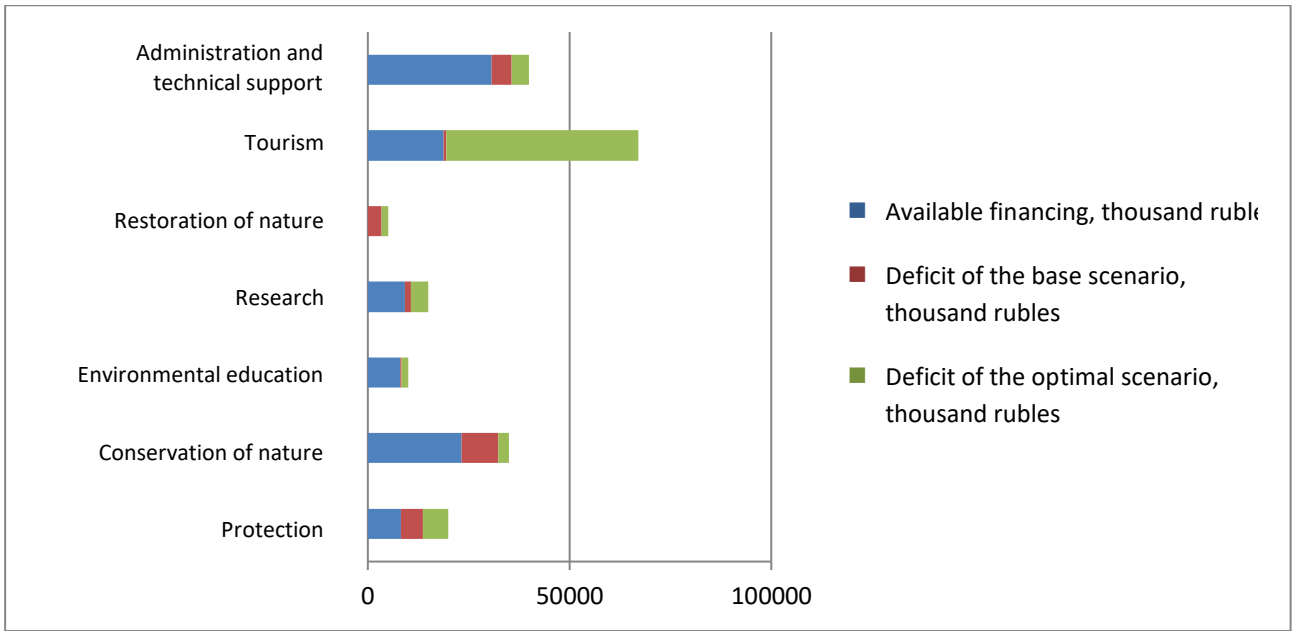

Figure 6. Assessment of the financing gap for the implementation of the Site programs in 2018[50].

[50] The base scenario programs are given in Appendix 4, the prospective programs of the optimal scenario for the Site development are justified in Appendix 5

APPENDIX 1

Territorial administration and boundaries description

The site is located in the Komi Republic, in the municipalities: Inta Urban District Municipality, Pechora Municipal District Municipality, Vuktyl Municipal District Municipality, Troitsko-Pechorsky Municipal District Municipality[1].

The site is located on the territory limited by coordinates: 61° - 66° north latitude, 56° - 62° east longtitude.
Coordinates of the site center - 63° 37' 33" north latitude 58° 57' 09" east longtitude (WGS84).

Table 1. Coordinates of end points and centers of the site clusters

Territory	Boundary				Center
	Northern	Southern	Eastern	Western	
Yugyd Va National Park	65°43'39.48" north latitude 60°33'0.89" east longtitude	63°10'53.58" north latitude 59°12'31.27" east longtitude	65°15'10.82" north latitude 61°20'52.89" east longtitude	64°11'37.21" north latitude, 57°28'17.59" east longtitude	
Pechora-Ilych State Reserve with a buffer zone					58°58'12" east longtitude 62°21'26" north latitude

Description of boundaries

The site includes Yugyd Va National Park with a protection zone, "Pechora-Ilych State Nature Biosphere Reserve" Federal State Budgetary Institution with a buffer zone.
The territory of Yugyd Va National Park includes the following forest compartments and natural boundaries:
a) the first land plot – No. 1ч, 2, 3, 4ч, 5ч, 6ч, 7-15 of Kozhimskoe district forestry; No. 1-5, 6ч, 7ч, 8, 9, 10ч, 11ч, 12-16 of Verkhnekozhimskoe district forestry, No. 1ч, 2-8 of Kosyunskoe district forestry, No. 1-131 of Syninskoe district forestry, No. 1-98 of Aranetskoe district forestry, No. 1-176, 177ч, 178-186, 187ч, 188-199, 201ч, 202ч, 203ч, 204ч, 205, 206 of Patokskoe district forestry, No. 1-169 of Nizhneshchugorskoe district forestry, No. 1ч, 2ч, 3ч, 4ч, 5-16, 17ч, 18ч, 19ч, 20ч, 21-31, 32ч, 33ч, 34ч, 35-112 of Podcherskoe district forestry, No. 1-53, 54 (northern part), 55, 56 of Verkhneshchugorskoe district forestry of the national park; No. 257-260, 300-303 of Ust-Voyskoe district forestry, No. 75-81, 147-154, 192-202, 247-258, 275-287, 299-311, 319-333, 338-350 of Shchugorskoe district forestry, No. 94-96, 149-160, 183-192, 213-221, 238, 246-251, 263-265, 272-276, 287-291, 311-316, 339-345, 358-361 of Podcherskoe district forestry of Vuktylskoe forestry; No. 6-13, 27, 28 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry.
b) the second land plot – No. 54 (southern part of the national boundary), 57, 58 of Verkhneshchugorskoe district forestry of the national park and compartments 52, 66, 79, 617-622 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry.
Protection zone of Yugyd Va National Park: No. 142ч, 144ч, 145ч, 146ч, 147ч, 148ч, 154ч, 164ч, 165ч, 166ч of Inta branch of Pechorskoe forestry; No. 4ч of Kozhimskoe district forestry of the national park; No. 1ч of Kosyunskoe district forestry of the national park; No. 182, 196, 197, 210, 211, 226, 227, 242, 243, 258, 259, 485ч, 486ч, 489ч, 491ч, 492, 493, 499ч, 500, 506, 507, 512, 516, 517, 521, 524, 525, 529, 530, 534-536, 541ч, 542, 543, 553, 554, 567, 597 of Syninskoe district forestry, No. 17-20, 38-40, 59-62, 88-90, 116-118, 143-146, 174, 175, 203, 204, 233, 234, 270, 271, 309, 310, 341-344 of Konetsborskoe

[1] Sketch maps of clusters of the site and their location are given in the administration plan, figures 1-3

district forestry of Pechorskoe district forestry; No. 65-67, 100, 101, 129, 130, 167, 168, 206-208, 250, 251, 293, 294 of Ust-Voyskoe district forestry, No. 60-70, 103, 133, 176, 184-191, 234, 236-240, 245, 246, 273, 274, 297, 298 of Shchugorskoe district forestry, No. 84-93, 107, 132, 164, 165, 195-201, 230-237, 261, 262, 285, 286, 309, 310, 337, 338, 346-348, 366-371, 377-380, 385, 386, 391 of Podcherskoe district forestry of Vuktylskoe forestry; No. 4, 5, 18-22, 25, 26, 47, 48, 51, 57, 65, 78 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry.
The territory of Pechora-Ilych State Natural Biosphere Reserve includes the following forest compartments and natural boundaries:
a) upper dark coniferous area – No. 1-267 of Verkhne-Ilychskoe district forestry, No. 268-338, 348-365, 386-403, 426-443, 465-481, 504-519, 543-558, 581-595, 619-633 of Ergo-Lyagskoe district forestry, No. 339-347, 366-385, 404-425, 444-464, 482-503, 520-542, 559-580, 596-618 of Nizhne-Ilychskoe district forestry, No. 635-844 of Verkhne-Pechorskoe district forestry of the reserve;
b) lower pine forest area – No. 845-916 of Yakshinskoe district forestry of the reserve.
The buffer zone of Pechora-Ilych State Natural Biosphere Reserve: compartments No. 23-28, 40-45, 60-65, 75-80, 97-102, 120-125, 142-147, 165-172 of Kuryinskoe district forestry of Komsomolskoe forestry; No. 1-72, 75-110, 113-145, 148-179, 181-462 of Verkhne-Pechorskoe district forestry of Komsomolskoe forestry.
The compartment numeration is given in accordance with the forest management materials of 2010 for Vuktyulskoe, Komsomolskoe and Pechoro-Ilychskoe forestries, of 1998 for Yugyd Va National Park and of 1978 for Pechora-Ilych Reserve.

Description of the boundary of the land plot of Yugyd Va National Park in Inta district.
***in the north*:** the National Park boundary begins from the source of the Bolshaya Tykotlova River (Khanty-Mansi Autonomous Area of Tyumen Region) from the administrative boundary with Khanty-Mansi Autonomous Area of Tyumen Region and goes westwards along the boundaries of 300 meter long protective strips of watersheds of the basin of the Kozhim River with the basins of the Lemva, Bolshaya Inta and Chernaya Rivers (along the northern boundaries of basin natural boundaries No. 9, 4, 2, 1 of Verkhne-Kozhimskoe forestry and No. 2, 1 of Kozhimskoe forestry).

***in the north-west and west*:** the boundary of the National Park goes along 200 kV high-voltage line No. 256 "Perm GRES-Inta" and land plots of the right of way of the Northern Railway to the crossing with the Kosyu River, then along the left bank of the Kosyu River to the crossing with the administrative boundary of Pechora Municipal District Municipality.

***in the south*:** the National Park boundary coincides with the administrative boundary of Pechora Municipal District Municipality, goes along the left bank of the Kosyu River to the mouth of the Levaya Vozhkosyu River. Then it goes straight for 15.5 km north-eastwards to the mouth of the Stanovoy Stream (a tributary of the Nidysey River). Then along the axes of the Stanovoy Stream and Limbekoyu River south-eastwards to the crossing with the axis of the Balabanyu River, then in the same direction to the boundary of the Komi Republic with Khanty-Mansi Autonomous District.

***in the east*:** the park boundary goes along the boundary of the Komi Republic with Khanty-Mansi Autonomous District of Tyumen Region - begins 1.0 km to north-west of the mouth of the Severnogo Naroda River and goes eastwards to the top of Severnoe Lezvie Mountain, then south-eastwards across the top of Granitnaya Mountain, then north-north-eastwards as a sinuous line along the Khalmeryuiz Range to the top of Khasavarkaiz Mountain. Then the boundary goes eastwards 1.2 km to south of the source of the Ponyu River, after that in general north-eastern direction 1.9 km to the south-west of the source of the Saransedayu River. Then in general north-north-eastern direction along the crest of the Narodny-Ityinsky Mountain Ridge of the Nether-Polar Urals to the source of the Bolshaya Tykotlova River.

Description of the boundary of the land plot of Yugyd Va National Park in Pechora Municipal District Municipality of the Komi Republic (counterclockwise):

in the north: the boundary of the national park coincides with the administrative boundary of Inta Urban District Municipality. It begins from the point at the boundary of the Komi Republic with Khanty-Mansi

Autonomous District located 1.0 km to the north-west of the source of the Severnogo Naroda River. Then north-westwards 2.8 km straight to the crossing with the axis of the Balabanyu River in the point located 3.8 km far from its source. Then in the same direction to the Limbekyu River. Then along the axis of the Limbekyu River downstream for 3.6 km to the mouth of its left nameless tributary. Then on the straight north-westwards for 17.1 km to the crossing with the axis of the Stanovoy Stream (a tributary of the Nidysey River) at the point located 4 km far from its source. Then along the axis of the Stanovoy Stream downstream to its mouth. Then on the straight south-westwards for 15.5 km to the mouth of the Levaya Vozhkosyu River (a tributary of the Kosyu River). Then along the left bank of the Kosyu River downstream to the mouth of the Vangyr River.

***in the west*:** along the left bank of the Vangyr River from its mouth to the Kosyu River to the crossing with the northern boundary of compartment 568(24) of Syninskoe forestry,
along its northern and western boundary, along the northern and western boundary of compartment 598(40), along the northern and western boundary of compartment 614(55), along the northern and western boundary of compartment 212(63), along the western boundary of compartment 228(92), 244(118), 260(124), along the southern boundary of compartment 260(124), 261(125), along the western boundary of compartment 456(129) of Syninskoe forestry. Then along the western and southern boundary of compartment 471(8) of Aranetskoe forestry, along the western and southern boundary of compartment 480(22), along the western boundary of compartment 483(25), 495(40), along the southern boundary of compartment 495(40) to crossing with the Gerdyu River. Then along the right bank of the Gerdyu River to the crossing with the northern boundary of compartment 345(96), along the northern and western boundary of compartment 345(96) of Aranetskoe forestry to the crossing with the administrative boundary of Vuktyl Municipal District Municipality (note: the new numeration of the compartment network according to the forest management of 1998 is given in brackets)

***in the south*:** the boundary of the national park goes along the administrative boundary of Vuktyl Municipal District Municipality. Along the southern boundary of compartment 345(96), 346(97), 347(98) of Aranetskoe forestry to the crossing with the Bolshoy Patok River. Then along the right bank of the Bolshoy Patok River upstream to the mouth of the Patokvozh River. Then along the right bank of the Bolshoy Patokvozh River located at the boundary of the Komi Republic with Khanty-Mansi Autonomous Area and located at the watershed of the Patokvozh River (the Komi Republic) and the nameless tributary of the Shchekurya River (Khanty-Mansi Autonomous Area), on the eastern bank of the nameless lake with water edge of 573.8 located in the Komi Republic and 1.9 km to south-west of the geodetic point with the elevation of 780.2 located in Khanty-Mansi Autonomous Area.

***in the east*:** the national park boundary goes along the boundary of the Komi Republic with Khanty-Mansi Autonomous Area along spurs and crest of the range of the Nether-Polar Urals along the watershed of the basins of the Pechora River and Ob River.

Description of the boundary of the land plot of Yugyd Va National Park in Vuktyl Municipal District.

Land plot 1.
in the north: the boundary begins from the north-western end of compartment 54 of Patokskoe district forestry and goes along the northern boundary 54, 55, then along the northern boundary of compartments 56, 57 to the crossing with the right bank of the Bolshoy Patok River, then along the right bank of the Bolshoy Patok River to the crosspoint with the right bank of the Patokvozh River, then along the right bank of the Patokvozh River to the crossing with the administrative boundary of the Komi Republic.

in the east: the boundary goes along the administrative boundary of the Komi Republic (going along the Ural Range) along the boundaries of compartments 3, 19, 22, 21, 36 of Patokskoe district forestry, along the boundaries of compartments 1, 4, 7, 12, 22, 32, 58 of Nizhne-Shchugorskoe district forestry, then along the boundaries of compartments 4, 8, 20, 19, 31, 32, 43, 52, 55, 56 of Verkhne-Shchugorskoe district forestry.

in the south: the boundary goes mainly north-westwards along the boundaries of compartments 56, 54, 53 of Verkhne-Shchugorskoe district forestry, then along the boundaries of compartments 112, 111, 108, 107, 102-98 of Podcherskoe forestry parallel to Punga-Vuktyl-Ukhta gas pipeline right-of-way.

in the west: the boundary goes from the south-western end of compartment 98, then westwards along the boundary of compartments 88-85 of Podcherskoe district

forestry, then from the south-western end of compartment 85 mainly north-westwards along the boundaries of compartments 84, 73, 68, 67, 61, 60, 55-49, 38-31 of Podcherskoe district forestry, then it goes on the right and left parallel to Podcherye-Vuktyl water passage in compartments 33, 34, 19, 20 of Podcherskoe district forestry. Then it goes north-westwards along the southern boundary of compartments 33, 32 of Podcherskoe district forestry, then it goes to the right of 35 kV overhead power transmission line No. 57 of Podcherye substation - Kyrta substation along the tree felling boundary to the crosspoint with the compartment line of compartments 18 and 4, then north-westwards along the boundaries of compartments 4-1, then north-eastwards along the edge of the side of the Boyarsky Vis Lake along the boundary of compartments 1-2 of Podcherskoe district forestry. Then southwards along the eastern boundary
of compartment 2, then mainly south-eastwards along the boundaries of compartments 3-16, 31, 47-48, 59, 64-66, 72, along the northern boundary of compartments 77-82 of Podcherskoe district forestry, then eastwards along the western boundary of compartments 48, 46, 44, 39, 37, 35, 33 of Verkhne-Shchugorskoe district forestry, then along the southern boundary of compartments 168-163, then mainly north-westwards along the boundaries of compartments 163, 157, 146, 145, 129, 112-110, 88, 64, 63, 33 of Nizhne-Shchugorskoe district forestry, then north-westwards along the boundaries of compartments 150-147, 167, 172, 176, 199-191, 206-203 of Patokskoe district forestry. Then it goes westwards to the right of the motor and tractor passage (former Edzhydyag Settlement) along the tree felling boundary to the crossing with the western boundary of compartment 201, then north-eastwards along the boundaries of compartments 201, 187 of Patokskoe district forestry. Then the boundary goes north-eastwards across the Shchugor River along the boundary with the water fund of the Pechora River to the crosspoint with the right bank of the Shchugor River. Then along the western boundary of compartment 177 of Patokskoe district forestry. Then south-eastwards along the northern boundary of compartments 177-185, then north-eastwards along the north-western boundary of compartment 173 of Patokskoe district forestry. Then the boundary goes mainly north-eastwards along the boundaries of compartments 168, 163, 140, 120, 99, 76, 54 of Patokskoe district forestry.

Land plot 2.
in the north: the boundary of the land plot begins from the north-western end of compartment 57 and goes south-eastwards along the boundary of compartments 57, 54, 58 of Verkhne-Shchugorskoe district forestry parallel to Punga-Vuktyl-Ukhta gas pipeline right-of-way.

in the east: the boundary goes mainly southwards along the administrative boundary of the Komi Republic along the eastern boundary of compartment 58 of Verkhne-Shchugorskoe district forestry.
in the south: the boundary goes along the southern boundary of compartment 58 of Verkhne-Shchugorskoe district forestry (northern boundary of compartments 28, 29 of "Pechora-Ilych Reserve" FSI). Then along the southern and western boundaries of compartment 58 of Verkhne-Shchugorskoe district forestry, along the southern and south-
western boundaries of compartments 620, 619, 617, 618, 57 of Verkhne-Shchugorskoe district forestry.

in the west: the boundary goes along the southern and western boundaries of compartment 57 of Verkhne-Shchugorskoe district forestry.

Description of boundaries of land plots planned to be included in Yugyd Va National Park.

Land plot 1.
Land plot 1 includes the following forest compartments: 257-260, 300-303 of Ust-Voyskoe district forestry; 75-81, 147-154, 192-202, 247-258, 275-287, 299-311, 319-333, 338-350 of Shchugorskoe

district forestry; 94-96, 149-160, 183-192, 212-221, 246-251, 272-276 of Podcherskoe district forestry of Vuktylskoe district forestry. The area of land plot 1 is 135444 hectares.
The boundaries of land plot 1 go:

in the north - along the northern boundary of compartments 257-260, along the eastern boundary of compartments 260, 303 of Ust-Voyskoe district forestry of Vuktylskoe forestry; then along the northern boundary of compartment 80, the northern and eastern boundaries of compartments 81 and 154, the northern boundary of compartments 200, 201, along the northern and eastern boundaries of compartment 202, the northern boundary of compartment 257 from the crosspoint with the eastern boundary of compartment 202, the northern and eastern boundaries of compartments 258 and 287, the eastern boundary of compartment 311, the northern boundary of compartments 329-333 of Shchugorskoe district forestry of Vuktylskoe forestry;

in the east – along the eastern boundary of compartments 333 and 350 Shchugorskoe district forestry of Vuktylskoe forestry and compartments 160, 192, 222, 251, 276 of Podcherskoe district forestry of Vuktylskoe forestry;

in the south – along the southern boundary of compartments 276-272 of Podcherskoe district forestry of Vuktylskoe forestry;

in the west – along the western boundary of compartment 272, southern and western boundary of compartment 246, southern boundary of compartments 215-212, along the western boundary of compartments 212, 183, along the southern boundary of compartment 150, along the southern and western boundary of compartment 149 of Podcherskoe district forestry of Vuktylskoe forestry; then along the southern and western boundary of compartment 338, along the southern boundary of compartments 320, 319 of Shchugorskoe district forestry of Vuktylskoe forestry; then along the southern boundary of compartments 96, 95, along the southern, western and northern boundary of compartment 94 of Podcherskoe district forestry of Vuktylskoe forestry to the crossing with the western side of compartment 299 of Shchugorskoe district forestry of Vuktylskoe forestry; then along the western boundary of compartments 299, 275, 247, 192, 147, along the southern (partially), western and northern boundaries of compartment 75 of Shchugorskoe district forestry of Vuktylskoe forestry; then along the western boundary of compartments 300, 257 of Ust-Voyskoe district forestry of Vuktylskoe forestry.
The numeration of compartments is given in accordance with the forest management materials of 2010.

Land plot 2.
Land plot 2 includes the following forest compartments: 6-13, 27, 28 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry; 238, 263-265, 287-291, 311-316, 339-345, 358-361 of Podcherskoe district forestry of Vuktylskoe forestry. The area of the land plot is 32129 hectares.
The boundaries of land plot 2 go:

in the north-east – along the northern and eastern boundaries of compartment 238, the northern boundary of compartment 264, the northern and eastern boundaries of compartment 265, the northern boundary of compartment 290, the northern and eastern boundaries of compartment 291, 316, 345 of Podcherskoe district forestry of Vuktylskoe forestry; then along the northern boundary of compartment 10-13, the eastern boundary of compartment 13 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry; then along the northern boundary of compartments 358-361, the eastern boundary of compartment 316 of Podcherskoe district forestry of Vuktylskoe forestry;

in the south – along the southern boundary of compartments 361-358 of Podcherskoe district forestry of Vuktylskoe forestry; then along the southern boundary of compartment 28, the southern and western boundaries of compartment 27, along the southern boundary of compartments 12-6 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry;
in the west – along the western boundary of compartment 6 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry to the crossing with the southern boundary of compartment 340 of Podcherskoe district forestry of Vuktylskoe forestry; then along the southern boundary of compartments 340 and 339, along the western boundary of compartments 339, 311, 287, 263, 238 of Podcherskoe district forestry of Vuktylskoe forestry;

The numeration of compartments is given in accordance with the forest management materials of 2010 for Vuktylskoe forestry and of 2006 for Pechoro-Ilychskoe forestry.

Land plot 3.
Land plot 3 includes the following forest compartments: 52, 66, 79, 617, 618, 621, 622 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry. The area of the land plot 2 is 15649 hectares.
The boundaries of land plot 3 go:

in the north – along the northern and eastern boundary of compartment 52 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry to the crossing with the administrative boundary of Troitsko-Pechorsky District; then eastwards along the boundary to the crossing with the eastern boundary of compartment 617 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry; then along the northern boundary of compartments 618, 621, 622 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry (along the administrative boundary of Troitsko-Pechorsky District to the crossing with the eastern boundary of compartment 622 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry);

in the east – along the eastern boundary of compartment 622 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry (along the administrative boundary of Troitsko-Pechorsky District to the crossing with the southern boundary of compartment 622 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry);

in the south – along the southern boundary of compartments 622; then along the right bank of the Kozhimyu River to its crossing with the western boundary of compartment 79 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry (along the southern boundary of natural boundaries 621, 618 and compartment 79 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry);

in the west – along the western boundary of compartments 79, 66, 52 of Eremeevskoe district forestry of Pechoro-Ilychskoe forestry.
The numeration of compartments is given in accordance with the forest management materials of 2006.

Description of the boundary of the land plot of Pechora-Ilych "State Natural Biosphere Reserve" FSBI

"Pechora-Ilych State Natural Biosphere Reserve" FSBI is represented by two isolated land plots (clusters) – Yakshinsky and Uralsky ones located in the south-western and eastern parts of the interfluve of the Verkhnyaya Pechora River and the Ilych River.

Yakshinsky land plot*:*
the ***south-western*** boundary is formed by the 54 km long section of the Pechora River between the mouths of its right-bank and left-bank tributaries the Plovinnaya and the Krutaya;
the ***northern*** boundary - 13 km long along the West-East ride between compartments from the mouth of the Krutaya River;
the ***eastern*** boundary - 19 km long along the South-North ride between compartments from the mouth of the Krutaya River.

Uralsky land plot:
the northern boundary - along the Ilych River and its tributary the Kozhimyu;
the western boundary - along the watershed of the Main Ural Range;
the southern boundary - along the Pechora River from its source to the former riverbed of the Poloy;
the western boundary - along the South-North ride between the compartments from the mouth of the former riverbed of the Poloy to the Ilych River 800 m from the inflow of the Izparedyu River upstream.

List of coordinates of distinguished points of the boundary of the designed protection zone of Pechora-Ilych State Natural Biosphere Reserve (including the territory of the buffer zone).

1. 59°4'2,172"E 63°15'59,241"N	28. 58°39'33,059"E 62°44'47,604"N	55. 57°36'20,433"E 61°46'13,194"N
2. 59°1'24,143"E 63°16'36,2"N	29. 58°43'51,998"E 62°44'3,846"N	56. 57°36'51,607"E 61°45'37,594"N
3. 59°0'21,613"E 63°16'23,21"N	30. 58°42'34,785"E 62°41'44,059"N	57. 57°36'56,276"E 61°30'12,509"N

4. 58°51'2,095"E 63°17'23,312"N
5. 58°50'6,274"E 63°17'11,151"N
6. 58°45'35,731"E 63°19'3,576"N
7. 58°42'55,264"E 63°17'19,495"N
8. 58°40'15,167"E 63°17'30,316"N
9. 58°39'17,09"E 63°16'37,481"N
10. 58°29'58,275"E 63°16'40,696"N
11. 58°29'51,259"E 63°11'35,56"N
12. 58°24'55,228"E 63°11'39,584"N
13. 58°25'9,306"E 63°8'58,913"N
14. 58°27'20,697"E 63°8'57,583"N
15. 58°27'3,514"E 63°6'52,9"N
16. 58°29'54,319"E 63°6'55,088"N
17. 58°29'54,319"E 63°6'55,088"N
18. 58°28'44,856"E 63°1'21,863"N
19. 58°28'51,815"E 62°55'45,85"N
20. 58°30'42,707"E 62°55'45,666"N
21. 58°30'30,582"E 62°53'56,787"N
22. 58°36'32,868"E 62°53'8,187"N
23. 58°35'3,837"E 62°51'7,301"N
24. 58°38'17,422"E 62°50'38,329"N
25. 58°37'17,955"E 62°49'2,887"N
26. 58°39'29,012"E 62°48'43,521"N
27. 58°40'49,625"E 62°46'19,853"N
31. 58°47'8,229"E 62°40'59,028"N
32. 58°45'36,596"E 62°38'52,335"N
33. 58°54'36,594"E 62°37'34,893"N
34. 58°52'26,683"E 62°34'32,296"N
35. 58°54'23,628"E 62°34'12,875"N
36.58°53'6,971"E 62°32'8,038"N
37. 58°55'12,518"E 62°31'51,462"N
38. 58°53'45,327"E 62°29'48,758"N
39. 58°51'35,811"E 62°30'8,34"N
40. 58°50'4,734"E 62°28'6,644"N
41. 58°38'40,789"E 62°29'46,35"N
42. 58°37'16,916"E 62°27'42,455"N
43. 58°27'51,055"E 62°28'54,12"N
44. 58°29'5,86"E 62°31'0,183"N
45. 58°15'19,58"E 62°33'16,122"N
46. 58°16'21,758"E 62°34'54,658"N
47. 58°4'14,337"E 62°36'23,986"N
48.58°3'48,301"E 62°34'17,345"N
49. 58°2'33,24"E 62°34'20,882"N
50. 58°0'19,805"E 62°26'48,012"N
51. 57°56'47,674"E 62°27'15,656"N
52. 57°49'26,206"E 62°14'42,928"N
53. 57°44'39,518"E 62°6'44,215"N
54. 57°44'4,789"E 61°55'22,349"N
58. 58°50'42,748"E 61°29'43,5"N
59. 58°50'53,501"E 61°31'8,203"N
60. 58°53'12,585"E 61°31'33,67"N
61. 59°3'0,154"E 61°32'17,201"N
62. 59°14'17,021"E 61°37'37,79"N
63. 59°25'8,177"E 61°45'14,82"N
64. 59°20'5,686"E 61°49'51,066"N
65. 59°29'15,058"E 61°56'51,219"N
66. 59°28'9,271"E 61°59'31,219"N
67. 59°26'2,575"E 62°5'42,871"N
68. 59°24'1,395"E 62°9'23,888"N
69. 59°26'32,324"E 62°11'7,279"N
70. 59°32'45,698"E 62°19'6,26"N
71. 59°38'37,038"E 62°24'22,942"N
72. 59°38'22,17"E 62°33'25,374"N
73. 59°28'2,996"E 62°34'5,755"N
74. 59°28'5,278"E 62°39'46,023"N
75. 59°25'59,539"E 62°45'11,42"N
76. 59°27'58,819"E 62°55'35,217"N
77. 59°14'53,604"E 62°59'25,487"N
78. 59°17'23,347"E 63°5'40,966"N
79. 59°18'43,526"E 63°11'25,058"N

Labor resources

Table 2. Labor resources and need in them

Staff	National park			Reserve			
	According to the manning table	2016 actual	Urgent need	According to the manning table	2016 actual	Urgent need exclusive of the buffer zone	Urgent need including the buffer zone
Employees	68	60	120-160*	78.75	68	90	100-120*

*-The need in labor resources has been calculated based on the load on employees:
- in the national park (with a protection zone) one security guard[2] has to guard 59.2 thousand hectares, in the reserve with a protection zone - 39. 2 thousand hectares although the norm is 6.5-10 thousand hectares per one employee as specified in the forest management materials. The urgent need has been calculated based on 30 thousand hectares of the specially protected natural territory per one security guard - at such load the guard may be said to be effective;
- one employee of the environmental education department has to serve: 490 tourists and 2,500 excursionists in the park, from 100 to 280 people in the reserve, although the load of 250-300 of tourists per a department employee a year has been accepted as a norm;
- the number of employees of main activity maintenance departments has been calculated based on the amount of work, the increase of the number of employees of the departments by 50% will make it possible to carry out all work of proper quality in time.
Table 3 shows current distribution of employees according to their functional tasks.

Table 3. Distribution of labor resources of the specially protected natural territory (percentage of the actual number) according to their functional tasks in 2016 in %

Departments	National park	Reserve
	%	%
Directorate (including branch heads for the park and deputy heads for the reserve)	5	6
Financial and economic*	5	5
Science department*	5	12
Ecological education*	13	8
Security*	37	31
Main activity maintenance*	35	29
Elk farm	-	9
In general, specially protected natural areas: in %%	100	100
In general, specially protected natural areas, employees:	60	68

*- for the national park the department includes the department head

[2] the functions of the security include raids of protection of the territory from poachers, fires, general labor and accounting activities, tourist escorts, being on duty at posts, etc.

Level of mechanization of the site

Table 4. Level of mechanization of the site, 2016

Machines and mechanisms, fire-extinguishing means, weapon and special equipment,	National park (pcs)	Reserve (pcs)	**Total for the site (pcs)**
Machines and mechanisms			
Tractors	1	4	**5**
Passenger cars	10	5	**15**
Bus (special shift work)	1	-	**1**
Snowmobiles	19	17	**36**
KS-102 boat	1	2	**3**
Small size vessels	16	17	**33**
Outboard motors	21	25	**46**
Small size vessels of special design (air cushion vehicle, snow mobile)	2	1	**3**
All-terrain vehicles (incl. Snow and swamp-going vehicles)	1	1	**2**
Fire-extinguishing means			
Power-driven pumps	12	6	**18**
Backpack sprayers	81	45	**126**
Petrol-powered saws	19	12	**31**
Weapon and special means			
Weapon	17	-	**17**
Special means	0	-	**0**

Land improvement indicators of the site territory

Table 5.
Land improvement indicators of the site territory

Infrastructure facility	National park	Reserve	Buffer zone	Site
Car parks, pcs	3	0	0	**3**
Places equipped for camping areas, pcs	78	2	-	**80**
Other equipped recreational areas and picnic points, pcs	108		3	**111**
View points, pcs.	19	2	-	**21**
Public catering facilities, pcs	-	-	-	**-**
Other facilities *(bridges, ladderways): pcs (running meters)*	70 (1,000)	(130)	-	**(1,130)**
Stopping points and shelters	99	6	1	**106**
Total capacity of stopping points, places	328	60	20	**408**
Average price of accommodation, rub/ bed/ day (from-to)	325 (250-400)	900	-	**600**
Average price of high-level accommodation, rub./ bed/ day	750	1300	-	**1000**
Available information centers, pcs	5	0	-	**5**
Cordons and control and security points (including checkpoints), pcs	3 (1)	11	1	**15 (1)**
Ecological routes, pcs (km)	5 (5)	7 (83.5)	3 (12)	**15 (100.5)**

Security service performance indicators

Table 6. Dynamics of performance indicators of the security service of the national park

No.	Indicator	Years		
		2014	2015	2016
1.	Revealed violations, total	68	76	75
2.	Imposed administrative fines (thousand rub.)	204.0	244.5	580.1
3.	Collected administrative fines (thousand rub.)	162.0	197.0	269.2
4.	Confiscated illegal nature management tools, total	10	53	15
5.	Lodged claims (thousand rub.)	142.0	182.7	176.4

No.	Indicator	Years		
		2014	2015	2016
6.	Collected money based on claims (thousand rub.)	51.0	74.2	119.6
7.	Revealed violations sent to the Ministry of Internal Affairs of the RF	5	8	1
8.	Initiated criminal cases	3	5	1
9.	Brought to criminal liability (pers.)	0	3	0

Table 7. Dynamics of performance indicators of the security service of the reserve

No.	Indicator	Years		
		2014	2015	2016
1.	Revealed violations, total	75	94	58
2.	Imposed administrative fines (thousand rub.)	298.5	285.3	62
3.	Collected administrative fines (thousand rub.)	78.5	82.5	29
4.	Confiscated illegal nature management tools, total	0	0	0
5.	Lodged claims (thousand rub.)	0	0	0
6.	Collected money based on claims (thousand rub.)	0	0	0
7.	Revealed violations sent to the Ministry of Internal Affairs of the RF	0	0	0
8.	Initiated criminal cases	0	0	0
9.	Brought to criminal liability (pers.)	0	0	0

Table 8. Performance indicators of the security service of the site, 2016

No.	Indicator	National park, 2016	Reserve, 2016	Buffer zone, 2016	Site, 2016
1.	Revealed violations, total	75	58	0	**133**
2.	Imposed administrative fines (thousand rub.)	580.1	62	0	**642.1**
3.	Collected administrative fines (thousand rub.)	269.2	29	0	**298.2**
4.	Confiscated illegal nature management tools, total	15	0	0	**15**
5.	Lodged claims (thousand rub.)	176.4	0	0	**176.4**
6.	Collected money based on claims (thousand rub.)	119.6	0	0	**119.6**
7.	Revealed violations sent to the Ministry of Internal Affairs of the RF	1	0	0	**1**
8.	Initiated criminal cases	1	0	0	**1**
9.	Brought to criminal liability (pers.)	0	0	0	**0**

APPENDIX 2

The Environmental value of the World Heritage site Virgin Komi Forests

The World Heritage site includes a group of 8 protected areas located on the boundary between two physiographic provinces, the Russian Plain and the Ural Mountains range. Its territory is notable for its large area, diversity of landscapes and their undisturbedness, as well as exceptional species diversity. The mountainous taiga of the Urals is considered to be one of the 200[1] ecological regions that support the global environmental balance of the Earth.

The story of exploration of nature and resources on the territory of the site began in the 18th century with the first complex surveys, mostly geological ones. The story of the regular studies of the biota on the territory of the site extends back almost 60 years: in the early 1960s, the science department of the Pechora-Ilych Nature Reserve was created, and the Institute of Biology within the Komi research center of the Academy of Science of the Soviet Union started its work.

Terrains and their elements

The landscapes of the site are unique.

More than a third of the site area is taken by highlands, about a third is a steeply sloping submontane belt, less than a third is taken by the plains terrain of the Pechora lowland.

The high mountain regions are mostly concentrated within the Yugyd Va National Park in the Nether-Polar Urals. This is a true highland consisting of a zone of ridge-like ranges along the north-south line. In its widest part it reaches 70 km, and it stretches 150 km from north to south within the borders of the site. The following ranges are the longest: Obeiz, Western Saledy, Eastern Saledy, Sablya, Maldynyrd, Kursambay, Issledovatelsky (Research) Ridge. They are notable for pronounced alpine terrain with sharp crests and rocky peaks that are hard to access: Kolokolnya mountain (1721 m), Mansiner mountain (1779 m), Karpinskogo mountain (1803 m), Naroda mountain (1896 m), etc.

Manaraga mountain crowned with rock pillars (1663 m) – the "bear paw" – was for a long time believed to be the highest peak of the Nether-Polar Urals. It became the symbol of the national park.

The landscape is diversified by the numerous canyon-like river valleys cutting through rock masses. Glacial cirques, cirque lakes, troughs and moraines are common. In the northern part of the park there are 38 glaciers with the area of 5.5 square kilometers.

The mountain part of the Northern Urals within the boundaries of the site (the southern part of the national park and the mountain section of the nature reserve) is characterized by a more subdued relief with average heights of 1000 m in the northern part and 800 m in the southern one. Khoraiz (1326 m), Lortsempeya (1358 m) and Telpos-iz (1617 m) peaks are located here in the northern part, and Kozhymiz (1195 m, the highest in the nature reserve), Kycheliz, Tumbaliz, Shchukayel'iz and Parusiz in the southern one.

There are four distinctive mountain ranges within the nature reserve, with the width of about 50 km. The longest and easternmost mountain range is called the Korennoy Poyasovy Kamen'; to the west of it, the Ilych Poyasovy Kamen' is located, which is represented, among other things, by the Manpupunyor rock formation (seven rock pillars which, in 2008, earned the status of "One of the seven wonders of Russia"). To the west of the Ilych Kamen', two other mountain ridges are located, which ends abrupt at the level of the Ydzhid-Lyagi river. They do not form a united group and are topped by granite rock – theTorreporreiz, Makariz, Nerimiz, Sotchemyolyiz (1040 m). On the west, the Ural highland ends with the Western ridge.

The mountain slopes are sylvan, their tops at the height of 1200-1250 m are covered with stone fields. Rock pillars from geological material resistant to weathering are commonly found on the mountain ranges of the Northern Urals; they have the form of picturesque pillars (Manpupunyor), towers (Otorten) and "cities" (Torreporreiz).

[1] Global 200 is the list of ecological regions of the World Wildlife Fund (WWF) that support the global environmental balance.

Throughout its existence the mountain belt of the Urals was the area of multiple re-upheavals which were accompanied by a more or less deep destruction of the terrain. The whole region was subject to numerous glaciations, and currently its terrain is mostly formed through the working of denudation agents. [2]

Along the western slopes of the Nether-Polar and Northern Urals, there is a long submontane belt with mean heights of 220-350 meters (the Ural Uvaly), which was formed by sedimentary strata. The higher ridges (Ovin-Parma, Mertvaya Parma, Ydzhidparma, Vysokaya Parma) with height up to 500-600 m rise at the places of exposure of solid quartz sandstone and are usually wooded. However, some peaks (Shezhymiz, Tumbuk, Manskiye Bolvany, etc.) have rocky deposits. The highest mountain in the Uralskiye Uvaly ridge is Shezhymiz mountain, the top of which is 857 m tall.

Between the Uvaly ridges, wide lowlands are located, which correspond to the areas of limestone development and stretch from north to south. In the places of exposure of carbonate rocks, the karstic landforms are pronounced – caves, shakeholes, dry gulches. The river tributaries are confined to the depressions between the uvaly.

The terrain of the western slopes has a continuous gradient to the west. It is followed by the main rivers of the site: the Kozhim, Big Synya, Shchugor, Podcherem, Pechora (along its upper reaches), Ilych (along its upper reaches), Un'ya. On the valley sides of these rivers, picturesque rocks are situated; they are especially numerous on the Un'ya river.

The plains part of the site is located within the boundaries of the Pechora lowland, which is basically a plain sloping towards the north. The lowland is characterized by small heights (no more than 150-175 m) and monotonous terrain, since the irregularities of the ancient plain were buried by the mass of the quarternary glacial drifts of 100-150 m in depth. The infrequent low hills and crests give a gently rolling nature to the locality.

As a result of the activities of the rivers, the terrain of the near-river regions is of a steplike terraciform nature. For example, there are five well-pronounced terraces near the Pechora river.

Thanks to the differences in the nature of the terrain, the lithological structure of the ridges, their steepness, the direction of sloping, the height above sea level, the hydrological regime and the nature of the plant formation, the site has varied soil cover and altitudinal zonality.

The river network on the territory of the site is well-developed. The water courses originate on the western slope of the Ural range. The river Pechora is the longest; its first-order tributaries are Podcherem, Shchugor, Ilych, Un'ya, the second- and third-order tributaries are Kos'yu, Kozhim, Vangyr, Big Patok, Ydzhyd Lyaga and others.

In their upper reaches, all rivers are of a mountain nature, characterized by swift current, rocky river bed, rapids, sandbars and waterfalls. On the submontane and plains terrain, the rivers achieve a typical plains character with a tranquil current, streams, dead channels and islands.

There are numerous mountain lakes (more than 800 of them) at the Nether-Polar Urals. The most picturesque are the lakes of glacier origin, with depth of up to 16 m, located at significant height. The large lakes include the Torgovoye, the Balbanty, and the Okunyovyye lakes.

The level of water content of the rivers depends on winter and summer precipitation; more than half of the annual flow of the rivers is provided by the snow feed, the rain precipitation is in the second place (25-35%), the share of the groundwater feed is the lowest.

The climate of the Nether-Polar and Northern Urals is strongly continental and severe. It develops under the influence of western transport of air masses and frequent intrusion of cold Arctic air from the north along the mountain ranges. Due to such circulation, there is an intense cyclonic activity and deformation of air flows by the mountains, resulting in highly unstable and excessively humid weather. The Nether-Polar and Northern Urals are the regions of the Urals richest in precipitation. It is especially abundant on the western facings of the Nether-Polar Urals – up to 1500 mm and more a year; in the mountain regions of the Northern Urals this parameter is 1000 mm. On the plains and in the submontane region, the annual amount of precipitation is down to 500 mm.

The majority of precipitation occurs between April and October. Up to 40% of the annual precipitation occurs in the form of snow.

On the Nether-Polar Urals, the average monthly temperature of the coldest month, January, reaches 18°C below zero in the south and 21°C in the north. The winter temperature minimum is 55°C below zero. Winter continues from October to mid-April, and in the highlands, a bit longer than that. For

the winter period, strong winds are typical. The thaws are accompanied by sharp fluctuations in daily temperatures: during the night the air cools down to 30°C below zero, during the day it warms up to 10°C above zero. The average monthly temperature of July, the warmest month in the Nether-Polar Urals, is 10°C above zero, in its submontane regions it's 12°C below zero. On the whole, the summer is characterized by cool and variable weather with frequent cold spells and night frosts. The length of summer in the Nether-Polar Urals is 60-80 days, autumn is 50-60 days, winter continues for about 230 days.

In the highlands of the Northern Urals, the annual average temperature is 4°C below zero. This parameter changes in the direction of the plains: in the submontane regions (Ust-Unya) it already reaches 1.1°C below zero, and on the plains (Yaksha) it is 0.8°C above zero.

Environmental situation and threats

The man-made impact brought about by the development of the industry, transportation, extraction of minerals, construction and operation of line facilities as well as agricultural activities and, in part, forest fires leads to changes in the environment.

The territory of the site currently is not subject to critical technogenic burdens, including pollution transport. At the same time, atmospheric pollution transport as well as the consequences of falling missile stages from the Plesetsky test ground (mostly in the buffer zone of the nature reserve) demand a study of their influence (table 1).

Table 1. The areas of the site subjected to technogenic impact

Site, location, area	Type of impact, period of impact and consequences[3]	Opportunity for preservation, monitoring and recultivation
The Kozhim river, Yugyd Va National Park, Inta district	Mining placer gold, 1960s – 1980s	The environmental restoration of the fields takes place faster in case of the rolling microterrain of a field
The Kozhim river, Yugyd Va National Park, Inta district	Extracting gangue quartz, to the present day	Existing operation – continued monitoring of pollution
The Balban'yu river, tributary of the Kozhim river, Yugyd Va National Park, Inta district	Development of a quartzite-sandstone deposit for production of high-endurance broken stone – planned	Scheduled. Monitoring water courses downstream
The Syv'yu river, tributary of the Kozhim river, Yugyd Va National Park, Inta district	Development of the deposit of carbonate rock for production of cladding materials – planned	Scheduled. Monitoring water courses downstream
The Kozhim river, Yugyd Va National Park, Inta district	Development of vein gold deposits – planned	Scheduled. Monitoring water courses downstream
Motor and tractor passage Inta - Sana Vozh - Zhelannoye, Yugyd Va National Park, Inta district	Access of transport, people, pollution of water courses during equipment crossing, poaching since 1960s and to the present day	Periodic control of pollution at key points (crossings, staging posts, side lanes off the groundfill passage, etc.)
Yugyd Va National Park, Vuktyl district	The Siyaniye Severa gas pipeline fragments the park, facilitates the access of the equipment and poaching	Agreement on joint pollution control in the area of bridge crossings of the rivers and on the boundary between the protected zone of the gas pipeline and the park
Yugyd Va National Park, Inta district	Tourist traffic up to 3500 people a year, poaching, littering, soil erosion	Organizing camping stations, waste bins, restrooms, paths, notices with rules of

[3] Influence of development..., 1994 (synopsis: it has been established that serious damage was done to the unique nature complexes of the Kozhim river, especially to the rare species. The environmental recovery of the ecosystems takes place extremely slowly)

Site, location, area	Type of impact, period of impact and consequences[3]	Opportunity for preservation, monitoring and recultivation
		conduct
Yugyd Va National Park, Vuktyl district	Cut over lands from the 1960s-1980s in the interstream area between the rivers Podcherem and Shchugor	Including the cut over lands into the park or its protective zone
Nature reserve, the western border of the mountain cluster	Cut over lands from the 1960s-1980s, facilitates access of equipment, poaching	Creating protective zone, intense forest restoration (young growth tending)
Nature Reserve (Sibiryakovsky passage), buffer zone (Man'skaya Volosnitsa river, Imperatorskaya river, the Klyuchiki stow)	Mining placer gold on a limited scale (mid-19th century, early 20th century and the 1970s)	
Nature Reserve, the project of a cellulose and cardboard plant in the Troitsky-Pechorsky district	Scheduled – suppression of conifer forests, pollution of water courses (Pechora river), felling immature forests	Waste treatment facilities, monitoring emissions and drains
Nature Reserve, the Manpupunyor formation	Tourist pressure of about 1000 people a year, anthropogenic change of landscape, soil erosion	Organizing camping stations, waste bins, restrooms, paths, notices with rules of conduct, accompanying groups, parking for cars and motorcycles
The nature reserve and the park, visited areas and areas of temporary accommodation (posts, tourist bases)	Soil erosion, increased content level of suspended substances in the water of the water courses, destruction of natural plant communities and decrease in their species diversity	
Forestry Department site forest fires	On the average: 2 fires a year over the total area of 200 ha (within the period of 1997-2016)	
National park – grazing deer	Overgrazing that leads to degradation of lichen cover, poaching – shooting wild reindeer and predators	Controlling the numbers and regulating the rotation of pastures, insuring the herds, controlling grazing and monitoring pastures
Yugyd Va National Park, Inta district	Technogenic impact on the vegetation, import of weed seeds, cutting down woody plants, collecting medicinal plants, the vegetation cover on the camping sites being destroyed by the tourists	Changes in vegetation complexes (45% of species of natural vegetation have been registered in anthropogenic ecotopes. Apophytization index 96.7% – synantropization). Revegetation. Plantations of medicinal plants. Touristic infrastructure lowering the impact on the natural complexes, replacing firewood with gas.
Forestry Department site – lichens	Fires, felling and windfalls lead to critical reduction in diversity among lichens (twice and more); rare and protected species are the first to disappear	Identification and protection of lichen habitats, fire safety measures and prevention.
Bodies of water of Forestry Department site – algae	Forest felling, surveying and mining mineral deposits, building line structures and transportation, recreation pressure accompanied by domestic sewage and waste	Pollution indicators – changes in the taxonomic composition, the predominant complex, the structures of the communities and quantitative indicators of communities of algae[4]

[4] The indicators are reflected in more detail in the PDF report for the B phase of the UNDP/GEF project for the protected areas of the Republic of Komi: Development of a complex of indicators of the state of biodiversity for the system of its monitoring on the

Site, location, area	Type of impact, period of impact and consequences[3]	Opportunity for preservation, monitoring and recultivation
Site territory – insects	Lepidopterans – collecting (and making souvenirs) – increase of commercial pressure and anthropogenic pressure lead to transformation of assemblies of lepidopterans and penetration of eurytopic species. Destruction of the nutritive base of the lepidopterans (for example, roseroot (Rhodiola rosea), which is an object of illegal trading and serves as nutritive base for small Apollo (Parnassius phoebus))	Controlling the collecting done by visitors, limiting access to habitats of unique assemblies of lepidopterans, restoring the vegetation structure and habitats
Site territory – plankton	construction and operation of industrial plants and timber harvesting: pollution of water bodies by suspended substances and heavy metals. Organic contamination of water bodies: drainage, tourism	decrease in species diversity and quantitative development of zooplankton, the plankton migrating to river outlets and replacement of some species by others
Site territory – benthos	Forest clearance along small water courses that lack water protection zones. Waters warming up. Water bodies shallowing due to driftage of suspended particles. Industrial pollution (by chloroorganics). In the course of gold mining the areas suitable for settlement by benthos decrease to 5% of the natural level.	Creating water protection zones for any water courses. Limiting industrial production. Recultivation of water banks which prevents washing out suspended particles and increases the opacity of small water courses.
Site territory – fish	Reduction of the population of salmonoids due to poaching (mostly) and industrial pollution of the water courses	Rejuvenation of populations, decrease in population size, loss of species.
Site territory – amphibians and reptiles	Forest clearance, cattle grazing, use of fertilizers, mining, building roads, oil and gas pipelines, chemical pollution. Vegetal invasion is a negative influence. Rise of temperature of the water courses influences the proliferation.	The common frog (Rana temporaria) and the moor frog (Rana arvalis) are species with a good potential for chemical testing for heavy metals and hydrocarbons in muscular tissues, which allows evaluating the spread of pollution
Site territory – avifauna	Anthropogenic impact on the habitats of birds, hunting, fishing, haymaking, collecting wild-growing plants, tourism Direct demise of birds and their broods, decrease in nutritional base of ichthyophagic birds, increase of the disturbance factor during the period of nesting	Closing the identified nesting places for visitation during the period of nesting, prohibition on haymaking within the identified habitats of rare species. Preservation
Site territory – mammals	Anthropogenic impact on feeding and protection stations (felling, mining, line structures), illegal hunting (hoofed mammals)	Preservation

Biological diversity [5]

Vegetation

project territory. Tatarinov A. G. et al. HTTP://UNDP-KOMI.ORG/INDEX.PHP?OPTION=COM_CONTENT&VIEW=ARTICLE&ID=4:2009-03-18-15-05-09&CATID=31:-PDF-B&ITEMID=54

[5] Notes on the biodiversity of the site and its clusters were prepared as a part of preparation and implementation of the UNDP/GEF project for the protected areas of the Republic of Komi. http://undp-komi.org. Reports, 2006-2015, based on the PDF Report for the B phase of the UNDP/GEF project for the protected areas of the Republic of Komi: Uniqueness and global relevance of the biodiversity of the territory of the project. A.V. Bobretsov, T.N. Pystina et al., 2006. Hereinafter: "Reports"

According to the botanical and geographical zoning, the majority of the site falls into the Ural-Western Siberia province of the Euro-Asiatic conifer forest (taiga) region, and the forests of the smaller (plains) part are included into the North European province of the same region[6]. The vegetation cover has a complex structure: it has some traits of zonal distribution due to significant length of the territory from south to north and some traits of vertical zonality due to its mountain terrain.

The main types of vegetation are the forests of the plains, submontane regions and the slopes of the Urals as well as the mountain tundra. Less widespread are the swamps (lowland, spring, upland and transition ones). In the floodplains and creek valleys, communities of perennial herbs and brushwoods (mostly osiery) have developed. The communities formed by bushes (willow, juniper, dwarf birch and alder) can also be found in the mountains, above the tree line.

The area covered by woods amounts to more than half of the territory of the site. The dominant species in the majority of the forest landscapes is the Siberian spruce. In the mountain forests of the Northern Ural, which fall into the subzone of the middle taiga and the transition area between the middle and northern subzones of the taiga, a significant role in the formation of forest stand is played by the Siberian fir and the Siberian cedar. Moving north, the share of these species among the planted vegetation decreases, and they are replaced by the Siberian larch, which to the north of the 64th parallel forms mountain forests and woodland and comes up to the tree line on the slopes of the Saledy, Obeiz and Maldy ranges and the Sablya massif; the most southern location of the larch woodland massif is located on the Shchukael'-iz range. The pine forests do not take up a lot of space and are mostly common on the sandy soils of the fluvioglacial plain and the sandy terraces of the river Pechora. In the mountain forest belt of the Northern Urals, the fragments of pinery are confined to swamps only.

As for broad-leaved trees the most usual component of the tree layer is the birch. In case of catastrophic breakdowns of forest ecosystems (fires and windfalls), the birch and the aspen replace the coniferous species.

Low crown density of the growing stock, typical for virgin forest ecosystems and window dynamics, determines the mosaic composition of their lower layers. The underbrush is usually underdeveloped. The species composition of the herbaceous-suffruticose layer is poor. The forests of the site are characterized by a well-developed mat of moss and/or lichens. The moss mat is usually formed by green mosses; at the areas of increased humidity, a leading role in the formation of the ground cover starts to be played by sphagnum mosses, and at the drained ecotopes, by lichen spots. In the mountain forests, the role of herbaceous plants, principally ferns, has increased.

Excessive humidity and low average annual temperatures on the territory of the site contribute to swamp formation. The size of the swamped areas on the plains areas grows with the increase of the distance away from the river valleys and into watershed territories. The swampiness of the submontane and mountainous landscape zones is lower than that of the plains zone.

The valleys of rivers and creeks crossing the submontane and mountainous landscape zones of the site are underdeveloped. On the rocky stream beds and along the rocky towpaths, thickets of *Petasites radiatus (J.F.Gmel.) J.Toman (1972)* are formed. The towpath areas farther from the bank line are occupied by motley grasses. As the flood plain level increases, the free-growing grassland vegetation of the towpaths is replaced by meadow communities. Prevailing on the meadows are large gramineous plants or motley grasses. Without human interference, little by little the meadows begin to be overgrown by bushes and trees and are replaced by willow woods and primary birch woods of the herbaceous type.

In the mountains, the vertical zonality of the vegetation cover is clearly evident. The vegetation cover of the lower mountain belt of the Urals is similar to the vegetation of the submontane regions. At heights, the crown cover of dark coniferous forests begins to thin out, suppressed and top-dry trees appear in it, the share of firs or (on the Nether-Polar Urals) larch increases. Besides coniferous tree plantations, there are pure birch forests of the herbaceous type developed here, alternating with mountain meadow areas. Open mountain forests are little by little replaced with open woodland alternating with mountain tundra areas. The tree line in the southern part of the site is at the height of about 700 meters above the sea level, and on the Nether-Polar Urals it goes down to 400-200 meters above the sea level. Above the tree line, groupings of juniper are more typical of the southern part of the site, and osiery is widespread above the tree line in the Nether-Polar Urals and along the dells, in the southern part mostly along the dells. In the high mountains, there are dwarf species of plants.

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[6] Reports...

Vegetation

Higher plants

The first information about the vegetation of the site was obtained in the middle of the 19th century during the expedition of E. Hoffmann. Major studies go back to 1920s, and by now the vegetation complexes of the federal protected areas – the Pechora-Ilych Nature Reserve and the Yugyd Va National Park have been studied in detail.

The list of vascular plants[7] includes 817 species from 326 genera belonging to 92 families. This number amounts to a bit more than two thirds of the total number of species registered on the European Northeast of Russia. In the north to south direction, an increase of species diversity is noted. For example, for the territory of the Yugyd Va National Park, 668 species are known, and for the Pechora-Ilych Nature Reserve, 775 species.

The mainstay of the vegetation of the site is formed by angiospermous plants, with 2.6 more dycotyledons than monocotyledons. This proportion is close to the parameters for the whole taiga area of the Republic of Komi[8]. The species diversity of the gymnospermous plants is not great; however, some of them (*Picea obovata Ledeb.*, *Abies sibirica Ledeb.*, *Larix sibirica Ledeb.*, *Pinus sylvestris L.*) define the outlook of the landscapes of the majority of the territory of the site.

In the submontane and mountainous landscape zones, significant role is played by seedless vascular plants, primarily ferns. The share of the spore plants in this situation constitutes 5.6% from the total amount of species.

The systematic structure of the vegetation has a number of particular features concerning the major families. The top ten families notable by the most diversity in their species composition include *Asteraceae* (91 species), *Cyperaceae* (83), *Poaceae* (72), *Rosaceae* (50), *Caryophyllaceae* (44), *Ranunculaceae* (34), *Scrophulariaceae* (32), *Brassicaceae* (31), *Salicaceae* (24), *Fabaceae* (22).

The leading position of the first three families is typical for all the boreal floras in Eurasia. The leading families of the site include more than half of the species (59.1%). At the same time, one third of the families include one species only, which shows the relative youth of the flora of the site, the formation of which took place starting in the end of Pleistocene.

The range of the largest genera includes *Carex* (64 species), *Salix* (24), *Poa* (16), *Alchemilla* (15), *Hieracium* (15), *Viola* (13), *Potamogeton* (12), *Ranunculus* (12), *Stellaria* (12), *Juncus* (11). The aforementioned taxa unite about a quarter (23.7%) of the species. It is worth noting the clear leading position of the genera *Carex* and *Salix*, typical for the taiga floras of the European Northwest of Russia. The mountain features of the flora are reflected in the high diversity of the representatives of the genera *Poa, Hieracium, Juncus* and *Viola*. More than half of the genera (56.1%) contain one species only.

In the process of forming vegetation complexes, the territory of the site was little by little populated by species differing in the type and size of their range. Today the most widespread here are the boreal plants that determine the outlook of the plant communities of the taiga area. This latitudinal group includes 403 species (51.7%). The presence of a large mountain system with a marked mountain tundra and a golets belt within it determines a fairly high share of plants of the northern latitudinal groups – arctic, hypoarctic and arctic-alpine. These include the typical plants of the mountain and plains tundras (*Arctous alpina, Carex arctisibirica, Harrimanella hypnoides, Salix arctica, Salix lanata*), болот (*Betula nana, Salix lapponum*) and some inhabitants of the forests (*Avenella flexuosa, Sorbus sibirica*). Certain representatives of the arctic-alpine group (*Arabis alpina, Cryptogramma crispa, Cystopteris dickieana, Salix recurvigemmis*) also inhabit the rocks that stretch along the banks of the Ural rivers. In summary, there are 246 species of northern groups (31.6%); however, their participation in the formation of vegetation is not equivalent. The plants of the arctic-alpine element are much more numerous (127 species) than those of the arctic (47) and hypoarctic (72) elements.

The role of the plants of the southern latitudinal groups – nemoral-boreal, boreal and forest-steppe ones – is much smaller. The vegetation of the model territory includes 58 such plants (7.5%).

The species of the nemoral-boreal and nemoral groups (*Aegopodium podagraria, Carex rhizina, Daphne mezereum, Lathyrus vernus, Stellaria holostea, Milium effusum*, etc.) are probably relicts of the warm climatic periods of the Quaternary period.

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[7] Bobretsov A. V., Pystina T. N. et al. Uniqueness and global relevance of the biodiversity of the territory of the project. Report for the B phase of the UNDP/GEF project for the protected areas of the Republic of Komi. http://undp-komi.org

[8] Reports...

The forest-steppe group includes relicts of different ages (*Astragalus danicus, Anemone sylvestris, Dendranthema zawadskii, Pentaphylloides fruticosa, Pulsatilla patens, Veronica officinalis,* etc.).

The number of polyzonal species is also small – 56 (7.2%). Besides aquatic plants (*Alisma plantago-aquatica,* representatives of genera *Callitriche, Lemna, Potamogeton*), these also include weeds (*Capsella bursa-pastoris, Plantago major, Poa annua, Polygonum aviculare, Stellaria media, Thlaspi arvense,* etc.). The diversity of weed species within the protected area is much less than on the neighboring territories under cultivation by humans, so the share of polyzonal species turned out to be almost two times less than in the floras of the subzones of the northern and middle taiga.

The floras located in the boreal area of the Northern hemisphere differ from the floras of other areas by predominance of species with large geographical ranges, including the whole of the holarctic region or the Euro-Asian continent. The flora of the site is not an exception. It consists of Euro-Asian and circumpolar species – 34.4 and 33.4% relatively. A characteristic feature of the flora resulting from the site's location on the border of Europe and Asia is the participation of species typical for Siberia, which is higher than in other regions of the European Northeast of Russia (12.3%). The plants of this group play an important role in forming the vegetation cover.

For example, the species of trees characteristic for the communities of the Siberian polydominant taiga (*Picea obovata, Abies sibirica, Pinus sibirica, Larix sibirica*) act as edificators for forest communities of the site landscapes.

There are more European species than Asian ones – 14.8%. Many species of the families *Asteraceae, Rosaceae, Fabaceae* are predominantly spread in Europe.

The distinguishing feature of the flora of the site is the presence of endemic species only present within the Ural highland (*Oxytropis uralensis, Lagotis uralensis, Alchemilla semispoliata, Anemonasrtum biarmiense, Gagea samojedorum,* etc.) or the European Northeast (*Gypsophila uralensis* and *Lotus peczoricus*).

The territory of the site is characterized by severe climatic conditions – low values of annual average temperatures, short duration of the warm period of the year, and the volume of precipitation exceeds the standard of evaporation. Typical for most terrains are podzolic, swamp podzolic and peat soils, acid and poor in mineral elements and humus. All this determines the range of life forms and the balance of ecological groups of plants in the flora. The majority of plants are herbs. These include 668 perennial plants and 44 annual and biennial ones. The tree life forms are less diverse. There are 18 species of trees, 36 species of shrubs, 4 subshrubs and 28 small shrubs. The prevailing species are these that do not make big demands on soil composition. Oligotrophic species constitute 13%, and 45.7% fall to the share of mezooligotrophics. The plants of these groups populate rocks, swamps, mountain tundras and open woodlands; these include the typical forest plants of the lichen, green moss, long moss, grass-sphagnum and sphagnum groups of types. Mesotrophic plants constitute 29%. This group unites the plants of meadows and forests of the herbaceous group of types. Eumesotrophic plants make up 10%, and eutrophs only 2.3%.

With respect to the humidity factor, the species of the flora are distributed in the following way. The mesophytes make up the largest share (41.8%). These include the majority of the plants populating meadow communities and forests of well drained habitats, as well as moss tundras. Marshy and floodplain forests and wet meadows are populated by mesohygrophytes. This group includes 24.7% of the species. On the banks of water bodies, on the towpaths and swamps, hygrophytes are common; 7.5% of the species belong to this group. 36 species (4.6%) are true aquatic plants (hydrophytes). Under the canopy of pine forests of the lichen type, in the lichen tundras and on rocks the plants that can stand the deficiency of humidity are common. Their majority (19.1%) is included in the xeromesophytes group; the true xerophytes are far less common, they make up 2.3%.

The analysis of cenotic confinedness of the species shows the prevalence of meadow plants and plants typical for forest fringes and openings, which make up 30.5% of the list. This happens because the meadow communities, which occupy a subordinated role in the vegetation cover of the reserve, have the most optimal parameters of richness and moistening of the soils and, as the result, a high alpha diversity. The participation of the plants of the forest (18%) and tundra (18.4%) cenotic groups is significant, the one of the swamp group is a bit smaller (10.2%). Such a ratio on the whole corresponds to the representativity of various types of vegetation in the landscapes of the region.

The species that lean towards the unique ecotopes of the rocks are fairly diverse (8.2%). It is mostly that the relicts of various eras are concentrated here, representing both northern and southern groups of species.

It is possible to evaluate the participation of the weed (6.5%), coastal water (4.2%) and water (4%) plants as insignificant.

The ecosystems concentrated on the territory of the site function as key habitats of many rare, endemic and relict plant and animal species protected at local, regional and international levels.

The analysis of the available data shows that 172 out of 253 species (68%) of the vascular plants included in the Red Book of the Republic of Komi reside on the territory of the site. Out of these, 2 species belong to the 1 (E)* category, 22 are classed as 3 (R) category, 33 taxa are included in the 4 (I) category and 55 are protected in the 5 (Cd) status.

Among the rare plants there are species included in the Red Book of the Russian Federation (*Calypso bulbosa, Castillea arctica ssp. vorkutensis, Cypripedium calceolus, Dactylorhiza traunsteineri, Schivereckia podolica*) and the IUCN Red Lists (*Cypripedium calceolus*).

A number of species has their only locations in Europe on the discussed territory (*Novotorularia humilis, Primula pallasii*), others (*Pinus sibirica*) are on the boundaries of distribution.

The degree of anthropogenic transformation of the flora of the site can be assessed as insignificant, except for the area of active impact in the catchment area of the Kozhim river (Table 1).

Bryophytes

The mosses of the different parts of the site have been explored in an irregular manner; the species richness of this group of plants is identified to the fullest extent only in the Pechora-Ilych Nature Reserve.

The territory of the Pechora-Ilych biosphere reserve, which takes up 1.7% of the area of the Republic of Komi, contains about 55% of the species diversity of the bryoflora of the region.

The registered bryophytes belong to two classes, liverworts and leafy mosses. The list of bryophyte species includes 410 species and 5 subvarieties, including 90 species and 2 subvarieties of liverworts.

The systematic structure of the moss flora of the reserve has a number of particular features. The top ten families include the families found in both the taiga and the tundra zones of the Holarctic: *Amblystegiaceae, Sphagnaceae* and *Dicranaceae*. An important role in the composition of the bryophlore is also played by the *Pottiaceae* and *Grimmiaceae* families, represented mostly by mountain species which are fairly rare on the territory of the Republic of Komi and are found on the rocky substrates of the outbreaks of geological material and in the tundra areas. The share of the top ten families is 71%, that is, 2/3 of the whole composition of bryophytes, which underscores the northern nature of the bryoflora.

The bryophytes are registered on the whole territory of the nature reserve. There is no plant community where they are not found.

In all the explored forest formations of the reserve, the most numerous are the epigeic mosses, the most widespread among which are *Hylocomium splendens* (Hedw.) Schimp., *Pleurozium schreberi* (Brid.) Mitt., *Polytrichum commune* Hedw., *Aulacomnium palustre* (Hedw.) Schwaegr.

There are many rare bryophytes growing in the forest communities, including the taxonomic relicts of the Tertiary period: *Buxbaumia aphylla* (Hedw.) (on rotting wood) and *Schistostega pennata* (Hedw.) (on the roots of fallen spruces).

In the transition and upland swamps, both by the number of species and by participation in the formation of the moss cover, the representatives of the Sphagnaceae family are predominant; among these, the most interesting are the discoveries of *Sphagnum platyphyllum* (Lindb. ex Braithw.) Sull. ex Warnst.,listed in the Red Book of the Republic of Komi (1998), and *S. obtusum* Warnst., which is sometimes found in the European Northeast.

On the rocks along the banks of the rivers Pechora and Ilych and their tributaries as well on the rock pillars *Ditrichum flexicaule* (Schwaegr.) Hampe, *Distichium capillaceum* (Hedw.) Bruch et Schimp. and such protected species as *Neckera pennata* (Hedw.), *Myurella sibirica* (C.Muell.) Reim are growing. The last of the mosses listed above is in danger of disappearance in Europe; it is very rarely encountered in the European Northeast and is amassed only in the nature reserve.

The moss cover of tundra groupings which one can often encounter on the northern slopes of the mountains and on the Northern Ural mountain tops is composed of both forest species (*Hylocomium splendens, Polytrichum commune, Polytrichum juniperinum* (Hedw.), *Sanionia uncinata* (Hedw.) Loeske) and the typically tundra ones (*Aulacomnium turgidum* (Wahlenb.) Schwaegr., *Dicranum elongatum* Schleich. ex Schwaegr.). It is in such a location that the arctic moss *Loeskypnum badium* (Hartm.) Paul has been registered, which is currently found in the Republic of Komi only within the nature reserve.

The first to colonize bare spots of earth are not only ordinary bryophytes (Dicranella subulata (Hedw.) Schimp., Ceratodon purpureus (Hedw.) Brid., Pogonatum urnigerum (Hedw.) P.Beauv.), but also very rare leafy mosses encountered for first time in the territory of the Northern Urals (Bryum bicolor Dicks., B. amblyodon C. Muell., Dicranella humilis Ruthe, Pohlia andalusica (Hoehnel) Broth.) and the Republic of Komi (Atrichum flavisetum Mitt.).

The core of the bryoflora of the reserve consists of boreal species dominant in the epigeic cover of vegetation communities. A significant share (16%) belongs to bryophytes related to mid-mountain environmental conditions, which permits to characterize the studied bryophyte flora as mountain-boreal.

The location of the reserve on the border between Europe and Asia has determined the presence here of the bryophytes that have not only the circumpolar (that is, found in all the sectors of the Northern Hemisphere) type of range but also the European-American, Eurosiberian-American, Eurasian-American, Siberian and Siberian-American types.

There are 57 rare species of leafy mosses in the nature reserve that are under protection and are included into the Red Book of the Republic of Komi. The criteria of inclusion into the lists of rare bryophyte species that need protection are the small number of their locations on the territory of the reserve and the presence of the species in the Red Books of Russia and of the bryophytes of Europe.

One of the important results of the bryological studies in the Pechora-Ilych reserve is the discovery of six species of leafy mosses (*Myurella sibirica, Neckera pennata, N. besseri* (Lob.) Jur., *Buxbaumia aphylla, Hygrohypnum norvegicum* (Schimp.) Amann., *Dicranum viride* (Sull. et Lesq.) Lindb.) which are under protection in many European countries (Red Data ..., 1995). Also, 17 species of bryophytes were found on the studied territory which are encountered for the first time on the territory of the Republic of Komi.

The bryoflora of the Yugyd Va National Park is underexplored. On the whole, 156 species of leafy mosses and 33 liverworts have been registered. The bryophytes were mostly collected in the catchment areas of the rivers Kozhim (tributaries Big and Little Khayma, Durnaya), Lemva and Shchugor (Little Patok).

In the epigeic cover of the explored swamps and forests of the national park, the bryophytes always dominate and work as edificators. In the floodplain birch forests, species atypical for the northern Taiga, the Northern and Nether-Polar Urals have been noted – *Orthodicranum montanum* (Hedw.) Loeske, *Myrinia pulvinata* (Wahlenb.) Schimp., *Pylaisiella polyantha* (Hedw.) Grout. On the transition and upland swamps, there are representatives of the Sphagnaceae family rarely met in the Republic of Komi, *Sphagnum aongstroemii* C. Hartm., *S. lenense* Lindb. The indicators of the spring feeding of the swamps located in the valley ecotopes of the national park are *Paludella squarrosa* (Hedw.) Brid., *Helodium blandowii* (Web. et Mohr) Warnst., *Tomentypnum nitens* (Hedw.) Loeske.

On the ledge rocks, the *Dicranella grevilleana* (Brid.) Schimp leafy moss fairly rare on the territory of the European Northeast was discovered. At the outbreaks of rock, many unique species grow, including some very rare ones.

The geographical analysis shows that the bryoflora of the Yugyd Va National Park is mostly formed by the representatives of the boreal element. The most typical of those are *Hylocomium splendens*, *Pleurozium schreberi*, *Polytrichum commune*, *Ptilium crista-castrensis* (Hedw.) De Not., *Dicranum scoparium* Hedw., *Warnstorfia exannulata* (Guemb.) Loeske, *Aulacomnium palustre*, *Sphagnum angustifolium* (Russ. Ex Russ.) C. Jens., *S. capillifolium* (Ehrh.) Hedw., *S. girgensohnii* Russ., *S. magellanicum* Brid., *S. russowi* Warnst.

Among the hypoarctomountainous species the distribution of which is related to Arctic, to the northern part of the taiga zone and the mountains of the more southern latitudes, those often encountered are *Pseudobryum cinclidioides (Hueb.) T. Kop.* and *Rhizomnium pseudopunctatum* (Bruch et Schimp.) T. Kop. Other representatives of this element are more rarely seen within the boundaries of the surveyed territory; however, in their distribution they, too, are related to cold and excessively moist locations. For example, *Paludella squarrosa, Helodium blandowii, Calliergon richardsonii* (Mitt.) Kindb. grow on lowland and transition swamps.

It is very natural that the bryoflora of the national park is formed due to the participation of mountain species (*Abietinella abietina* (Hedw.) Fleisch., *Fontinalis antipyretica* Hedw., *Palustriella decipiens* (De Not.) Ochyra, *Racomitrium canescens* (Hedw.) Brid.) as well as the representatives of the northern latitudinal elements – the arctic mountain one and the hypoarctic one. The arctic mountain species *Polytrichastrum alpinum* (Hedw.) G. L. Smit is widespread in the nether-polar regions of both hemispheres as well as in the highlands of all continents. The hypoarctic moss *Sphagnum jensenii* H. Lindb. almost never enters the Arctic and is sporadically distributed over the whole boreal zone of the

Holarctic. The species of southern distribution – the nemoral *Myrinia pulvinata* and *Pylasiella polyantha* are very rarely met in the national park, only on the bark of deciduous trees in the floodplain willow and birch forests. Out of cosmopolitan species, only the *Ceratodon purpureus* (Hedw.) Brid. has been found.

The information listed here permits us to characterize the bryoflora of the national park as boreal with significant participation of mountain species as well as representatives of the northern geographical elements.

On the territory of the national park, there are seven protected species of bryophytes included in the Red Book of the Republic of Komi and three included in the Red Book of the bryophytes of Europe, with various categories of protection. Besides this, bryological research in the national park permitted to establish new locations of species sporadically found on the territory of the Republic of Komi (*Calliergon richardsonii, Dicranella grevilleana, Polytrichastrum alpinum*) as well as nine types of moss rare for the catchment area of the river Kozhim (*Dicranella grevilleana, Hygrohypnum norvegicum, Calliergon richardsonii, Polytrichastrum alpinum, Myrinia pulvinata, Orthodicranum montanum, Pylaisiella polyantha, Rhizomnium magnifolium* (Horik.) T. Kop., *Sphagnum teres* (Schimp.) Aongstr. ex C. Hartm.).

Basically, the bryoflora of the explored landscapes of the site (the territory of the Pechora-Ilych State Biosphere Reserve and the Yugyd Va National Park) by its systematic and geographic structures is of a mountain-taiga type.

The uniqueness of the bryoflora of these protected territories can be seen in the high percentage of participation of the rare species of bryophytes. In the explored region, 59 protected bryophytes out of 154 species included in the Red Book of the Republic of Komi have been found, as well as seven species from the Red Book of the bryophytes of Europe.

Besides, 17 types of bryophytes also due for inclusion in the Red Book of the Republic of Komi were found in the nature reserve for the first time in the Republic of Komi.

However, it is worth noting that the bryoflora of the territory of the site has not been identified completely and is waiting for its researcher.

For the majority of rare species of leafy mosses and liverworts listed in the regional Red Books of Russia and foreign countries, the specific threats and limiting factors still haven't been established.

The protection of bryophytes is currently mostly implemented by preserving their habitats in an unchanged state, since it is known that the mosses mostly perish when their habitats are destroyed due to felled forests, construction, mining and air pollution.

Lichens

The lichen biotas of the mountain regions are characterized by the richness and uniqueness of species composition due to a broad range of environmental niches found there because of the diversity of vegetation, substrates and microclimatic conditions. The best studied are the lichens of the plains part of the reserve.

Currently 866 species of lichens and mushrooms associated with them have been found in the Pechora-Ilych Nature Reserve, belonging to 241 genera, 78 families, 20 orders and 2 divisions[9]. This amounts to about 86% of the whole species composition of the lichens of the Republic of Komi. Out of these, 384 (that is, 44.3%) are currently found only in the nature reserve.

The diversity of lichens of the submontane and especially mountainous areas has been underexplored. Presumably only about half of the species of lichens of these areas have been identified.

The systematic structure of the biota of the lichens of the nature reserve is typical for the moderately boreal zone, the range of the leading families and genera by the number of their species indicates the mountain-boreal features of the biota.

If the high position of the families *Lecanoraceae, Cladoniaceae, Physciaceae* and *Bacidiaceae* within the range of families is characteristic for both mountainous and plains regions of the boreal zone, then the representatives of the families *Teloschistaceae, Porpidiaceae, Lecideaceae* are typical mountain species, and the families *Pertusariaceae* and *Verrucariaceae* have a leading position in the arctic and arctic-highland regions. The mountainous features are also notable at the genus level due to high positions of the genera *Caloplaca, Pertusaria, Lecidea, Rhizocarpon* and *Stereocaulon,* uniting epilite and epigeic species.

The mountain-boreal nature of the lichen biota in question is also supported by the analysis of distribution of the lichens by geographic elements. 38% of all the lichens belong to the boreal geographic

[9] Reports...

group; this percentage is significantly lower than in the plains – 62%. Besides the boreal species, arctic-alpine (29%), nemoral (10%), mountainous (9%) and multizonal (14%) lichens have been registered.

The diversity of the lichens is directly proportional to the number of substrates suitable for their habitation. Among the ecological substrate groups, epilites (36%), epiphites (25) and epigeics (21%) are predominant. Species of epixylic and epibryophyte groups have been noted, as well as parasites and parasymbionts on lichen thalluses.

The distribution of species by terrain regions, except for the plains coniferous area where the main works were concentrated, is currently of a preliminary nature. Nevertheless, for the plains area of the nature reserve 272 species are known, for the submontane area, 607 species, and for the mountains, 582 species.

Out of the surveyed vegetation communities and types of habitats, the maximum diversity of lichens is noted in the forest communities – 454 species. Following in the descending order by the number of species are mountain woodlands (319), high-mountain tundras (248), loose rocks and rock pillars (121), rocks (107), swamps (99) and meadows (32)[10].

Among the different forest formations, the spruce and fir-spruce forests are in the lead by the number of species and presence of rare and protected taxa. Of the most interest among these are first of all the valley and riverine spruce and fir woods of the submontane and mountainous landscape areas. The rarest lichens here are *Sclerophora coniophaea, Cheiromycina flabelliformis, Evernia divaricata, Chaenotheca gracillima, C. laevigata, Usnea longissima*. In old-aged aspen forests, high species diversity of lichens is also noted, as well as a large number of rare, unique and protected species; the most valuable are the findings of *Heterodermia speciosa, Sticta nylanderiana, Pertusaria hemisphaerica, Cetrelia olivetorum*.

Altogether, on the territory of the Pechora-Ilych nature reserve, its buffer area and the neighboring areas 65 out of 79 species of lichens protected on the republican level have been discovered. Six species are under protection on the territory of the Russian Federation. Out of these, only three species (*Bryoria fremontii, Lobaria pulmonaria, Tuckneraria laureri*) are included in the list of protected species on the territory of the republic.

The habitats of three other species protected in Russia (*Leptogium burnetiae, Lichenomphalina hudsoniana, Stereocaulon dactylophyllum*) were found very recently.

Many of the protected species are also under protection in the European boreal countries.

The distribution by categories adopted in the Red Book of the Republic of Komi is the following: 11 species are classed in the highest protection category 1 (E), 12 species – 2 (V), 17 – 3 (R), 14 – 4 (I), 11 – 5 (Cd).

High frequency of occurrence is mostly the characteristic of lichens having low grades of protection. However, seven species often met in the reserve have a 2 (V) protected status – these are *Cyphelium karelicum, Chaenotheca chlorella, Cladonia bellidiflora, C. luteoalba, Collema subflaccidum, Evernia divaricata, Stereocaulon dactylophyllum.* For many of them, many fairly viable populations have been identified.

Unique habitats within the nature reserve were found for 18 Red Book species, out of which 4 species have the protection status 1(E) – these are *Chaenothecopsis haematopus, Dimerella lutea,Multiclavula mucida, Sphinctrina turbinata.* The said lichens are also very rare on the territory of the Republic of Komi on the whole – only 2 to 4 habitats are known for each of them.

The maximum number of protected species was registered in the submontane landscape region – 55 lichens. On the lowland Yakshinsky area 41 species were found, in the mountains, 38 species.

The low number of protected species in the Northern Ural is only explained by insufficient exploration. The overwhelming majority of protected species grows in forests of various types (54 species or 79%). This pattern is characteristic for the Republic of Komi as a whole, where almost 97% of the Red Book lichens grow in the forests.

The richness of species composition and multiple finds of rare species of lichens are not the only thing that characterizes the lichen biota of the Northern Ural and adjoining territories. In the opinion of the European lichenologists, nowhere else in Europe such unique epiphyte complexes have survived, where in one substrate you can find from 3 to 8 species included in the Red Books of various levels.

Not only the forest communities of the nature reserve, but also the forests on the adjoining territories are characterized by a high level of species diversity, including Red Book species. For example, of especial interest are overmature aspen forests widespread on the hillsides of Andyuga Parma

[10] The figures shown for the number of species by types of habitat are incomplete due to small numbers assembled

(the Un'ya wildlife sanctuary) and old-aged spruce forests and outcrops of rocks on the left bank of the river Pechora near the Shizhim post (wildlife sanctuary The river Pechora area). An exceptionally rich composition of species is characteristic for forests growing in the vicinity of the Ebeliz range (the river Ilych catchment area). In the riverine spruce forests here the most numerous population on the project territory of a very rare epiphyte, *Usnea longissima*), which is rightfully considered to be the symbol of virgin forests, has been currently discovered.

The Yugyd Va National Park is less explored in what concerns lichens. According to the information of the explorers, more than 450 species of lichens are found in the Nether-Polar Urals. In the taxonomic structure of the lichen biota, the most species diversity in the park is found in the families Parmeliaceae, Cladoniaceae, Lecanoraceae, Physciaceae, Pertusariaceae, Bacidiaceae, Lecideaceae, etc. The lists of top ten families and genera of the national park and the nature reserve are very similar. The range of substrates in the mountains is very rich: it includes various rocks, fine earth spots, crushed stone areas, gravel, peat areas, dead timber, live trees and shrubs, various types of lichen and moss cover. The balance of substrate groups of lichens in mountain tundras is different from the plains tundras and the taiga zone. Among the macrolichens, epigeic species prevail, as they do in plains tundras (more than 100 species), but their share (about 60%) is much smaller. The second place belongs to the epilite group (about 50 species) which is what defines the uniqueness of the Urals lichen floras. Out of these, the role of the representatives of the families Parmeliaceae (Arctoparmelia centrifuga, Asachinea chrysantha, Brodoa intestiniformis, Melanelia stygia, Parmelia saxatilis, Tuckermannopsis hepatizon), Stereocaulaceae (Stereocaulon saxatile, S. vesuvianum, S. botryosum, S. subcoralloides, S. symphycheilum), Umbilicariaceae (Umbilicaria cylindrical, U. deusta, U. hyperborea, U. proboscidea, U. torrefacta), Physciaceae (Physcia caesia, P. dubia, Physconia muscigena), Teloschistaceae (Xanthoria candelaria, X. elegans) is the most significant in forming the mountain tundra and alpine tundra lichen groupings. In the primary soil formation on rock substrates, the role of crustaceous epilite lichens representing the genera Lecidea, Porpidia, Rhizocarpon, Lecanora, Pertusaria is important. In the mountain tundras there is also more than 30 species of epiphyte and epixile macrolichens, the species diversity of which is much higher in taiga communities. Among the crustaceous lichens, the diversity of epiphytes, epixiles and epibryophytes that settle on mosses is quite significant (more than 50 species).

Microclimatic and corresponding phytocenotic conditions in the mountain tundras of the Nether-Polar Urals are quite diverse. The regular change in their balance determines the pattern of altitudinal zonality which is also noticeable in the analysis of the lichen biota. Each zone has a characteristic species composition of lichens. The species diversity of the lichen and the structure of the lichen synusia changes along the altitude gradient. In the larch woodland belt, the participation of the lichens in the composition of the ground vegetation is insignificant: the projective cover does not exceed 10%, and the species saturation is about 30 species. However, the total number of the species of macrolichens due to epiphytes and epixiles is quite large, more than 70 species. The character of the epigeic lichen synusias is mostly determined by fruticose cladonias (*Cladonia arbuscula, C. rangiferina, C. stellaris, C. uncialis*). In the small bush tundra belt, 45 species of macrolichens can be found, the species saturation of lichen synusias can reach 35 species, and the summary projective cover does not exceed 15%. As well as fruticose cladonias, the place of co-dominants in epigeic lichen synusias can be taken by cetrarias (*Cetraria isladica, Flavocetraria nivalis, F. cucullata*) and stereocaulons (*Sterecaulon alpinum, S. paschale*). In the suffruticose tundra belt, the number of species rises to 60, species saturation to 40, and projective cover to 25-40%. Here the significance of fruticose cladonias in the composition of epigeic lichen synusias decreases, the cetraria groupings become more widespread. In the lichen tundra belt, all the cenotic indicators of the lichen synusias reach their maximum value: 75 species of macrolichens can be found here, species saturation reaches the level of 50 species, and the projective cover reaches 50%. Many epilites, due to decreased competition from the obligate epigeic lichens, switch to the fine earth substrate. Besides the species listed above, *Arctoparmelia centrifuga, Asachinea chrysantha, Cetraria nigricans* and *Sphaerophorus globosus* are also abundant here. In the alpine tundra belt, a decrease of the general species diversity of lichens to 65 species and of species saturation to 32 species is observed; however, the projective cover is not significantly changed. The over-the-soil lichen synusias simplify their structure. The most abundant are the psychrophyte species – *Cladonia borealis, C. bellidiflora, Cetrariella delisei.*

The hydrological regime in the mountain tundras varies from unstable (rock surfaces, loose rocks) to stagnant (peat bogs). At the same time the Urals region is more humid in comparison to the nearby plains territories. Much more precipitation falls here than on the neighboring territories. This is why in the lichen flora of the Nether-Polar Urals all the groups of lichens in their relation to humidity conditions are represented, from xerophytes to hygrophytes. The xerophyte group includes the majority of epilyte

lichens from Parmeliaceae and Umbilicariaceae families. Most cladonia and stereocaulon species prefer growing in the conditions of moderate humidity. The typical hygrophites are the cyanobiont lichens from the Collemataceae and Peltigeraceae families.

For the mountain tundras, significant ranges of variance of snow depth are also characteristic. This is why both chionophilous and chionophobic lichens are characterized by significant diversity. The chionophilous lichen groupings develop on slopes covered by deep snow in winter or in basin landscapes and are composed first of all from such species as *Cladonia ecmocyna, C. bellidiflora, Stereocaulon rivulorum, S. glareosum, Cetrariella delisei.* Chionophobic groupings are confined to elevated elements of the landscape where the snow cover in winter is constantly blown away. For these, the presence of the representatives of the Parmeliaceae family – *Alectoria ohcroleuca, A. nigricans, Bryocaulon divergens, Bryoria nitidula, Flavocetraria nivalis, F. cucullata, Cetraria nigricans, Pseudephebe pubescens* – is characteristic.

The habitats encountered in the Nether-Polar Urals are not equisignificant in what relates to species and cenotic diversity of lichens. Its largest share falls to rock pillars and complexes of spotted suffruticose tundras and rocky deposits.

The species composition of stone streams and rocks is very rich. The complete list of macrolichens of these ecotopes includes more than 140 species.

The lichen flora of the Nether-Polar Urals also has a number of particular features in what concerns botany and geography. The latitudinal and longitudinal boundaries of dispersal of many species pass through the territory of the Nether-Polar Urals. On the whole, Urals is the zone of contact of Eastern European and Western Siberian lichen floras, and the Nether-Polar Urals, of arcto-mountainous and boreal-mountainous Urals lichen floras. Many species found here have a mountainous habitat, that is, do not grow on the neighboring plains territories (there are more than 30 such species among the macrolichens). A great diversity in arcto-alpine species (45) is also typical. Nevertheless, the boreal fraction (about 70 species) prevails. A significant share of species (25) is characterized by multizonal distribution. The nemoral (4) and hypoarcto-mountainous (10) elements are represented by several species.

In the national park, rare and protected species of lichens are encountered or may be found, many of which are listed in the Red Book of the Republic of Komi. These are *Bryoria bicolor, Hypogymnia vittata, Lasallia rossica, Lasallia pensylvanica, Melanelia agnata, Parmelia fraudans, Pilophorus robustus, Stereocaulon nanodes, S. spathuliferum, S. sibiricum, Umbilicaria decussata, U. leiocarpa, U. vellea* and *Xanthoria sorediata*, which are acclimatized on rocky substrates; *Cetraria laevigata, Cladonia acuminata, C. decorticata, C. luteoalba, C. macrophyllodes, C. scabriuscula, Hypogymnia subobscura, Peltigera elisabethae, P. frippii, P. lepidophora, P. lyngei, P. venosa, Solorina saccata, S. spongiosa* and *Vulpicida tilesii*, inhabiting the ground layer of the tundra aggregations.

Algae

The territory of the site retains freshwater resources which here are concentrated in numerous mountain lakes, glaciers, snowfields, creeks and rivers. In the structure of water ecosystems algae are of major importance, since they are a primary element in the organization of the freshwater biota, functioning as producers of organic matter and oxygen.

The role of the algae is especially great in extreme conditions, including in mountain ecosystems where harsh conditions influence the diversity of all the groups of live organisms.

Many species of algae are sensitive to various types of anthropogenic impact and are environmental indicators of the state of fresh water ecosystems. In the conditions of protected areas, reference ecosystems.

The studies of biodiversity on the territory of the site are few and fragmentary. The best studied are the algae of the national park, the catchment areas of the rivers Shchugor, Vangyr, Maly Patok and Kozhim. On the territory of the Pechora-Ilych Nature Reserve the studies of algae are sporadic.

To this moment, more than 500 species of algae in seven divisions have been identified on the territory of the national park. In the catchment area of the river Shchugor 295 species, subspecies and forms falling into six divisions of freshwater algae have been found, out of which the Cyanophyta make up 70 species (23.7%), the Chrysophyta –7 (2.4%), the Bacillariophyta –154 (52.2%), the Xanthophyta – 10 (3.4%), the Chlorophyta –50 (16.9%), the Rhodophyta –4 (1.3%). The most diversity of algae (242 species) has been registered in a streamway of the river on the territory of the mountains.

In the Vangyr river valley, the Ponomarevskoye lake was studied, and 136 species (157 with subspecies and forms) of diatomic algae falling into 34 genera, 15 families and four orders were found

there. The species richness of diatoms in the Ponomarevskoye lake may be compared with their richness in the mountain valley lakes of the Nether-Polar Urals.

In the Nether-Polar Urals in the Vangyr river valley the algae of the Sabelnikovoye lake and the overgrowth of mosses of the coastal zone of the lake have been studied. 57 species of diatoms have been found. In what concerns their diversity, the leaders are the genera *Cymbella, Gomphonema, Achnanhtes typical for the overgrowth cenoses,* the second place is taken by *Fragillaria, Navicula, Nitschia.*

For the diatomic communities on mosses, polydominance is typical, including several species with the maximum abundance of six points. Prevailing in the epyphyton were widespread dominant species *Achnanthes linearis* (W. Sm.) Grun., *Cymbella ventricosa* Kütz.,*Gomphonema acuminatum* Ehr. In the periphyton of the mosses, 10 species of algae were found, with the predominance of the blue-green algae *Rivularia aquatica* (de Wild.) Geitl sensu lat. and *Nostoc linckia (*Roth) Born. ex Born. et Flah., which form colonies of up to 3 mm in diameters; classified as subdominants according to their abundance are *N. paludosum* Kütz. ex Born. et Flah. and *Tolypothrix tenuis* Kütz. ex Born. et Flah. The diversity of green algae is fairly high. These are large multicellular filamentous algae *Chaetophora pisiformis* (Roth) Ag., *Bulbochaete varians* Wittr., *Spirogyra sp.* and unicellular Desmidiáles: *Closterium acerosum* (Schrank) Ehrenb., *Cosmarium margaritiferum* Menegh.

In the catchment areas of the rivers Kozhim and Small Patok, 301 species from 7 divisions were identified. The diversity of the plankton, periphyton, benthos of the lemnic and lentic ecosystems has been studied. The mainstay of the algae communities is formed by the families *Desmidiaceae, Nostocaceae, Oscillatoriaceae, Phormidiacae, Merismopediaceae и Rivulariaceae* of the Chlorophyta and Cyanophyta divisions. It was demonstrated that the complex of dominant species is formed by green, blue-green and diatomic algae, which is on the whole characteristic for the water ecosystems of the northern regions as well as mountain algofloras.

As a result of the studies of algae diversity by the Institute of Biology in various bodies of water in the catchment area of the river Big Patok, 300 species belonging to 86 genera of 48 families, 16 orders and 7 divisions were identified. The mainstay of the algae communities is formed by the families *Desmidiaceae, Nostocaceae, Oscillatoriaceae* and *Phormidiacae* of the Chlorophyta and Cyanophyta divisions, which is also characteristic for other algae floras of the explored water bodies on the territory of the national park. The lowest diversity in the ecological groupings is found among the algae of the plankton (25 species), which is characteristic for mountain water bodies with low mineralization and a harsh temperature regime. The richest species diversity is found among the algae of the periphyton: 125 species of algae from 7 divisions have been identified here. In the benthos, 56 species of algae from 5 divisions have been identified.

The ecologic and geographical analysis showed the predominance in the explored water bodies of plankton-benthos (45%) and plankton (30%) species which are widespread (70%) and indifferent towards the salinity (46%) and acidity (54%) of the environment. The dominant complex of the lakes includes algae characteristic for the overgrowth of stagnant water bodies: *Tolypothrix tenuis, Anabaena lemmermannii* P.Richt. et al. In the rivers, the mainstay of the species diversity of the algae communities is formed by the epiliton and periphyton algae, the majority of which is rheophilic: *Ulothrix zonata* (Web. et Mohr.) Kütz., *Hydrurus foetidus* Kirhn., *Tetraspora lacustris* Lemm. et al.

In the explored water bodies and water courses, rare species of algae were identified that are exclusive to undisturbed very clean freshwater ecosystems. Out of these, on stony sandbars and shallows of the river Patok and creeks, large (sometimes up to 3-10 cm) fruticose thalluses of the red *Batrachospermum moniliforme* Roth and *Lemanea fluviatilis* Ag. algae have been encountered; the mucous chords of the yellow-green *Hydrurus foetidus* alga and thelong thalluses of the green alga *Tetraspora cylindrical* (Wahl.) Ag. are also found here en masse. On the bottom of a number of large and small lakes, macroscopic thalluses of the charophyte *Nitella opaca* (Bruz.) Ag. gather. All the aforementioned algae are classed as rare species, some of them are listed in the Red Books of many regions and are recommended for listing in the Red Book of Russia. On the territory of the Republic of Komi, these species can only be found in the water bodies of the Nether-Polar and Northern Urals where anthropogenic pollution is absent and the hydrochemical characteristics of these water bodies correspond to the xeno- and oligotrophic status, first grade of water quality.

The development of these species in water bodies is the evidence of the good state of the water ecosystems of the site within the boundaries of the Northern and Nether-Polar Urals.

Fungi

The fungi have a varied role among the components of the forest biocenoses. The fungi provide plants with soil mineral elements and water (mycorhiza formers). Wood-destroying fungi, due to a powerful fermentative complex are able to decompose lignine and cellulose and play a leading role in the process of destruction of wood, which is one of the key stages in the process of circulation of elements and energy in forest ecosystems.

To assess the state of the forest ecosystems, it was suggested to use some species of fungi (mostly aphyllophoroid macromycetes) as the most significant bioindicators of the state of the forest.

The best explored is the microbiota (especially two taxonomic groups of fungi – the aphyllophoroid macromycetes and the agaricoid basidiomycetes) of the Pechora-Ilych Nature Reserve.

Within the nature reserve and its buffer zone, the habitats of 295 species of wood-destroying fungi were found, belonging to 128 genera, 47 families and 21 order.

The taxonomic analysis of the biota of the aphyllophoroid macromycetes found that the largest orders on the territory of the nature reserve are *Hyphodermatales* (56 species), *Fomitopsidales* (42) and *Hymenochaetales* (25). The leading families are *Chaetoporellaceae* (27 species), *Phaeolaceae* (22), *Fomitopsidaceae,* (20), *Schizophyllaceae* (17), *Coriolaceae* and *Phellinaceae* (15 species each).

On the whole, the range of families is characteristic for the taiga zone of the northwestern part of Russia, where a high level of biodiversity is mostly found in the families *Chaetoporellaceae*, *Fomitopsidaceae*, *Phaeolaceae* and *Schizophyllaceae*.

The average species saturation of families is 6.3, and with genera, 2.3. The largest number of species is found in such genera as *Phellinus* (15 species), *Postia* (14), *Hyphodontia* and *Skeletocutis* (10 each), *Antrodia* and *Phlebia* (9 and 8 species accordingly).

The high species saturation of such genera as *Antrodia, Phlebia, Postia* and *Skeletocutis* also is an evidence of the boreal features of the explored biota.

Identification of the characteristics of the geographic distribution of species that make up the biota, its position among the zonal and regional biotas is one of the main tasks of mycogeography.

Among the aphyllophoroid macromycetes on the territory of the reserve, the most completely represented are the species of the multizonal geographic element – 155 (53%), which includes such fungi as *Amphinema byssoides, Gloeoporus dichrous, Fomitopsis pinicola, Hyphodontia sambuci, Porotheleum fimbriatum* etc.

The representatives of the boreal elements, which include *Antrodia serialis, Cystostereum murrayi, Chaetoderma luna, Fomitopsis rosea,Skeletocutis papyracea* etc., amount to 128 species (43%). Together, they constitute the main core of the biota of aphyllophoroid macromycetes – 151 species (96% of the whole species composition)

The share of nemoral species is small, 4% only (*Ganoderma lucidum, Ischnoderma resinosum, Oxyporus populinus, Sistotremastrum niveocremeum* etc.).

The distribution by longitudinal-regional parameter showed that the majority of species have ranges of extensive type. For example, there are 114 multiregional species widespread in both Northern and Southern hemispheres (39% of the total species composition) – these are *Bjerkandera adusta, Hymenochaete tabacina, Mycoacia fuscoatra, Phellinus nigrolimitatus*, etc.

Within the boundaries of the Holarctic floral reign, 143 species have been identified (48%): *Antrodia heteromorpha, Diplomitoporus lindbladii, Hapalopilus rutilans, Phellinus chrysoloma, Steccherinum fimbriatum, Veluticeps abietina*, etc. The species with eurasian, european and amphiatlantic distribution are represented by insignificant numbers and in total amount to 13%.

As a whole, in the biota of the aphyllophoroid macromycetes of the nature reserve prevailing are the species the ranges of which in the world are quite extensive – the species of the multizonal geographical element with a multiregional type of range (cosmopolites) and boreal species with a holarctic type of range.

The substrate is one of the main factors that define the presence and change of species of aphyllophoroid macromycetes in a specific biogeocenosis. The majority of aphyllophoroid macromycetes (263 out of 295 registered species of the nature reserve, or 89%) are xylotrophs, that is, the major substrate for them is wood in its various states (live wood, dead wood, fallen trunks and branches, etc.)

One of the minor groups (0.2%) are sapotrophs on herbaceous plants which are represented by species of the genus *Typhula*.

31 species (10.8%) have been identified on ground litter, humidified wood remainder (leaf fall, forest litter and cones) and soil – these are mostly the representatives of cantarelloid, clavariod and bunker fungi. Seven species were found on the fruit bodies of other macromycetes.

As a rule, there aren't many strictly specialized and omnivorous species among the xylotrophic group of aphyllophoroid macromycetes, the majority of fungi are confined to specific groups of species (coniferous or deciduous), usually with preference for one or two hosts.

Out of 263 species identified on wood only 38 species (15%) can be classified as omnivorous, since they were found on the wood of both deciduous and coniferous trees.

110 species (42%) are connected to the wood of deciduous trees, and a group of a similar size amounting to 115 species (43%) unites the species found on coniferous trees only.

The largest number of wood-destroying fungi was found on the main forest-forming species of trees – on spruces (124 species), pines (89), birch (101) and aspen (112). On other tree species the diversity is much less: 50 species for willow, 38 for larch, 32 for cedar, etc. The most specificity of species composition of aphyllophoroid fungi among coniferous trees is found for spruces (32 species) and pines (16 species). For other gymnosperms the specificity is low: less than 10 species, or can't be traced.

A similar pattern is notable when analyzing the species specificity of aphyllophoroid macromycetes which settle on the wood of deciduous trees. As with coniferous trees, the most specificity is notable among the main forest-forming species – aspen (23 species) and birch – 12 species.

For 245 wood-destroying species, by literature data it was possible to identify the type of rot they produce. 186 species (76%) produce white rot, 59 (24%) are brown rot fungi.

The largest number of aphyllophoroid fungi (181 species) is found in spruce forests. In other formations, the indicator of species richness is a bit lower and amounts to 165 species for mixed forests, 132 for aspen forests, 131 for pine forests, 67 and 62 for birch forests and floodplain ecotopes respectively. The largest number of unique species was found in spruce forests. These include *Diplomitoporus crustulinus, Laurilia sulcata, Piloporia sajanensis, Skeletocutis kuehneri, Tubulicrinis medius*, etc. For other forest formations this indicator is much lower.

The list of fungi species included in the Red Book of the Republic of Komi has 32 taxa, 23 species out of which are aphyllophoroid macromycetes. On the territory of the nature reserve 21 species were noted, out of these 11 species have the 3(R*) status(Clavariadelphus pistillaris, Diplomitoporus crustulinus, Fomitopsis officinalis, Ganoderma lucidum, Grifola frondosa, Hericium coralloides, Phlebia martiana, Pycnoporellus alboluteus, Rigidoporus crocatus, Skeletocutis lilacina* and *Steccherinum collabens*), five species each belong to the categories of protection 4(I) (*Anomoporia albolutescens, Bondarzewia mesenterica, Clavicorona cristata, Creolophus cirratus* and *Onnia tomentosa*) and 5(Cd) (*Antrodia crassa, Climacodon septentrionalis, Fomitopsis cajanderi, Lentinellus vulpinus* и *Phellinus sulphurascens*).

A detailed study of species diversity of agaricoid fungi of the Pechora-Ilych Nature Reserve was conducted only in the southern part of the reserve (the catchment area of the upper Pechora). The fungi were collected in all the terrain regions and in all the altitudinal belts of the western macroslope of the Urals. As a result, 301 species belonging to 76 genera, 20 families and 5 orders have been identified. Out of these 229 species are listed for the first time for the Republic of Komi, one species (*Mythicomyces corneipes* (Fr.) Redhead et A.H. Sm.) is new for Russia. Besides, since 1941 a study of phenology and productivity of 22 types of edible mushrooms is being conducted in the lowland area of the nature reserve.

The top ten leading families of agaricoid basidiomycetes of the nature reserve include *Cortinariaceae* (86 species), *Tricholomataceae* (73), *Russulaceae* (34), *Strophariaceae*, *Boletaceae* (16 species each), *Bolbitiaceae* (11), *Entolomataceae* (9), *Pluteaceae* (8), *Agaricaceae*, *Amanitaceae*, *Coprinaceae* (7 species each). The first three families *Cortinariaceae, Tricholomataceae* and *Russulaceae* account for 64% of the species. The leading position of these families in the mycobiota is characteristic for the whole forest zone of the Holarctic. The small numbers of the families *Amanitaceae* and *Hygrophoraceae* (4%), mostly represented by nemoral species, also indicates the boreality of the explored biota.

Single- and two-species families amount to 2% of all the genera. The other families which include from three to four species amount to 7%. The largest number of genera is noted in the families *Tricholomataceae* (26 genera), *Cortinariaceae* (9) and *Strophariaceae* (7). The abundance of species in the genera *Cortinarius, Mycena, Lactarius, Russula, Galerina, Clitocybe*, characteristic for northern biotas, confirms the boreality of the studied biota.

The role of the "southern" genera – *Entoloma*, *Pluteus* is small (2% and 3% of the total number of species respectively). 33 genera are single-species. The genus *Suillus* (8 species) being among the principal genera shows the Eastern Asian influence on the formation of the mycobiota of the nature reserve.

The analysis of the trophic structure of the mycobiota of the agaricoid basidiomycetes of the territory of the nature reserve showed that the majority of species are classified as saprotrophs (53%). Out of these, xylotrophs, litter and humus saprotrophs are prevailing (19%, 14% and 11% respectively). The mycorhiza formers amount to 46.5%. One species is a facultative parasite.

The distribution by main types of habitats showed that the biggest species diversity is found in forest communities, and among them, in spruce forests. The least species are found in mountain tundra and in ruderal habitats. In terms of nutrition, saprotrophs prevail in almost all the ecotopes studied. The share of xylotrophs in forest habitats is roughly similar. They are absent in mountain tundras and on meadows, since windfall here is almost absent. The litter saprotrophs were found in all types of explored forests and mountain tundras. Other trophic groups are represented by a small number of species, but their distribution by various types of habitats has a number of particular features. The mycorhiza formers prevail in pine, small-leave and mixed forests and are present in almost all the explored habitats. Their share in different types of forests is roughly similar. There are very few of them in mountain tundras and on the meadows.

It was found that from the plains to the mountains the species composition of agaricoid fungi decreases: 202 species on the plains, 169 in the foothills, 88 in the mountains. The high systematic diversity of the mycobiota of the plains area is explained by a more productive natural environment. The following protected species were found on the territory of the reserve: *Cortinarius violaceus, Gyroporus cyanescens, Leccinum percandidum* and *Tylopilusfelleus*.

The mycological aspect of the natural ecosystems of the Yugyd Va National Park is much less explored. Currently, only the information on species diversity of aphillophoroid macromycetes for forest communities of the middle and lower reaches of the Small Patok river has been obtained. 93 species of 17 orders, 30 families and 58 genera were identified.

The taxonomic analysis of the biota of the wood-destroying fungi showed that the largest orders are *Hyphodermatales* (22 species), *Hymenochaetales* (16), *Fomitopsidales* (11) and *Schizophyllales* (8). The leading families are *Chaetoporellaceae* and *Phellinaceae* (10 species each), *Fomitopsidaceae* and *Schizophyllaceae* (8 species each).

The average species saturation of a family is 3.1, of a genus – 1.6. The large genera include *Phellinus* (10 species), *Hyphodontia, Skeletocutis* и *Trichaptum* (4 species each), *Antrodia, Fomitopsis, Phanerochaete* and *Trametes* (3 species each). The high species saturation of such typical boreal genera as *Antrodia, Hyphodontia, Fomitopsis* and *Skeletocutis* is an evidence of the boreal features of the explored mycobiota.

The most completely represented species on the territory of the park are those of the multizonal geographical element – 57 (61 %), which includes such species as *Amphinema byssoides, Gloeoporus dichrous, Fomitopsis pinicola, Hyphodontia sambuci,Porotheleum fimbriatum, Trametes ochracea*, etc. The representatives of the boreal element (*Antrodia serialis, Cystostereum murrayi, Chaetoderma luna, Fomitopsis rosea, Skeletocutis kuehneri* etc.) include 34 species (37 %). Jointly they make up the mainstay of the mycobiota – 91 species (98% of the whole species composition). Only 2% fall to the species of the nemoral geographic element (*Cystostereum subabruptum* and *Hypochnicium eichleri*).

The distribution by the longitudinal-regional characteristic is as follows: 37 holarctic species, or 40 % (*Amylocystis lapponica, Diplomitoporus lindbladii, Fomitopsis rosea, Phellinus chrysoloma, Trichaptum abietinum, Veluticeps abietina* etc), 46 multiregional species, 50 % (*Antrodia serialis, Bjerkandera adusta, Hymenochaete tabacina, Mycoacia fuscoatra, Phellinus nigrolimitatus* etc.). The species with european, amphiatlantic and eurasian distribution are represented by insignificant numbers and in total amount to 10%.

The majority of the identified aphillophoroid macromycetes is classified as xylotrophs, that is, they inhabit trees – 93 species. Wood-destroying fungi are highly selective towards their substrate. For example, 49 species are found on the wood of coniferous trees only, 39 on small-leaved deciduous trees. 5 species live on both deciduous and coniferous trees.

The maximum number of species of fungi is connected to such species of trees prevailing in that region as spruce, on which 49 species are registered, and birch – 33 species. The number of species identified on other tree species is insignificant: 10 species on willow wood, 7 on larch wood, 6 on aspen wood, 3 on cedar wood, 2 on bird cherry and larch, 1 on rowan and alder each.

The most specificity of the species composition of wood-destroying fungi is found on spruce, on the wood of which 38 species not found on other tree species have been registered (*Amylocystis lapponica, Crustoderma dryinum, Dichostereum boreale, Heterobasidion parviporum, Phlebiopsis gigantea, Onnia leporina, Vesiculomyces citrinus*, etc.). Out of the deciduous tree species these with the

most specificity are the birch – 23 species (*Chondrostereum purpureum, Fomes fomentarius, Hyphodontia barba-jovis, Piptoporus betulinus, Phellinus nigricans* etc.) and the willow – 22 species (*Gloeocystidiellum leucoxanthum, Hymenochaete tabacina, Hymenochaete tabacina* etc.).

As in other taiga forests, the number of fungi that invoke white rot is much higher than the number of fungi that invoke brown rot – 84% and 16% respectively.

Two species were found in the catchment area of the river Small Patok (*Fomitopsis cajanderi* and *Hericium coralloides*) that are listed in the Red Book of the Republic of Komi.

In the undisturbed old-aged spruce woodlands of the middle and lower reaches of the river Small Patok species were found that serve as indicators of virgin forests – these are *Amylocystis lapponica, Cystostereum murrayi, Laurilia sulcata* and *Phlebia centrifuga*. Besides, the most significant species of old-aged forests (*Chaetoderma luna, Crustoderma dryinum, Fomitopsis rosea, Onnia leporina, Perenniporia subacida, Phellinus chrysoloma, P. ferrugineofuscus, P. nigrolimitatus, P. viticola* and *Pycnoporellus fulgens*) that suffer in significant ways from forest management practices were also identified. It is worth noting at the same time that some of the indicator species listed above were found quite often and in large amounts, for example, *Laurilia sulcata, Phlebia centrifuga, Perenniporia subacida, Phellinus chrysoloma, P. ferrugineofuscus*.

The mycobiotas of the site are typical for the taiga zone, their basis are species widespread in European forests. High taxonomic diversity of aphillophoroid and agaricoid macromycetes, presence of a large number of rare and protected species as well as indicator species are the evidence of absence of anthropogenic influence and of high ecological value of forest ecotopes.

Soil-dwelling invertebrates

It is believed that the soil fauna and its habitat are the only universal and stable biological system which is preserved in the environment even in the situation of the deepest transformations.

The role of the soil-dwelling invertebrates in the life of the biogeocenosis is significant – they participate in soil formation, creation and preservation of soil fertility, restoration of the nutritional agents within the soil that were removed from it by plants, and constitute an integral part of the integrated food chain system. The state of the soil-dwelling fauna reflects the processes that take place in the soil, and the information about the population of the soils helps tracing the particular features of soil formation in different types of soils.

Currently this issue is becoming more relevant, since as a result of human economic activities indigenous types of soil with related ecosystems are disappearing. During the last 50 years, the anthropogenic impact on the ecosystems has increased, and the need to diagnose the changes in soil cover led to the development of the bioindication branch of the soil zoology studies.

The invertebrates are used as indirect bioindicators of anthropogenic change; this is why they are recommended for use in monitoring on the level of a complex of species. Currently such representatives of the soil fauna as earthworms, coleopterans, springtails, oribatids are acknowledged as the leading groups for the biomonitoring of the soil layer of ecosystems. The following can be viewed as such criteria of anthropogenic violation of ecosystems: a) taxonomic diversity of invertebrates (including species diversity) which characterizes the degree of the mosaicity of the soil and vegetation conditions in the explored biocenosis; b) density (specimen/m2) and biomass (g/m2) related to the richness of the soil and the productivity of the biocenosis; c) the spectrum of life forms and trophic groups reflecting the range of ecological niches and utilization of layers. Various types of anthropogenic impact violate the structure of the biocenosis which leads to changes in the stated characteristics.

In the soils of the site there are resident invertebrates of two dimensional-functional groups. The mesofauna is represented by such large invertebrates as earthworms, common centipedes, ground beetles, road beetles, snapping beetles, weevils, soldier beetles, larvae of dipterous and lepidopterous insects. The microfauna consists of oribatids and springtails.

The earthworms (Lumbricidae) as saprophages are prevalent by density and biomass in taiga biocenoses with well developed soil profile, slight litter and productive hydrothermal regime. The dispersal of the predatory Lithobiidae centipedes scarcely depends on the type of soil and biocenosis; this is why they are numerous everywhere. These with the most density among the soil dwellers are the Coleoptera: ground beetles, road beetles, snapping beetles, weevils, soldier beetles, but their biomass in the forest ecosystem is not high.

The Oribatei, which are saprophages in a general sense by the nature of their feeding, make a significant contribution to the processes of decomposition of plant residue and humus formation. In various types of forests they process up to 360 cm3 of plant residue in a year.

In taiga on podzolic soils, the density of most of the groups of mesofauna decreases, and for the oribatids it increases; consequently, the participation of these microarthropods in the processes of transformation of organic matter also increases. In coniferous forests, the activity of the oribatid mites is especially significant, since the qualitative changes of the pine needle and branch waste produced by these mites cannot be implemented by other groups of invertebrates. By eating out the content of pine needles, the mites utilize a part of the pine needle waste and crush the remaining part, increasing its surface 10 thousand times.

The springtails (Collembola) have a significant role in the processes of destruction of organic matter. The oribatid mites participate in the transformation of organic matter in the forest biocenoses, but the role of the springtails increases in the tundra communities. The springtails are saphrophages with prevailing consumption of floccus. As a rule, the ecological structure of the springtail population in the soils of the site is the following: about half of the species (48-60 %) is classified as top litter life forms, on the second place by the number of species are semi-soil life forms, and the euedaphic life form is characterized by the lowest amount of species.

Listed below are the characteristics of the structure of the population of soil invertebrates found during the research on the project territory. In the Pechora-Ilych Nature Reserve (the Yanypupunyer ridge) the springtail fauna includes 70 species from 41 genera and 13 families. The I*sotomidae* family has the most species diversity and number of species widespread in this region (25)l; it is followed by *Neanuridae* (10), *Hypogastruridae* (9), *Onychiuridae* (6) and *Entomobryidae* (5). In the mountain-forest belt, 53 species of springtail were found, in the sub-golets belt, 35, and in the mountain-tundra one, 50 species. In the mountain-tundra belt, the number of species in the *Isotomidae* family increases with decrease in families *Neanuridae,Tomoceridae*, down to complete disappearance of species of the *Arrhopalitidae* family.

The road beetle fauna includes 50 species. The best represented are the subfamilies *Tachyporinae*, *Aleocharinae* и *Omaliinae*. When moving from the mountain-forest belt through the sub-golets one to the mountain-tundra belt, a logical fall in the species diversity of the road beetles can be observed. A high number of road beetles is noted in the vegetation communities of the mountain-forest belt.

In the Yugyd Va National Park, the data on soil invertebrates was received only for the catchment area for the Small Patok river. The collembola fauna includes 44 species of 34 genera and 12 families. The most diverse are the Isotomidae (12 species) and Neanuridae (10) families. They are followed by families that contain three to five species: Onychiuridae (5), Entomobryidae (4), Hypogastruridae (3), others are represented by one or two species.

In the mountain-forest belt, 26 species were found, in the sub-golets belt, 22, and in the mountain-tundra one, 15 species. The ground beetles are represented by 40 species, and road beetles, by 69 species. The biggest density of springtails – 85-90 thousand specimens/m^2 was found in the mountain-forest belt. In the communities of the sub-golets and mountain-tundra belts the density of springtails is lower – 30-35 thousand specimens/m^2 and 25-35 thousand specimens/m^2 respectively. The density of road beetles in the biocenoses of the mountain-forest belt is 10-40 specimens/m^2, the dynamic density is 2-8 specimens/10 catcher days. Meanwhile in the northern part of the Nether-Polar Urals the density of road beetles is 10-15 specimens/m^2, and the catchability is 2-5 specimens/10 catcher days.

Currently on the territory of the site the soil invertebrates are represented by the main taxa of two dimensional-functional groups. The majority of the studied communities is characterized by multispecies complexes of soil invertebrates with a fairly small (5-12) number of dominant species and a rich "tail" of small-number forms typical for undisturbed habitats. The density of invertebrates on the project territory varies depending on the type of soil and vegetation. The biomass of the invertebrates corresponds to the data on the main biotic components in ecosystems. The soil invertebrates of the territory are characterized by a wide range of ecological and trophic groups as well as life forms.

Human interference with ecosystems will lead to change in structural parameters of the soil fauna, disappearance of a number of groups from among mesofauna, explosion of the numbers of other groups and, as a result, to decrease in stability of the ecosystem.

Ground invertebrates

The territory of the site remains one of the least explored regions of the Northern Europe in the entomological aspect. However, within the last several years on the territory of the nature reserve and the

national park specific taxonomic groups of lepidopterans (Lepidoptera) and dragonflies (Odonata) were studied in details. Currently, 98 species of Rhopalocera from six families, 54 species of Macroheterocera from 10 families and 35 species of Odonata have been registered here.

The distribution of butterflies by terrain regions, vegetation belts and types of fitocenoses on the territory of the site is uneven. The largest number of species is registered in the lowland part of the nature reserve (137) and in the foothills of the Northern and Nether-Polar Urals – 106 and 97 respectively. The project territory lacks endemic species; however, there are unique species assemblies of butterflies represented in the nature communities which by their structure differ significantly from assemblies represented in the neighboring regions of the Northeastern Europe and Western Siberia.

The dominant type of vegetation in the region under consideration are the dark coniferous woods which are usually avoided by butterflies due to the strong canopy density and the composition and structure of vegetation as well as conditions of mesoclimate unsuitable for their development. Specific species: thorn butterfly *Aporia crataegi* (L.), brimstone butterfly *Gonepteryx rhamni* (L.), mourning cloak butterfly *Nymphalis antiopa* (L.), silver-washed fritillary *Argynnis paphia* (L.), as well as eurytopic lepidopterans usually found in abundance in many other habitats – wood white butterfly *Leptidea sinapis* (L.), gray-veined white *Pieris napi* (L.), small cabbage white *P. rapae* (L.) and cabbage white *P. brassicae* (L.), orange-tip white *Anthocharis cardamines* (L.), comma butterfly *Polygonia c-album* (L.), small tortoise-shell butterfly *Aglais urticae* (L.), small pearl-bordered fritillary *Boloria selene* ([Den. et Schiff.]), dark-green fritillary *Argynnis aglaja* (L.), arran brown *Erebia ligea* (L.), large ringlet *E. euryale* (Esp.), blue butterfly *Callophrys rubi* (L.) may live in spruce forests in the tree fall "windows", in pine forests, birch and aspen forests, on forest firebreaks, roads and paths, as well as along the banks of rivers and creeks.

The sub-golets birch woodlands of the Northern and Nether-Polar Urals are rich in butterflies. Here you can find more than 30 species of them. The most abundant species everywhere are the arran brown *Erebia ligea,* the large ringlet *E. rebia euryale*, the holly blue *Celastrina argiolus* (L.). Fairly common are the violet copper *Lycaena helle* ([Den. et Schiff.]), the wood white butterfly *Leptidea sinapis*, the Thor's fritillary *Boloria thore* (Hbn.).

The species assemblies of the butterflies of the larch forests of the northern part of the national park (the river Kozhim catchment area) are worth a special mention. 35 species of butterflies are found here. The most abundant in the larch woods are the large ringlet*Erebia euryale*, *Boloria angarensis* (Ersh.) and *Oeneis magna* Gr.. The large number of the last two Siberian species is uncommon for the fauna of the Urals. The *Boloria angarensis* is found in the northern subzones of the plains taiga, however, it is not abundant anywhere. The *Oeneis magna* until recently was only registered on the eastern macroslope of the Polar Urals, and that was in quite insignificant numbers. The background species also include the Norse grayling *Oeneis norna* (Bckl.), arran brown *Erebia ligea*, the Lapland ringlet *Erebia embla* (Bckl.), the common ringlet *Coenonympha tullia* (Müll.) and the cranberry blue *Vacciniina optilete* (Knoch). In the larch wood, the red-book species of fritillaries *Issoria eugenia* (Ev.) and the red-disked alpine*Erebia discoidalis* Kirby, the arcto-boreal Frigga fritillary *Boloria frigga* (Bckl.) and the *Polyommatus kamtschadalis* (Schel.) are found. The tundra habitat species can also be found in larch forest areas – these are the Ross's alpine *Erebia rossii* (Curt.) and the Arctic ringlet *Erebia disa* (Bckl.), the Arctic grayling *Oeneis bore* (Schn.) and the melissa Arctic*O. melissa* (Fabr.), the mountain fritillary *Boloria alaskensis* Holl.

One of the characteristic types of nature communities that include butterflies on the project territory are swamps. About 60 species reside there. The core of the species composition of the Rhopalocera of the swamps are arcto-boreal species: the moorland clouded yellow *Colias palaeno* (L.), the cranberry fritillary *Boloria aquilonaris* (Stich.), the bog fritillary *Boloria eunomia* (Esp.), the Frigga fritillary *Boloria frigga* (Bckl.), the Freija fritillary *Boloria freija* (Bckl.), the Lapland ringlet *Erebia embla*, the Baltic grayling *Oeneis jutta* (Hbn.), the common ringlet *Coenonympha tullia*, the cranberry blue *Vacciniina optilete*.

One of the main types of natural communities inhabited by the Rhopalocera on the project territory are meadows. They are permanently or temporarily populated by more than 80 species of six families, that is, three quarters of the species composition of all the butterflies of the site. The most abundant species everywhere are the arran brown *Erebia ligea*, the large ringlet *Erebia euryale*, the lesser marbled fritillary *Brenthis ino* (Rott.), the green-veined white *Pieris napi*. The background species also include lesser fritillaries: the pearl-bordered fritillary *Boloria euphrosyne* (L.), the Thor fritillary *Boloria thore*, the small pearl-bordered fritillary *Boloria selene*. In some areas the Titania fritillary *Boloria titania* (Esp.), the silver-studded blue *Plebejus argus* (L.), the geranium argus *Aricia eumedon* (Esp.), the

Mazarine blue *Cyaniris semiargus* (Rott.) are abundant. In the end of the summer the silvery argus *Aricia nicias* (Meig.), the scarce copper *Heodes virgaureae* (L.) and the common blue butterfly *Polyommatus icarus* (Rott.) prevail in what concerns numbers.

In the sub-golets belt of the protected part of the Northern Urals, on the meadows near the boundary of the mountain tundras, the arran brown *Erebia ligea*, the large ringlet *Erebia euryale* and the mountain fritillary *Boloria alaskensis* are abundant, the Phoebus Apollo was fairly common *Parnassius phoebus* (Fabr.)

The tundras are one of the characteristic types of natural communities which include butterflies. On the territory of the site, the tundras are widespread on top of the mountain ranges of the Northern and Nether-Polar Urals. The most low-mountain here are the bushy tundras. These are also the most populated with butterflies – about 25 species are recorded there. Often found in bushy tundras are the Ross's alpine Erebia rossii and Arctic ringlet Erebia disa, the Norse grayling Oeneis norna, the large ringlet Erebia euryale, the bog fritillary Boloria eunomia, the small pearl-bordered fritillary Boloria selene, the Frigga fritillary Boloria frigga, the Freija fritillary Boloria freija, which significantly distinguishes the mountain tundras of the site from the northern regions of the Subarctic. The mountain rocky lichen tundras on the territory of the site are populated by the few specimens of the melissa Arctic Oeneis Melissa, the mountain fritillary Boloria alaskensis, the peak white Parapieris callidice (Hbn.), the Norse grayling Oeneis norna, the Ross's alpine Erebia rossii.

Almost all species of butterfies (19 out of 20) listed in the Red Book of the Republic of Komi are found on the territory of the Pechora-Ilych Nature Reserve and the Yugyd Va National Park. For many of them – *Parnassius phoebus*, *P. mnemosyne* (L.), *Issoria eugenia*, *Erebia discoidalis*, *Aglia tau* (L.), *Saturnia pavonia* (L.), *Laothoe amurensis* (Stg.), *Smerinthus caecus* Men., *Catocala fraxini* (L.) - the territory of the site is the only place in the north of Russia where preserving and maintaining acceptable numbers of their local populations is possible.

For example, on the territory of the Pechora-Ilych Nature Reserve, one of the largest (might be the largest in Europe) populations of the clouded Apollo exists, which, among other things, is represented here by the particular subspecies *Parnassius mnemosyne timanica* Eisn. et Sed. The Phoebus Apollo, listed in the Red Books of many regions of Russia and foreign states, is very numerous on the territory of the national park. In some mountain regions its density reaches 20-30 specimens to a square meter. Judging by data from literature, this is the highest index of the numerical strength of the species, the range of which includes mountain regions from Western Europe to North America.

Moreover, several other species of butterflies are found on the territory of the national park and reserve which are currently not protected by law but must by all means be included in the next edition of the Red Book of the Republic of Komi. This first of all concerns the Apollo *Parnassius apollo* (L.), isolated samples of which were recently found in the mountains of the Nether-Polar Urals, the very rare arctic species *Gynaephora lugens* (Kozh.), registered on the territory of the national park, the Siberian *Oeneis magna*, an isolated population of which, the only one in Europe, was found in the north of the park, and some others.

35 species of dragonflies from 8 families have been registered on the territory of the site. The most common are the representatives of the hawker family (Aeschnidae): the brown hawker *Aeschna grandis* (L.), the common hawker *A. juncea* (L.). In the highlands the Subarctic hawker *A. subarctica* (Wall.) is found. Also numerous are the *Libelullidae*, which are represented on the site by 9 species. Two species of dragonflies included in the Red Book of the Republic of Komi are common here: the beatiful demoiselle *Callopteryx virgo* (L.) and the broad-bodied chaser *Ladona depressa* (L.). Besides, in the recent years the populations of species fairly rare on the European Northeast of Russia were found here – the green hawker *Aeschna viridis* (L.) and the banded demoiselle *Callopteryx splendens* (Harr.).

Overall, the odonatofauna of the territory of the site is fairly diverse (85% of the whole North European fauna), which can be explained most of all by the undisturbed and stable habitats.

Zooplankton

99 species, subspecies and forms of animals were registered as part of the zooplankton of the waters on the territory of the site; out of these, 38 are rotifers (Rotatoria), and the other 61 are crustaceans (Crustacea). The experts consider the data to be erroneously low, since the fauna of the region is underexplored.

In July and August, the animal plankton of rivers and floodplain water bodies in the Pechora-Ilych Nature Reserve was represented by 53 species and forms of rotifers and crustaceans, and in the buffer zone, by 23 species and forms. The highest species diversity among the plankton invertebrates was

characteristic for the Uk'yu river (30 species and forms), which was exceptional among the explored water bodies by its well-developed floodplain, and its degree of exploration turned out to be the best.

The zooplankton of the Pechora river within the nature reserve was poor in what concerned the number of species (15) and quantitative indexes. Only in long river bays, in nardosmia and cowslip thickets the mass development of plankton invertebrates was noted, mostly not identified even to the rotifer family belonging to the Bdelloida order (89% of the numbers and 96% of the zooplankton biomass). Some authors characterized the zooplankton of the Pechora river within the nature reserve as "exceptionally poor".

In the catchment area of the river Ilych, more diverse zooplankton was found (46 species and forms), out of these only 29 were in the river Ilych itself. The similarity of the faunas of the rivers Uk'yu and Ilych was characterized as transitional from moderate to significant. In terms of quantity, the plankton community in the main course and the tributaries was underdeveloped. The maximum values for numbers and biomass for the catchment area were registered in the long river bay of the river Kozhym'yu.

The zooplankton of the river Un'ya (the buffer zone of the Pechora-Ilych reserve) by the number of species registered there takes an intermediate position among the studied rivers (Pechora, Ilych, Un'ya). The particular feature of this river is the predominance of cladocerans over other groups of zooplankton organisms by the number of species. Three types of rotifers were found in the region only in the catchment area of the river Un'ya. By the average quantitative indicators of development the Un'ya river did not differ from the other explored rivers of the nature reserve. In the flood water bodies, the animal plankton was more numerous than in the river bed and in the lake. In the long river bays the copepods prevailed by their numbers and biomass (52-94% и 70-95% of total values respectively). The dominant plankton species by abundance in separate samples were: *Eucyclops serrulatus* (31%), *Euchlanis sp.* (35%); by biomass: *Macrocyclops albidus* (50%), *Eucyclops serrulatus* (67%), *Mesocyclops leuckarti* (32%), as well as the non-identified naupliuses Copepoda (31-74% of the amount of zooplankton and 37% of the total biomass).

The lake plankton fauna in the Yugyd Va national park during the research period was represented by 9 rotifers, 6 cladocerans and 6 copepods, out of which 3 species are harpacticoids, which are considered to be benthos animals. Such low species diversity of zooplankton in lakes is explained first of all by severe climatic conditions in mountain regions, due to which the period of the study (almost the middle of the calendar summer) in these regions actually coincided with the beginning of biological spring. The composition of the plankton and its numbers corresponded to this stage of existence of the communities: those predominant were the copepods, immature and adult individuals that have wintered, females with egg pouches.

In the rivers of the national park, judging by the data from the river Shchugor, the zooplankton is practically absent. In the stream there are single plankters washed out of the benthos and the flood water bodies. In long river bays, channels and floodplain lakes of the river Shchugor the zooplankton is formed. On the whole, for the catchment area of this river the most diverse animal plankton for the protected territories has been identified, mostly due to the lake fauna.

In what concerns zoogeography, the plankton fauna of the waters of the territory of the site was characterized by the prevalence of widespread species. 43% species and subspecies had palearctic distribution, 13% had holarctic distribution, about 40% had worldwide distribution. Nevertheless, some species that were only once found in our collections turned out to be rare not only for the survey region, but also to the adjoining territories and the Northeast of the European Russia: *Leydigia leydigii, Filinia cornuta cornuta, Macrocyclops fuscus*. Other species: *Polyarthra dolichoptera, Bipalpus hudsoni, Notholca foliacea, N. squamula, Conochilus sp., Eucyclops macruroides, Cyclops vicinus*, which are rare on the explored territory, were common in the neighboring regions. And finally, the rotifers *Euchlanis deflexa larga, Notholca jugosa* for now are found in the Republic of Komi only in the surveyed lakes of the Nether-Polar Urals, and *Ophryoxus gracilis spinifera* – only in the catchment area of the river Ilych. The most common in the summer zooplankton of the studied water bodies were *Euchlanis sp.* (occurrence in samples – 53%), *Chydorus sphaericus* (occurrence in samples – 60%) и *Eucyclops serrulatus* (occurence in samples – 33%).

The ecological diversity of the plankton fauna reflected the diversity of the mode of life of the hydrobionts, their attitude to such factors as speed of the current, depth, presence of macrophyte growth, etc. Out of the species we encountered, about 4% are acidophiles, approximately 8% are benthos species, 22% euplankton species, 10% litoral ones, 24% phytophile ones, 14% phytophile-litoral ones, 2% phytophile-benthos ones and 16% eurybiont ones. In water bodies of various types the proportion of ecological groups of species varied. 15 species of zooplankters were present in the river beds, with 12 of

them being found in sheltered areas with absence of current in the growth of the higher aquatic plants. And only 3 species were found in samples gathered in the current. In the river streamways, species were found that by their ecological characteristics are classed as eurybiont, phytophile, litoral or benthos species.

In the floodplains water bodies, the composition of the zooplankton depended on the presence of thickets of higher aquatic plants. The fauna of the stations with thickets in floodplains water bodies turned out to be richer by the number of species in comparison to the population of the open water: 2.7 times on the Un'ya river and 1.8 times on the Uk'yu river. The number of ecological groups of species in the river Uk'yu is similar in both types of stations, and in the Un'ya river it is different. The number of eurybiont species was similar in all groups of stations except for the floodplains water bodies without thickets on the Un'ya river, where their number turned out to be lower.

There were more phytophile, litoral and pelagic species inside the thickets of higher aquatic plants than out of these.

The composition of the zooplankton in the floodplain water bodies depended on their size. A larger number of euplankton species was registered in the large long river bays and dead streams than in the small ones.

In the mountain lakes, the majority of the zooplankton numbers was in the middle of the water bodies due to mass development of euplanktonic Cyclopoida, usually belonging to one species.

Benthos

The numerous water courses and water bodies of the site are populated with various benthic fauna which includes both purely aquatic organisms and amphibiotic invertebrates that spend only a part of their life in the aquatic environment.

The zoobenthos is an important link in the food chain of the water bodies, it serves as a basis of nourishment for the fish living here, this is why the preservation of its biodiversity is very important for normal functioning of water ecosystems.

By now the best studied on the territory of the site is the benthic fauna of the catchment area of the rivers Shchugor, Kozhim, Kos'yu, Big Synya, Upper Pechora and a number of the mountain and piedmont lakes of the Urals.

As a result of the studies conducted, 30 large systematic taxa of hydrobionts belonging to the following types were established within the benthic fauna of the running and standing waters of the site: sponges, coelenterates, flatworms, nematodes, annelids, mollusks, bryozoans, arthropods. The rivers are inhabited by representatives of 29 groups, the lakes, by representatives of 26 groups of hydrobionts. The majority of the species of water invertebrates of these groups can only live in transparent cold water on stable soils.

Currently more than 800 species of invertebrates have been identified in the benthos of the studied region, with the most species diversity (about 600 species) being registered in the flowing waters. In the lakes of the national park, just within 9 groups of hydrobionts (not taking into account the dipterans which are the largest in species), 189 species have been established.

Among the proaquatic animals inhabiting the water bodies of the park and the nature reserve, the most diverse is the species composition of the oligochaete worms. Representatives of 66 species were found in rivers, 50, in lakes. The general list of these worms includes 72 species, out of which the most diverse ones are the *Naididae* (36 species) and *Tubificidae* (11 species) families. In the rivers, the lithophylic species *Nais pseudobtusa* and the psammophylic *Propappus volki* are high in numbers, as well as the worms of the *Enchytraeidae* family. In the majority of the surveyed lakes, such species as *Spirosperma ferox* and *Lumbriculus variegatus* were found; the number of occurrences for *Vejdovskiella comata* and *Limnodrilus udekemianus* is a bit lower. By their numbers in the lakes, the species from the *Tubificidae* family are predominant among the oligochaetes.

The majority of the identified species of oligochaetes are holarctic, palearctic or cosmopolitic. Two species of the genus *Trichodrilus*, identified in the river Shchugor, turned out to be new for science.

The mollusks that are a part of the zoobenthos of the running waters of the surveyed territory do not play a significant role; however, in lakes this group often takes up a leading position in the formation of the biomass. About 20 species of mollusks were identified in water courses, while in lakes their list includes 27 species out of 5 families. In the majority of lakes the fairly numerous species *Euglesa borealis* is found, which inhabits silt-covered soils. In the fauna of the Mezhgornye lakes the species *Cicinna depressa* and *Anisus albus* are predominant in terms of numbers, out of the mollusks of the Ponomarevskoye lakes, *Cincinna frigida* are highly quantitatively developed. The representatives of the

family *Lymnaeidae*, which is the most common and abundant in the European Northeast, are rarely found in the lakes of the Urals, which is apparently due to low mineralization of the water of these lakes.

The crustaceans, which are not very significant in flowing waters, are well developed in lakes and often predominant in numbers. In the flowing waters, only 15 species of benthic cladocerans were found in the benthos samples. The most common among the cladocerans of the lakes (altogether 36 species were identified here) were *Eurycercus lamellatus*, *Chydorus sphaericus*, *Bosmina longirostris* and *Biapertura affinis*. The species composition of harpacticoids, previously unexplored group of Copepoda, was determined. 9 species are found in rivers, 7 are registered in lakes. Two species are dominant in both rivers and lakes – *Atthetyella nordenskjoldi* and *Moraria duthiei.* A new species of harpacticoids was found in the lake Patok – *Moraria schmeili*. Among the other copepods, 15 species were found in flowing waters, 26 species in lakes with predominance of *Eucyclops serrulatus*, *Macrocyclops albidus*, *Megacyclops viridis*. The phyllopoda, represented by tadpole shrimps, are rare on the territory of the park and inhabit only few lakes where they make up a significant part of the diet of the fish. The amphipoda, representatives of higher crustaceans, are much more often found in the lakes of the park; their species composition is still not determined. Water acarids are widespread in the water courses and bodies of water on the protected territories. Their list includes 85 species. The species encountered in running waters more often than others and in larger quantity are *Atractides nodipalpis*, *Lebertia porosa, Feltria minuta*. The acarids are much more rare in the lakes, the species *Sperchon glandulosus* is predominant.

The most characteristic groups living in the rivers of the Urals are the ancient orders of insects – mayflies, stone flies, caddis flies and beetles. In the lakes the fauna of these hydrobionts is not as rich as in the rivers. The species composition of the orders of mayflies and caddis flies in the water courses of the site is the most diverse. The list of the mayflies includes 67 species; the species of the families *Baetidae, Ephemerellidae, Heptageniidae, Caenidae* are numerous. In lakes the caddis flies are mostly represented by genera *Siphlonurus*, *Caenis* и *Leptophlebia*, among which 16 species have been registered. 75 species of caddis flies are found in the flowing waters of the Urals. The most common are the representatives of the genera *Rhyacophila, Arctopsyche, Hydropsiche, Brachicentrus, Apatania*. In the mountain lakes 7 species have been registered, mostly from the genera*Apatania* and *Limnephilus*. Out of 34 species of stone flies inhabiting the territory of the European Northeast of Russia, 30 were found in rivers on the territory of the nature reserve and the national park. The species from the genera *Capnia*, *Diura*, *Arcynopteryx, Leuctra* reach the highest numbers. Only 4 species inhabit the lakes, the two more common are*Arcynopteryx compacta* и *Nemoura arctica*. The water beetle fauna is very diverse. Altogether 97 species are found in the catchment area of the river Pechora. In the lakes the beetle fauna is less well explored, the list only includes 16 species; the most typical are the beetles from the genera *Agabus*, *Platambus*, *Haliplus.*

Currently in the mountain lakes the species composition of the dipterans, the group of insects that is the most numerous and rich in species, as well as of such hydrobionts as amphipodes and phyllopodes, is not determined. For the catchment area of the river Pechora, 308 species of chironomids are known, and on the eastern slope of the Urals, 75 species of these invertebrates have been identified. The dragonflies on the site are also insufficiently studied, especially those that reside in mountain lakes. Collecting the imago of the dragonflies in the lakes of the Balban-yu river catchment area permitted expanding the known range of the species *Leucorrhinia dubia*, which previously was listed as only as far north as the river Ukhta.

Besides significant species diversity, the water invertebrates are also fairly high in numbers. For example, in the rivers of the national park the numbers of the zoobenthos amount to 5 to 40.2 thousand specimens to m2. In the majority of the mountain lakes the number of aquatic organisms rarely exceeds 10 thousand specimens to m2, more often it amounts to about 5 thousand specimens to m2. Due to the high number of sediment dwellers, various trophic connections in the water environment are implemented, normal functioning of the water ecosystems is supported.

The majority of the water invertebrates of the nature reserve and the national park have broad ranges, palearctic or holarctic. A large number of species is widespread in Europe. At the same time, the fauna also includes Siberian species which have small species diversity but are the most numerous ones.

The protected territories are inhabited by a number of species of water invertebrates listed in the Red Book of the Republic of Komi. These are rare species of mayflies registered in the rivers of the Pechora-Ilych Nature Reserve, often found locally – *Arthroplea congener*, *Brachycercus harisella*, *Paraleptophlebia werneri*. Only in the catchment areas of the rivers Shchugor and Ilych rare and limited in numbers species of stone flies *Capnia bifrons* and *C. vidua* are found. The caddis flies living on the site – *Arctopsyche ladogensis* and the rare beautifully colored species *Semblis phalaenoides* are listed in the

Red Book. Out of protoaquatic forms these to be protected are the hairworm – *Gordius pavlovskii* and the leech *Boreobdella verrucata*.

Fish

The territory of the site is covered by a dense network of rivers; on the north it includes a large number of mountain and floodplain lakes. The ichthyofauna of the water bodies of the site includes 22 species of fish-like vertebrates and fish of 11 families, including adromous and semiadromous as well as rare and disappearing species. Almost half of them is represented by salmonoid fish belonging to the salmon, whitefish and grayling families. An important feature of the ichthyofauna of the basin of the river Pechora and the catchments of a number of its Ural tributaries included into its basin is the presence here of presumptive glacial relicts, among which are the residential form of the Arctic char, the Arctic grayling and the peled of some mountain lakes. This category also includes the peled and the Siberian whitefish from the mountain lakes of the neighboring catchment area of the river Shchugor where the Arctic char also reportedly resides. While the majority of the rivers of the site preserve a regime that is close to the natural one, the commercial development of the Kozhim river valley led to negative changes in structure and biological parameters of the fish.

Despite the fact that the study of the ichthyofauna of the Urals lakes and of the diversity of the fish communities connected to them started relatively recently, it is possible to conclude that even with the small numbers of the species of fish included in the fish population of the surveyed lakes of the Northern and Nether-Polar Urals, for the majority of them a pronounced distinctiveness of the species composition is characteristic. At the same time the structure of the communities of fish of these lakes conforms to the pattern common among the biological communities of high altitudes which shows in the predominance of representatives of one or two species. These materials are the evidence of exceptional value and uniqueness of biological diversity of aquatic communities of mountain lakes, of its connection, which has a pronounced adaptive significance, with the glacial history of the Urals and the origin of lakes, to a significant degree determined by mutual influence of Siberian and European faunas in the area of their contact on the border of the catchment areas of the rivers Pechora and Ob.

The most valuable salmonoid species of the site is the Atlantic salmon, which uses the mountain and submontane parts of Urals water courses as spawning grounds. The population of the producers of the Pechora Atlantic salmon is mostly formed by the fish of the autumn form that enter the primary course of Pechora from the sea feeding areas a year before spawning. The anadromous migrating fish reach the spawning grounds of the specific water courses at various dates. For example, a part of them appears in the river Shchugor already in the same year that they enter from the sea, but the spawning migration of the Atlantic salmon to the rivers Kos'yu, Kozhim and Vangyr starts in late July, not long before spawning. It has been established that since 1992 the absolute majority of spawning grounds preserving a regime close to natural in the catchment area of the spawning water courses of the site is empty, and the density of the juvenile Atlantic salmon at the feeding stations is at the minimum level. This evidences the critical state of the local groupings of Atlantic salmon, due to which there is a real possibility of losing the gene pool of a number of populations of Atlantic salmon from the Urals tributaries of the river Pechora.

The most widespread in the bodies of water on the territory in question is one of the rare species of salmonoids that spawn in spring, the European grayling. In summertime the grayling feeds at the stationary parts of rivers and creeks, and immediately before ice formation it forms clusters and migrates downstream to winter habitats localized within the river system. After the melting of the ice the grayling makes a spawning migration in the opposite direction.

The habitat of another valuable representative of the local ichthyofauna, the whitefish, is limited mostly to the middle and lower reaches of the water courses of the project territory. During the navigation season, the whitefish is fairly common on the pits and stretches of many Urals rivers; however, it only spawns in some of them, in autumn leaving, for example, the rivers Kozhim and Vangyr.

The dispersal of other salmonoid fish has a more sporadic nature. Actually, the round-nosed whitefish and the resident form of the Arctic char are only found in the tributaries of the river Usa, and the latter species also in mountain lakes. The permanent habitat of the peled is also located here; for example, a population of the peled was found in the catchment area of the upper reaches of the river Vangyr.

The taimen is probably close to extinction; judging by questionnaire data, only individual fishes have been encountered outside of the territory of the site. A steep downfall in the number of populations of the majority of the species of salmonoids, especially Atlantic salmon, has been observed. For now, this concerns whitefish, peled and grayling to a lesser degree.

The shifts in population characteristics of the fish related to the youthification of populations bring serious concerns. Due to the extremely small numbers of spawning population some salmonoids barely use traditional spawning grounds, including large and unique ones.

The list of fish species populating the territory of the site and protected on the local level includes four species: Arctic grayling – category 3(R), Arctic char, listed in the Red Book of the Republic of Komi as paliya (*Salvelinus lepechini*) – category 3(R), Siberian white salmon – category 2(V) and taimen – category 0(Ex).

The bullhead is one of the most common and widespread species of fish in the bodies of water on the territory of the site and in the whole Republic of Komi, it is listed in the Red Book of Russia.

Amphibians and reptiles

Among the vertebrates, amphibians (Amfibia) and reptiles (Reptilia) are represented on the territory of the site with low species diversity. Due to the particularities of the ecology, a number of species have indicator qualities and may be used for environmental monitoring.

Out of the five species of amphibian fauna of the European Northeast, four are represented in the Pechora-Ilych Nature Reserve – Siberian salamander, common toad, brown frog, moor frog. Siberian salamander *(Hynobius keyserlingii)*. The current range of the species includes both the taiga and tundra (southern bushy tundras) zones of the region and the site. One of the little studied species, due to sporadic distribution pattern and secretive way of life it is very rarely encountered. Brown frog *(Rana temporaria)*. Common in Europe and Asia. Out of all the amphibians, this is the most numerous species of the nature reserve and national park. It is very resistant to cold and can survive large amplitudes of air temperatures. Its spawn and larvae also survive much lower temperature than that of the other frogs. Due to these characteristics this species is very widespread. The moor frog *(Rana arvalis)*. It penetrates further north than the brown frog. The share of this species among the tailless amphibians of the site is currently 15%. Common toad *(Bufo bufo)*. The northern boundary of the distribution of this species passes through the Pechora-Ilych Nature Reserve. The furthest to the north that the common toad was ever encountered was on the river Ilych. Currently the numbers of the toad are growing, it became a fairly common species for the forests near Pechora. Its share among the tailless amphibians is 12.4%. The most density is found in the forests of the pine cluster of the nature reserve near the river Pechora (from Volosnitsy village to Mamyl village).

The fauna of the reptiles of the site territory is much poorer. Out of the five species of this group represented in the Republic of Komi, only one is found here, the common lizard (*Lacerta vivipara*). It is widespread on the whole territory of the Pechora-Ilych Nature Reserve and the Yugyd Va National Park. It is more common in plains region and its range of habitation is broader – from upland swamps to floodplains of rivers. In the submontane region, where huge spaces are occupied by dark coniferous forests, it is more localized. Its main habitats here are located in the thoroughly warmed areas of dells and river and creek valleys.

The fauna of the amphibians and reptiles of the territory of the site is represented by 5 species, which amounts to 50% of all species noted within the region. Out of the noted species, the territory of the Pechora-Ilych Nature Reserve and the Yugyd Va National Park includes the northern boundary of the habitation of the common toad in its lowland part and of the common frog and the common lizard in the mountain part. In the south of the territory in question the Siberian salamander is fairly common, which has been included in the Red Book of the Republic of Komi. The surviving layout of the landscapes and slight commercial development help the preservation of the gene pool of rare and protected species.

Birds

The current list of the birds registered on the territory of the site includes 240 species falling into 16 orders and 47 families.

The best represented are the orders of passeriformes, charadriiformes, anseriformes and falconiformes. The species diversity of the strigiformes, piciformes and galliformes is much smaller. Other orders are represented by 1-5 species.

The higher bird diversity parameters of the Pechora-Ilych reserve (238 species) are due to the significant duration of ornithological studies and better state of exploration of its territory. The year-round observation of birds has been continuing here for more than 70 years. The routed and stationary surveys cover all the terrain groups represented within the nature reserve: plains, submontane and mountainous.

Special studies of the avifauna of the Yugyd Va National Park were being conducted here long before the park was organized, by expeditions in 1928, between 1968 and 1975 and in 1977, after the park

was organized, observations were conducted regularly. In the last five years alone, 28 new species were added to the list of the birds of the park, and for 20 more their status was adjusted. Currently 162 species of birds are known for the park.

Out of the total number of species registered within both reserves 168 (70%) belong to the category of regularly or periodically nesting, about 10% have transient status, others are vagrant. 38 species regularly spend the winter on the protected territory.

The level of representativeness of the avifauna of the protected territory of the two reserves is very high. 86% of birds known for the territory of the European Northeast of Russia have been recorded here, as well as 98% of the species residing within the Republic of Komi. As for the nesting avifauna of the mountain-taiga landscapes of the region, this index is close to 100%, and a number of species is only known to nest within the nature reserve.

By its origin the avifauna of the nature reserve and the national park is heterogeneous. Besides the common species it includes representatives of the Arctic, Siberian, European, Mediterranean, Tibetan and Chinese faunas.

The basis for the nesting fauna is formed by very common species (54%). A very significant part of the species composition is represented by the Siberian (23%) and European (16%) types of fauna. The share of the Arctic species does not exceed 5%, the Chinese, Tibetan and Mediterranean species are represented by individual species.

The boundaries of the breeding grounds of many European and Siberian species of birds pass through the territory of the nature reserve and the national park, which is of especial value in what relates to the preservation of biodiversity. For example, here is the western boundary of the European range of the pintail snipe (*Gallinago stenura*), the Blyth's cuckoo (*Cuculus saturatus*), the eastern tree pipit (*Anthus hodgsoni*), the Siberian accentor (*Prunella montanella*), the black-throated accentor (*P. atrogularis*), the red-flanked bluetail (*Tarsiger cyanurus*), the black-throated thrush (*Turdus atrogularis*), the yellow-browed warbler (*Phylloscopus inornatus*).

The qualitative composition of the avifauna of both reserves permits characterizing it on the whole as typical for the taiga zone. The original characteristics and transitive nature of the fauna are fully consistent with the physiographic and zonal landscape position of the territory on the boundary of Europe and Asia as well as at the convergence of two natural lands, the Russian Plain and the Urals Highland, and two subzones of taiga, the northern and the middle taiga.

The preserved outlook of the landscapes and slight commercial development of the territory help the preservation of the gene pool of the birds listed in the international list of global rare species (white-tailed eagle, crake, double snipe) as well as a number of Red Book species of international, federal and regional rank. Within the region in question, the presence of 33 specially protected species of birds listed in the Red Book of the Russian Federation (12 species) and the Republic of Komi (30 species) was noted. Out of these, 14 nest on the protected territory, 10 are registered as vagrant and 5 have only been encountered during seasonal migrations.

The role of the national park and the reserve is especially significant for preservation of such rare nesting species as white-tailed eagle (*Haliaeetus albicilla),* osprey (*Pandion haliaetus),* golden eagle *(Aquila chrysaetos)* and eagle owl *(Bubo bubo)*. These species may be classified as key objects of protection, since currently the major part of the population of these birds in the European Northeast is concentrated on the territory of these reserves. The current numbers of their nesting groupings within the protected territory of the site are at least: 30 pairs for white-tailed eagle, 15 for osprey, 10 for golden eagle and 20 for eagle owl. In the rest of the Pechora catchment area these birds of prey disappear from their old breeding grounds almost everywhere, and their numbers are close to critical.

The presence of large massifs of virgin forests supports the high numbers of the majority of typically taiga species, ecologically connected with mature forest formation, and the ecological structure of the bird population serves as a reference model of their natural communities in the forest zone of Europe.

Mammals

The current mammal fauna of the site includes 48 species, of which 38 are common for the federal reserves, 1 species was only found in the national park, and 9 species have been only encountered in the nature reserve. Therefore, 98% of the mammals of the site live in the nature reserve. The level of representativeness of the mammal fauna of the site is very high and amounts to 94.4% for the taiga area of the Republic of Komi and to 88% for the whole territory of the European Northeast of Russia. Such high species diversity of due not just to the size of the territory of the site, its relative undisturbedness and

landscape heterogeneity, but also its location on the boundary between the European and the Siberian fauna.

The taxonomic structure is on the whole typical for the region. As everywhere else, those most fully represented are the rodents and the predatory animals. Out of 22 species of rodents found in the Republic of Komi, 15 species live on the territory of the site. As for large rodents, the beaver, reacclimatized in the late 1930s, is numerous here, the numbers of the European flying squirrel are high here in comparison with other Northern regions, even though this territory is the northern boundary of its habitat. The red squirrel and the Siberian chipmunk are common. The numbers of the muskrat, which was acclimatized at the middle of the last century, are not high; nevertheless, its presence is noted on various rivers and lakes. Small (mouse-like) rodents are represented by 10 species typical for the European taiga. The particular characteristic of the mouse-like rodent population is that they mostly include species of Siberian origin. It is also worth noting their high summary number in the submontane and especially the mountain-forest landscapes. The huge biomass of small rodents is the mainstay of prosperity for many predatory mammals and birds.

The majority of the typical Arctic species (such as the brown lemmings) is absent on the territory of the site. Nevertheless, in the national park the inhabitance of the Middendorf's vole – a typically tundra species the majority of the range of which is in Siberia – has been noted.

As for predatory animals, 16 species are represented on the territory of the nature reserve and the park – all species found in the republic except for the European polecat. The Pechora-Ilych Nature Reserve and the Yugyd Va National Park are one of the unique places in Europe where the ranges of the sable and the pine marten overlap and their hybrid kidus resides. The numbers of the bears and wolverines are fairly high here. The diversity of landscapes which permits the bears to make feeding migrations and the large areas of virgin taiga forests provide not only preservation but prosperity for these species. The numbers of the wolves had a wide range of fluctuations: in late 1950s these were very high, in the 1970s they fell to a minimum, with no more than 10 individual animals living on the huge territory of the nature reserve. Currently the numbers of the species are growing, the wolves are regularly found in the submontane and mountainous parts of the reserve. The red fox, an animal widespread and common in the European part of Russia, in the nature reserve and the park is concentrated in the plains part, where its basic nourishment resources are much more abundant. It has been encountered in submontane dark coniferous forests and in the mountains mostly in wintertime, with most encounters falling to the share of migrating single animals. There are rare entries by polar foxes noted on the territory of the park and the reserve, though the breeding grounds of the polar fox are located much further to the north. This predator appears in some years, mostly in winter (rarely in autumn), and by the beginning of intensive snow melt it disappears. The ermine and the weasel, the small mustelids, are widespread over all the landscapes of the territory. Their numbers mostly depend on the state of their feed base, the mouse-like rodents. Most usually they are common, sometimes their numbers reach high levels. The Siberian weasel, a species close to them, has also been encountered on the territory of the nature reserve, even though it is very rare here, too. The European mink is an indigenous inhabitant of the described territory. Its numbers here were always low. Since mid-1980s, the American mink started to be encountered in the nature reserve; acclimatized in more southern regions, it was settling quickly. The otter inhabits all more or less large rivers and streams of the site. The lynx is a large cat that permanently resides and is annually recorded on the territory of the nature reserve, which is situated on the northeastern outskirts of the European geographic range of the lynx Entries have been noted on the territory of the national park. The badger and the raccoon dog are not permanent inhabitants of this territory, though they have been encountered both in the reserve and in the national park.

The insectivores (*Insectivora*) are represented in the region by 7 species of shrews (*Soricidae*) and 1 species of moles (*Talpidae*). Unlike many other regions of the European taiga, the fauna of this family is enriched by the presence of the tundra shrew, a species not characteristic for the forest zone and numerous in the tundra.

There are four species of bats inhabiting the nature reserve, two of which are ordinary (Brandt's bat and northern bat) and two are very rare (whiskered bat and long-eared bat). The bats also have been encountered in the national park, but their species have not been identified.

The lagomorphs are represented by two species. Out of these, the blue hare is one of the most common representatives of the aboriginal fauna of the upper Pechoran taiga. It inhabits all the landscape regions. Its numbers are low in comparison with other taiga regions. The northern pika sporadically populates the Polar and Nether-Polar Urals and a part of the Northern Urals. This is an isolated geographical form of the species the main habitat of which lies to the east of the river Yenisey. It resides

in large stone deposits of the lower part of the golets belts and is also found in the national park and the northern part of the nature reserve. The information on the numbers and the biology of the species is very scarce.

As for artiodactyles, three species are found here. The moose inhabits all the landscapes of the region. Within the last 150 years, two well-developed peaks of numerical strength have been witnessed in the upper reaches of Pechora, with a 100 year period of cycle between them. Currently the numbers of the species are in decline. The wild reindeer is a representative of the aboriginal fauna of the region. Currently the numbers of the species are at a low level. The boar was first encountered in the nature reserve in 1982; this species does not reside here permanently, but in the last two decades more than 100 encounters of traces and visual observations of boars were recorded.

General assessment of the uniqueness and global significance of the biodiversity of the Virgin Komi forests

The site represents a unique ground for preservation of biodiversity by means of contiguous massifs of boreal forests located on the boundaries of contact of nature zones for implementation of programs for study, preservation and presentation of biodiversity.

During the process of historical development of the vegetation cover in the postglacial period, stable native taiga fitocenoses have formed on the territory of the site, with the predominance of the breeds of the Siberian polydominant taiga – first of all *Picea obovata,* as well as *Abies sibirica, Larix sibirica*. The plantations of *Pinus sylvestris* are confined to the sandy terraces of large rivers and swampy areas of watersheds. A significant variety of ecological conditions determines the unique natural diversity of forest vegetation. Many forest communities are distinguished not only by a rich gene pool of trees and shrubs, but also by the presence of rare and specially protected herbaceous plants, bryophytes and lichens, as well as medicinal plants. Moreover, the site landscapes (including the massifs of the virgin forests of the European North) are inviolable and will remain so in the future.

The representativeness, which is a substantive parameter of the value of the territory, is influenced by: large area on which the nature complexes will be more fully represented (the length of the site is 400 km form north to south and 100 km from west to east); a position at the junction between the Russian Plain and the Urals Highland (Nether-Polar and Northern Urals – determines the diversity in natural conditions); the parts of the site have different geological origin and are composed from diverse geological material which, in its turn, enriches the terrain; the diversity of climatic variables (the amount of precipitation and the air temperature, the delay of air masses by mountain ranges); the single massif of undisturbed (virgin) forests, preserving the natural passage of nature processes.

Biodiversity is considered by specialists to be a criterion of objective assessment of "health" and value of the territory. The vegetation cover of the territory of the site, varied in its structure, has not been studied well enough, especially in mountain regions difficult to reach; the data on the flora, fauna, invertebrates, lichen and mycobiota of the region is also far from exhausting. Nevertheless, the available scientific evidence indicates a significant level of ecosystem and species diversity: for example, for the southern part of the site – the Pechora-Ilych State Reserve, where the biological diversity has been studied for more than 70 years, the habitation of at least 778 species and subspecies of vascular plants, 410 species and 5 varieties of mosses, 866 species of lichens and associated fungi, 295 species of aphyllophoroid and 301 species of agaricoid fungi, 48 species of mammals, 238 species of birds has been confirmed.

The boundary position of the site on the border between Europe and Asia has determined the distribution of a number of species of plants and animals that do not occur in the rest of the Republic of Komi. Often the main ranges of habitation of these species lie hundreds and thousands of kilometers away. For example, some representatives of vascular plants (*Plojodicarpus villosus, Elymus transbaikalensis, Neotorularia humilis*) are not found anywhere else in Europe. The location on the Northeast of Europe of the *Poa urssulensis, Pseudoregneria reflexiaristata, Festuca pseudodalmatica, Carex milissima* plants and *Issoria eugenia, Boloria angarensis, Oeneis melissa* lepidopterans is mostly connected with the model territory. Out of the vascular plants, 12 species are endemic for the Urals (*Oxytropis uralensis, Lagotis uralensis, Alchemolla semispolata, Anemonasrtum biarmiense, Gagea samoedorum*, etc.), abd two (*Gypsophila uralensis* and *Lotus peczoricus*), for the European Northeast.

On the national park territory, in the mountain tundra, a *Pararctia artropunctata* butterfly was found, the habitat of which until recently was considered to be limited to the Chukotka Peninsula. As for fish, in some water bodies of the Nether-Polar Urals the Arctic grayling *(Thymallus arcticus)* and the

humpback whitefish (*Coregonus lavaretus pidschian*) can be found, which, apparently, indicates the ancient water connections between Europe and Asia.

The avifauna is very variegated. In this group of animals the closeness of Siberia is very clearly felt – the share of the species of the Siberian complex (23%) is higher than that of the European one (15%). Among the Siberian bird species, some are very common or dominate in the bird population of some districts – the Arctic warbler *(Phylloscopus borealis),* the black-throated thrush *(Turdus atrogularis),* the brambling *(Fringilla montifringilla)* and the little bunting *(Emberiza pusilla)*. It is only on the territory of the site that such Siberian species as the Siberian accentor *(Prunella montanella)* and the Siberian rubythroat *(Luscinia calliope) can be found.*

Considering the mammalian fauna, it should be emphasized that on the site territory the core of the Ural population of the Northern pika *(Ochotona hyperborean)* is located, the main habitat of which is situated in Eastern Siberia. The Pechora-Ilych Reserve and the National Park are the only place in Europe where two closely related species – the pine marten *(Martes martes)* and the sable *(M. zibellina)* – live together, and are able to produce a hybrid species of kidus. The Siberian weasel *(Martes sibiricus),* a typical Siberian species, is often found on the site territory. Some of the species found here were first recorded not only for the Republic of Komi, but also for Russia as a whole.

Another important criterion for the assessment of the biological significance of the territory is the rarity of the organisms. The rarity of a species in nature is usually seen as the evidence of its potential disappearance due to heightened vulnerability. This category includes species located near the boundaries of their geographical range, species with very low density over the majority of their range and species with limited range.

When developing criteria for assessment of natural territories, the boundaries of rarity in combination with diversity and representativeness become an especially useful generalizing characteristic.

There will always be species among plants and animals the number of which for some reason is unacceptably low. Most of them are listed in the Red Books of various ranks. The most efficient method of preserving the Red Book species is to protect their habitats. This is why the specially protected territories are wonderful havens for a number of species of plants and animals.

The ecosystems concentrated on the territory of the site function as key habitats of many rare, endemic and relict plant and animal species protected at local, regional and international levels. The analysis of the available data shows that 172 out of 253 species (68%) of the vascular plants included in the Red Book of the Republic of Komi reside on the territory of the site. Out of these, 2 species belong to the 1 (E) category, 22 – 3 (R), 33 – 4 (I), and 55 are protected in the 5 (Cd) status. Among the rare plants there are species included in the Red Book of Russia (Calypso bulbosa, Castillea arctica ssp. vorkutensis, Cypripedium calceolus, Dactylorhiza traunsteineri, Schivereckia podolica) and the IUCN Red Lists (Cypripedium calceolus).

A number of species has their only locations in Europe on the discussed territory (*Novotorularia humilis, Primula pallasii*), others (*Pinus sibirica*) are on the boundaries of distribution. The uniqueness of the vascular plant flora is also shown by the presence of endemic species (*Anemonastrum biarmiense, Gypsophila uralensis, Linum boreale, Thymus talijevii*, etc.). There are 60 species of mosses on the territory of the site which are protected at the local level. This amounts to 39% of the total number of bryophytes included in the Red Book of the Republic of Komi. Most of the protected species belong to 3(R) and 5(Cd) categories – 29 and 24, respectively. There are 5 mosses protected in the status 2 (V) (*Dicranum viride, Grimmia unicolor, Racomitrium fusciculare, Myurella sibirica, Pseudoleskea patens*), 2 in the status 4 (I) (*Cynodontium bruntonii, Funaria microstoma*). Five species (*Dicranum viride, Schistostega pennata, Neckera pennata, Hydrohypnum norvegicum, Scleropodium arellanum*) are included in the Red Book of bryophytes of Europe.

The ecosystems of the site, first of all the virgin forests, play an important role as key habitats for rare lichens. There are 65 species of them registered, accounting for 82% of the total number of protected lichens in the region. *Bryoria fremontii, Lobaria pulmonaria, Tuckneraria laureri, Leptogium burnetiae, Lichenomphalina hudsoniana, Stereocaulon dactylophyllum* are protected not only at the local level, but also in the whole Russian Federation. Such species as *Lobaria hallii, Leptogium rivulare* are extremely rare all over the world and are found only in several spots. Rare lichens *Pannaria confusa, Cheiromycina flabelliformis, Phaeophyscia hirsuta, Chaenotheca subroscida, Chaenotecopsis vainioana, Phaeocalicium praecedens, Chaenothecopsis haematopus* are not known from other regions of Russia. Many lichen species found in virgin taiga forests (types of genera *Calicium, Cyphelium, Chaenotheca*, as well as *Usnea longissima, Cetrelia olivetorum, Heterodermia speciosa, Nephroma isidiosum* et al.), are

extremely rare in Western European countries with similar natural conditions (Sweden, Finland, Norway), where forest ecosystems are subject to strong anthropogenic pressure. A number of species, for example, *Sticta nylanderiana*, are on the western border of distribution in the region. The distribution of species by protection categories is as follows: 1 (E) –11, 2 (V) –12, 3 (R) –17, 4 (I) –14 and 5 (Cd) –11. From the standpoint of lichen floristry, the territory under consideration represents a great potential for study, since currently there are samples of lichens collected the characteristics of which do not allow for accurate determination of taxonomic affiliation; presumably these are species new for science.

The site mycobiota has been studied less. Nevertheless, there is information about the presence of a number of rare fungi species here. 21 species have been registered, which is about 75% of the total number of taxa included in the Red Book of the Republic of Komi (1998). Most species (11) belong to 3 (R) category. Fungi of 4 (I) and 5 (Cd) categories have also been recorded; there are 5 species of each. Four taxa (*Tylopilus alutarius, Leccinium percandidum, Grifola frondosa, Hericium coralloides*) are protected on a higher level and are included in the Red Book of the Russian Federation.

The list of vertebrate animals protected at the local level includes 31 species (57% of the total number included in the Red Book of the Republic of Komi). Out of the representatives of avifauna registered in the region in question, white-tailed eagle (*Haliaeetus albicilla*), gyrfalcon *(Falco rusticolus*), osprey (*Pandion haliaetus*), golden eagle (*Aquila chrysaetos*), peregrine (*Falco perigrinus*) are rare species included in the IUCN lists and the Red Book of Russia. Many of these species form relatively dense groupings on the project territory, though here, too, there is a steady trend of the decrease in their numbers. One of the species of fish the populations of which are fairly common in the water courses of the site, *Gottus gobio* is protected on the regional (Russian Federation) level. The disappearance of one of the species – taimen (*Hucho taimen*) is registered as a result of unsustainable use of fish resources; 8 species are under the threat of extinction (category 1 (E)), 5 are reducing their numbers (category 2 (V)). The majority of vertebrate animals needing protection have the status of rare species (18), 9 species are classed in the protection category 6 (I).

On the territory of the site there are 31 species of invertebrate animals out of 53 included in the Red Book of the Republic of Komi, which amounts to 58.5%. Such of them as *Capnia bifrons, C. vidua, Parnassua faebus, Sterinthus ocellatus, S. caesus* are not registered in other regions of the Republic of Komi. On the territory of the reserve and the national park, the most numerous populations in Europe of such red-listed lepidoptera as *Parnassius phoebus, P. mnemosyne* have been preserved; they are represented here by unique subspecies. On the unprotected territories, such species are on the verge of extinction due to violation of their habitats, destruction of nutritive base and commercial catching; this is why they are included in the Red Books of many regions of Russia and red lists of a number of European countries. The distribution of species by protection categories is as follows: 1 (E) and 2 (V) – 5 each, 3 – R –18, 4 (I) – 3.

The analysis of available data on biological diversity on the territory of the site shows that its landscapes are complexes of ecosystems almost untouched by human activities. They play an important role as habitats for rare species of plants, animals and fungi. The information about the biological diversity on the territory of the site is not comprehensive, which adds additional interest to the territory as a site for development of scientific tourism.

APPENDIX 3

FINANCIAL INFORMATION

In Table 1 the sources of financing of programs of specially protected natural areas (SPNA) and the site are divulged, in Tables 2-4 the actual expenses on each measure of specially protected natural areas are given, in Table 5 the comparison of actual expenses of specially protected natural areas included in the site territory is given for each type (and parameter) of the works.

The average values of the works cost were used for calculation of the need in resources for functioning of the buffer zone as well as the programs realized by one of the SPNA for the first time. The estimated values were calculated using officially published price indices in the Komi Republic[1] which were close to changes of the price parameters of SPNA services[2] specially prepared for the national park and reserve.

Table 1. Sources of financing in 2016 (year preceding the planning)

SOURCE OF FINANCING	National park, thousand rub.	Reserve, thousand rub.*	**Site, thousand rub.**
1. Funds obtained from the federal budget, total	44,701.3	**42,829.1**	**87,530.4**
Expenses on maintenance of the institution, total	38,408.2	42,229.1	**80,637.3**
Expenses on environmental protection measures			
Expenses within realization of the federal targeted investment program			
Special-purpose funds of Russian Foundation for Basic Research (RFBR)			
Other special-purpose budget funds (subsidies for other purposes)	6293.1	600.0	**6,893.1**
2. Funds obtained from the budget of the constituent entity of the federation (incl. budget environmental funds)			
3. Funds obtained from the municipal (local) budget (including municipal environmental funds)			
4. Funds of foreign grants, total	2,351.14		**2,351.14**
Grants of World Wilflife Fund (WWF)			
Granrs of projects of UNDP/ GEF	2,351.14		**2,351.14**
Other foreign grants			
5. Funds of Russian sponsors, total	500.0	35.8	**535.8**
Banks			
Industrial organizations	500.0		**500**
Transportation organizations			
Agricultural organizations			
Trade organizations			
Advertising agencies			
Other commercial structures			
Non-profit organizations		35.8	**35.8**
Individuals			

[1] http://komi.gks.ru

[2] See: Report on the scientific and research work on the subject: "Substantiation of basic standard costs of maintenance of specially protected natural areas (SPNA) of federal importance of the Komi Republic (Pechora-Ilych State Reserve and "Yugyd Va" National Park) and fulfillment by them of the imposed functions as well as SNPT of the Komi Republic of regional importance" by Autonomous Non-Profit Organization Scientific Research and Design Institute "Kadastr", Syktyvkar, 2010

SOURCE OF FINANCING	National park, thousand rub.	Reserve, thousand rub.*	**Site, thousand rub.**
6. Proceeds from own activity, total	4,956.66	1,066.2	**6,022.86**
Voluntary compensations (not related to lodgments of claims) for damage to natural complexes	96.3	-	**96.3**
Sale of timber and woodworking products	-	-	
Sale of mowing products	-	-	
Sale of meat and fish products from regulatory and scientific activity	-	14.0	**14**
Payment under land plot lease agreements	-	-	
Collecting payment for the services related to visiting the SPNA including excursion services	1,951.2	199.3	**2,150.5**
Collecting payment for video filming and photography	-	-	
Payment for use of hotel and stopping point services	1,512.66	292.4	**1,805.06**
Payment for visiting museums	-	43.8	**43.8**
Payment for other service including transportation services	737.1	119.5	**856.6**
Collecting payment for fishing licenses (authorizations)	-	-	
Collecting payment related to organization of sport and amateur hunting	-	-	
Collecting payment for other use of recreational resources	-	-	
Proceeds from sale of souvenirs and printed products	372.4	201.6	**574**
Proceeds from lease of fixed assets	-		
Proceeds from contractual research and scientific and scientific and technological works	161.6	40.0	**201.6**
Proceeds from sale of agricultural products of subsidiary farms	-	-	
Proceeds from activity of experimental breeding nurseries and farms	-	-	
Payment for housing and public utility services	-	155.6	**155.6**
Holding environmental practice and ecological camps	86.6	-	**86.6**
Other own activity	38.8	-	**38.8**
CONSOLIDATED BUDGET, TOTAL:	52,509.1	43,931.1	**96,440.2**

*-excluding the buffer zone (the budget of which consists of the payroll budget of employees of Verkhne-Pechorskoe district forestry of Komsomolskoe forestry, expenses on its measures and subvention of budgets, expenses on territory protection measures by the republican "Center for Specially Protected Natural Areas", fishing inspection and other environmental organizations)

Table 2. Expenses on measures of the World Heritage Site "Virgin Komi Forests" (VKF) in 2016

Measures	Unit of measure	VKF site		National park		Reserve	
		Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.
1	2			3	4	3	4
Maintenance, renovation, repair: fire lines, total	km	**46**	**643.1**	40.0	560.3	6	82.8
Installation and maintenance of fire-fighting stands	pcs	**20**	**413.5**	10.0	363.5	10	50
Forest engineering arrangement: sodic soils	pcs	**70**	**250.4**	70.0	250.4		
Forest engineering arrangement: bird boxes	pcs	**60**	**236.1**	60.0	236.1		
Selective sanitary fellings	ha						
Selective sanitary fellings	m^3	**300**	**1023.2**	300.0	1,023.2		
Cleaning the forest from littering:	ha						
Cleaning the forest from littering:	m^3	**230**	**1,370.4**	200.0	877.4	30	493.0
Current forest pathology research	man/day						
Current forest pathology research	ha	**20,000**	**2,994.4**	20,000.0	2994.4		
Installation of banners	pcs	**96**	**1,107.2**	26.0	255.4	70	851.8
Installation of information boards	pcs			-			
Installation of information signs and signposts	pcs	**12**	**137.7**	10.0	87.7	2	50.0
Foot patrolling of the SPNA and its protection zone	man/day						
Foot patrolling of the SPNA and its protection zone	km	**9,300**	**3,489.6**	1800.0	1293.4	7,500	2,196.2
Patrolling of the SPNA and its protection zone using motor transport	man/day						3,592.9
Patrolling of the SPNA and its protection zone using motor transport	km	**45,000**	**8,861.2**	30,000.0	5268.3	15,000	
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	man/day	**12,500**	**3,594.6**	12500.0	3594.6		
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	km	**20,000**	**4,277**			20,000	4,277.0
Flying around the SPNA and its protection zone	Flight hour	**110**	**2,937.5**	100.0	1,937.5	10	1,000.0
Maintenance of natural and cultural heritage museums	pcs	**1**	**1727**			1	1,727.0
Creation of information centers for visitors	pcs						
Maintenance of information centers for visitors	pcs	**5**	**368.3**	5.0	368.3		
Renewal of expositions of museums and information centers	Expositions	**6**	**490.9**	6.0	490.9		
Holding specialized exhibitions	pcs	**24**	**572**	21.0	541.4	3	30.6
Publishing by staff employees of popular scientific and propaganda articles in printed publications	Article, pcs	**52**	**753.5**	32.0	580.8	20	172.7
Television appearance of staff employees	pcs	**7**	**22.8**	7.0	22.8		
Radio appearance of staff employees	pcs	**5**	**20**	5.0	20.0		
Issue of periodical printed publications	copies	**3,000**	**350.4**	3,000.0	350.4		
Maintenance of the Web-site,	Man/day						

Measures	Unit of measure	VKF site		National park		Reserve	
		Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.
1	2			3	4	3	4
Issue of brochures and booklets, total number of copies of all issues	copies	**3,200**	**744.2**	1,200.0	241.8	2,000	502.4
Issue of posters, calendars, postcards, sets of postcards, total number of copies of all issues	copies						
Issue of other advertising products, number of issues	issue						
Issue of other advertising products	copies	**5,600**	**707.7**	600.0	115.3	5,000	592.4
Creation of video products	Pcs/minutes	**1**	**223.1**	1.0	223.1		
Holding children's ecological camps and expeditions	event	**68**	**532.3**	67.0	356.9	1	175.4
Organization and activity of study groups and forestry units	event	**1**	**175.3**			1	175.3
Organization and activity of study groups and forestry units	employees	**45**	**229.8**	20.0	229.8	25	
Holding school trips	event						
Holding school trips	employees						
Day of the Ecologist	event						
Day of the Ecologist	employees						
Day of the Forest Worker	event						
Day of the Forest Worker	employees						
Day of Birds	event						
Day of Birds	employees						
"March of Parks"	event						
"March of Parks"	employees						
Other events	event						
Others	persons						
Total: festive occasions and actions	employees	**3,400**	**1,156.8**	3,400.0	1,156.8		
Development of scientific topics (number of research works)	pcs	**12**	**8894.4**	10.0	2,286.0	2	6,608.4
Field works	Man/day						
Inventory of natural complex components	site						
Landscape mapping:	Man/day						
Vegetation mapping:	Man/day						
Other mapping:	Man/day						
Preparation and issue of monographs and subject collections:	number of copies						
Preparation and issue of monographs and subject collections:	number of copies						
Preparation of scientific articles in foreign and all-Russian journals	pcs						
Preparation of scientific articles in regional journals,	pcs						
Preparation of scientific articles and theses in subject collections,	pcs						
Development of recommendations for improving protection of the	publications						

Measures	Unit of measure	VKF site		National park		Reserve	
		Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.
1	2			3	4	3	4
territory and preservation of its natural complexes							
Development of recommendations for protection of rare species of plants and animals	publications						
Development of other recommendations,	publications						
Measuring parameneters of the environment including biota	pcs	**4**	**134.4**	4.0	134.4		
Long-term series of observations	pcs	**4**	**130**	4.0	130.0		
Creation and arrangement of excursion ecological trails	Trails						
Creation and arrangement of excursion ecological trails	**Km of trails**	**90**	**6,131.6**	10.0	1726.9	80	4,404.7
Development and passportization of tourist routes	Routes						
Development and passportization of tourist routes	Km of routes						
Creation and arrangement of view points	pcs	**3**	**117.5**	2.0	97.5	1	20.0
Equipment of recreation and picnic places	pcs	**43**	**737.6**	40.0	279.7	3	457.9
Equipment of places for tent camping	pcs						
Organization (and operation) of car parks	pcs	**1**	**60.6**	1.0	60.6		
Organization (and operation) of car parks	Car spaces						
Maintenance of guest houses and stopping points	pcs	**64**	**9,763.9**	57.0	8274.9	7	1489.0
Maintenance of guest houses and stopping points	beds						
Conducting excursions for visitors	Groups						
Conducting excursions for visitors	Excursionists	**3,600**	**1,997.8**	3500.0	1923.5	100	74.3
Preparation and publication of information materials for visitors: map charts, descriptions of routes, etc.	materials						
Preparation and publication of information materials for visitors:	copies						
Participation in tourist exhibitions and fairs	events						
Conducting conservation, restoration and repair works at the sites of historical and cultural heritage	sites						
Restoration and maintenance of priority cultural and landscape complexes in the traditional condition	sites						
Identification, mapping and certification of the sites of historical and cultural heritage	sites						
Development of recommendations for conservation of natural and cultural monuments	materials						
Total, works (for reference)			**67,377.8**		**38,354**		**29,023.8**
Total expenses of the SPNA in 2016			**98,140.3**		**52,509.1**		**45,631.2**

Table 3. Expenses per unit of work of "Pechora-Ilych State Nature Biosphere Reserve" FSBI, 2016

Measures	**Unit of measure**	**Amount of work in 2016, total (in units of measure)**	**Expenses, total on a measure Thousand rub.**	**Expenses per unit of works, thousand rub.**
1	2	3	4	5
Maintenance, renovation, repair: fire lines, total	km	6	82.8	13.8
Installation and maintenance of fire-fighting stands	pcs	10	50	5.0
Selective sanitary fellings	ha			
Selective sanitary fellings	m^3			
Cleaning the forest from littering:	ha		493.0	
Cleaning the forest from littering:	m^3	30		16.4
Current forest pathology research	man/day			
Current forest pathology research	ha			
Installation of banners	pcs	70	851.8	12.2
Installation of information boards	pcs			
Installation of information signs and signposts	pcs	2	50.0	25.0
Foot patrolling of the SPNA and its protection zone	man/day		2,196.2	
Foot patrolling of the SPNA and its protection zone	km	7500		0.3
Patrolling of the SPNA and its protection zone using motor transport	man/day		3,592.9	
Patrolling of the SPNA and its protection zone using motor transport	km	15,000		0.2
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	man/day		4,277.0	
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	km	20,000		0.2
Flying around the SPNA and its protection zone	Flight hour	10	1,000.0	100.0
Maintenance of natural and cultural heritage museums	pcs	1	1,727.0	1,727.0
Creation of information centers for visitors	pcs			
Maintenance of information centers for visitors	pcs			
Renewal of expositions of museums and information centers	Expositions			
Holding specialized exhibitions	pcs	3	30.6	10.2
Publishing by staff employees of popular scientific and propaganda articles in printed publications	Article, pcs	20	172.7	8.6
Television appearance of staff employees	pcs			
Radio appearance of staff employees	pcs			
Issue of periodical printed publications	copies			
Maintenance of the Web-site,	Man/day			
Issue of brochures and booklets, total number of copies of all issues	copies	2,000	502.4	0.3
Issue of posters, calendars, postcards, sets of postcards, total number of copies of all issues	copies			
Issue of other advertising products, number of issues	issue			
Issue of other advertising products	copies	5,000	592.4	0.1
Creation of video products	Pcs/minutes			
Holding children's ecological camps and expeditions	event	1	175.4	175.4

Measures	Unit of measure	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Expenses per unit of works, thousand rub.
1	2	3	4	5
Organization and activity of study groups and forestry units	event	1	175.3	
Organization and activity of study groups and forestry units	employees	25		7.0
Holding school trips	event			
Holding school trips	employees			
Day of the Ecologist	event			
Day of the Ecologist	employees			
Day of the Forest Worker	event			
Day of the Forest Worker	employees			
Day of Birds	event			
Day of Birds	employees			
"March of Parks"	event			
"March of Parks"	employees			
Other events	event			
Others	employees			
Development of scientific topics	pcs	2	6,608.4	3,304.2
Field works	Man/day			
Inventory of natural complex components	site			
Landscape mapping:	Man/day			
Vegetation mapping:	Man/day			
Other mapping:	Man/day			
Preparation and issue of monographs and subject collections:	number of copies			
Preparation and issue of monographs and subject collections:	number of copies			
Preparation of scientific articles in foreign and all-Russian journals	pcs			
Preparation of scientific articles in regional journals,	pcs			
Preparation of scientific articles and theses in subject collections,	pcs			
Development of recommendations for improving protection of the territory and preservation of its natural complexes	publications			
Development of recommendations for protection of rare species of plants and animals	publications			
Development of other recommendations,	publications			
Measuring parameneters of the environment including biota	Man/days			
Long-term series of observations	Man/days			
Creation and arrangement of excursion ecological trails	Trails		4404.7	
Creation and arrangement of excursion ecological trails	Km of trails	80		55.1
Development and passportization of tourist routes	Routes			
Development and passportization of tourist routes	Km of routes			
Creation and arrangement of view points	pcs	1	20.0	20.0
Equipment of recreation and picnic places	pcs	3	457.9	152.6
Equipment of places for tent camping	pcs			

Measures	Unit of measure	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Expenses per unit of works, thousand rub.
1	2	3	4	5
Organization (and operation) of car parks	pcs			
Organization (and operation) of car parks	Car spaces			
Maintenance of guest houses and stopping points	pcs	7	1,489.0	212.7
Maintenance of guest houses and stopping points	beds			
Conducting excursions for visitors	Groups			
Conducting excursions for visitors	Total excursionists	100	74.3	0.7
Preparation and publication of information materials for visitors: map charts, descriptions of routes, etc.	materials			
Preparation and publication of information materials for visitors:	copies			
Participation in tourist exhibitions and fairs	events			
Conducting conservation, restoration and repair works at the sites of historical and cultural heritage	sites			
Restoration and maintenance of priority cultural and landscape complexes in the traditional condition	sites			
Identification, mapping and certification of the sites of historical and cultural heritage	sites			
Development of recommendations for conservation of natural and cultural monuments	materials			

Table 4. Expenses per unit of works of Yugyd Va National Park FSBI, 2016

Measures	Unit of measure	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Expenses per unit of works, thousand rub.
1	2	3	4	5
Maintenance, renovation, repair: fire lines, total	km	***40.0***	**560.3**	14.0
Installation and maintenance of fire-fighting stands	pcs	***10.0***	**363.5**	36.4
Selective sanitary fellings	ha			
Selective sanitary fellings	m^3	**300.0**	**1,023.2**	3.4
Cleaning the forest from littering:	ha			
Cleaning the forest from littering:	m^3	**200.0**	**877.4**	4.4
Current forest pathology research	man/day			
Current forest pathology research	ha	**20,000.0**	**2,994.4**	0.1
Forest engineering arrangement: sodic soils	pcs	**70.0**	**250.4**	3.6
Forest engineering arrangement: bird boxes	pcs	**60.0**	**236.1**	3.9
Installation of banners	pcs	**26.0**	**255.4**	9.8
Installation of information boards	pcs	-		
Installation of information signs and signposts	pcs	**10.0**	**87.7**	8.8

Measures	Unit of measure	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Expenses per unit of works, thousand rub.
1	2	3	4	5
Foot patrolling of the SPNA and its protection zone	man/day			
Foot patrolling of the SPNA and its protection zone	km	**1,800.0**	**1,293.4**	0.7
Patrolling of the SPNA and its protection zone using motor transport	man/day			
Patrolling of the SPNA and its protection zone using motor transport	km	**30,000.0**	**5,268.3**	0.2
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	man/day	**12,500.0**	**3,594.6**	0.3
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	km			
Flying around the SPNA and its protection zone	Flight hour	**100.0**	**1,937.5**	19.4
Maintenance of natural and cultural heritage museums	pcs			
Creation of information centers for visitors	pcs			
Maintenance of information centers for visitors	pcs	**5.0**	**368.3**	73.7
Renewal of expositions of museums and information centers	Expositions	**6.0**	**490.9**	81.8
Holding specialized exhibitions	pcs	**21.0**	**541.4**	25.8
Publishing by staff employees of popular scientific and propaganda articles in printed publications	Article, pcs	**32.0**	**580.8**	18.2
Television appearance of staff employees	pcs	**7.0**	**22.8**	3.3
Radio appearance of staff employees	pcs	**5.0**	**20.0**	4.0
Issue of periodical printed publications	copies	**3,000.0**	**350.4**	0.1
Maintenance of the Web-site,	Man/day			
Issue of brochures and booklets, total number of copies of all issues	copies	**1,200.0**	**241.8**	0.2
Issue of posters, calendars, postcards, sets of postcards, total number of copies of all issues	copies			
Issue of other advertising products, number of issues	issue			
Issue of other advertising products	copies	**600.0**	**115.3**	0.2
Creation of video products	Pcs/minutes	**1.0**	**223.1**	223.1
Holding children's ecological camps and expeditions	event	**67.0**	**356.9**	5.3
Organization and activity of study groups and forestry units	event			
Organization and activity of study groups and forestry units	employees	**20.0**	**229.8**	11.5
Holding school trips	event			
Holding school trips	employees			
Day of the Ecologist	event			
Day of the Ecologist	employees			
Day of the Forest Worker	event			
Day of the Forest Worker	employees			
Day of Birds	event			
Day of Birds	employees			
"March of Parks"	event			
"March of Parks"	employees			
Total: festive occasions and actions	employees	**3,400.0**	**1,156.8**	0.3
Other events	event			
Others	employees			

Measures	Unit of measure	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Expenses per unit of works, thousand rub.
1	2	3	4	5
Development of scientific topics (number of research works)	pcs	**10.0**	**2,286.0**	228.6
Field works	Man/day			
Inventory of natural complex components	site			
Landscape mapping:	Man/day			
Vegetation mapping:	Man/day			
Other mapping:	Man/day			
Preparation and issue of monographs and subject collections:	number of copies			
Preparation and issue of monographs and subject collections:	number of copies			
Preparation of scientific articles in foreign and all-Russian journals	pcs			
Preparation of scientific articles in regional journals,	pcs			
Preparation of scientific articles and theses in subject collections,	pcs			
Development of recommendations for improving protection of the territory and preservation of its natural complexes	publications			
Development of recommendations for protection of rare species of plants and animals	publications			
Development of other recommendations,	publications			
Measuring parameters of the environment including biota	pcs	**4.0**	**134.4**	33.6
Long-term series of observations	pcs	**4.0**	**130.0**	32.5
Creation and arrangement of excursion ecological trails	Trails			
Creation and arrangement of excursion ecological trails	**Km of trails**	**10.0**	**1,726.9**	172.7
Development and passportization of tourist routes	Routes			
Development and passportization of tourist routes	Km of routes			
Creation and arrangement of view points	pcs	**2.0**	**97.5**	48.8
Equipment of recreation and picnic places	pcs	**40.0**	**279.7**	7.0
Equipment of places for tent camping	pcs			
Organization (and operation) of car parks	pcs	**1.0**	**60.6**	60.6
Organization (and operation) of car parks	Car spaces			
Maintenance of guest houses and stopping points	pcs	**57.0**	**8,274.9**	145.2
Maintenance of guest houses and stopping points	beds			
Conducting excursions for visitors	Groups			
Conducting excursions for visitors	Total excursionists	**3,500.0**	**1,923.5**	0.5
Preparation and publication of information materials for visitors: map charts, descriptions of routes, etc.	materials			
Preparation and publication of information materials for visitors:	copies			
Participation in tourist exhibitions and fairs	events			
Conducting conservation, restoration and repair works at the sites of historical and cultural heritage	sites			
Restoration and maintenance of priority cultural and landscape complexes in the traditional condition	sites			
Identification, mapping and certification of the sites of historical and cultural heritage	sites			

Measures	Unit of measure	Amount of work in 2016, total (in units of measure)	Expenses, total on a measure Thousand rub.	Expenses per unit of works, thousand rub.
1	2	3	4	5
Development of recommendations for conservation of natural and cultural monuments	materials			

Table 5 includes actual expenses of the SPNAs included in the VKF site territory for each type (and parameter) of works. The average values of the cost of works may be used for calculation of the need in resources for organization and functioning of buffer and protection zones included in the site territory as well as the programs realized by the SPNA for the first time.

Table 5. Actual expenses per unit of amount of works in the reserve and national park in 2016

Measures	Unit of measure	National park actual expenses per unit of works, thousand rub.	Reserve: actual expenses per unit of works, thousand rub.
Maintenance, renovation, repair: fire lines	km	14.0	13.8
Installation and maintenance of fire-fighting stands	pcs	36.4	5.0
Forest engineering arrangement: sodic soils	pcs	3.6	
Forest engineering arrangement: bird boxes	pcs	3.9	
Selective sanitary fellings	ha		
Selective sanitary fellings	m^3	3.4	
Cleaning the forest from littering:	ha		
Cleaning the forest from littering:	m^3	4.4	16.4
Current forest pathology research	man/day		
Current forest pathology research	ha	0.1	
Installation of banners	pcs	9.8	12.2
Installation of information boards	pcs		25.0
Installation of information signs and signposts	pcs	8.8	
Foot patrolling of the SPNA and its protection zone	man/day		
Foot patrolling of the SPNA and its protection zone	km	0.7	0.3
Patrolling of the SPNA and its protection zone using motor transport	man/day		
Patrolling of the SPNA and its protection zone using motor transport	km	0.2	0.2
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	man/day		
Patrolling of river, lake water areas within the borders of the SPNA and its protected zone	km	0.3	0.2
Flying around the SPNA and its protection zone	Flight hour	19.4	100.0
Maintenance of natural and cultural heritage museums	pcs		1727.0
Creation of information centers for visitors	pcs		

Measures	Unit of measure	National park actual expenses per unit of works, thousand rub.	Reserve: actual expenses per unit of works, thousand rub.
Maintenance of information centers for visitors	pcs	73.7	
Renewal of expositions of museums and information centers	Expositions	81.8	
Holding specialized exhibitions	pcs	25.8	10.2
Publishing by staff employees of popular scientific and propaganda articles in printed publications	Article, pcs	18.2	8.6
Television appearance of staff employees	pcs	3.3	
Radio appearance of staff employees	pcs	4.0	
Issue of periodical printed publications	copies	0.1	
Maintenance of the Web-site,	Man/day		
Issue of brochures and booklets, total number of copies of all issues	copies	0.2	0.3
Issue of posters, calendars, postcards, sets of postcards, total number of copies of all issues	copies		
Issue of other advertising products, number of issues	issue		
Issue of other advertising products	copies	0.2	0.1
Creation of video products	Pcs/minutes	223.1	
Holding children's ecological camps and expeditions	event	5.3	175.4
Organization and activity of study groups and forestry units	event		
Organization and activity of study groups and forestry units	employees	11.5	7.0
Holding school trips	event		
Holding school trips	employees		
Day of the Ecologist	event		
Day of the Ecologist	employees		
Day of the Forest Worker	event		
Day of the Forest Worker	employees		
Day of Birds	event		
Day of Birds	employees		
"March of Parks"	event		
"March of Parks"	employees		
Total: festive occasions and actions	employees	0.3	
Other events	event		
Others	employees		
Development of scientific topics (number of research works)	pcs	228.6	3,304.2
Field works	Man/day		
Inventory of natural complex components	site		
Laandscape mapping:	Man/day		
Vegetation mapping:	Man/day		
Other mapping:	Man/day		
Preparation and issue of monographs and subject collections:	number of copies		
Preparation and issue of monographs and subject collections:	number of copies		
Preparation of scientific articles in foreign and all-Russian journals	pcs		

Measures	Unit of measure	National park actual expenses per unit of works, thousand rub.	Reserve: actual expenses per unit of works, thousand rub.
Preparation of scientific articles in regional journals,	pcs		
Preparation of scientific articles and theses in subject collections,	pcs		
Development of recommendations for improving protection of the territory and preservation of its natural complexes	publications		
Development of recommendations for protection of rare species of plants and animals	publications		
Development of other recommendations,	publications		
Measuring parameters of the environment including biota	pcs	33.6	
Long-term series of observations	pcs	32.5	
Creation and arrangement of excursion ecological trails	Trails		
Creation and arrangement of excursion ecological trails	**Km of trails**	172.7	55.1
Development and passportization of tourist routes	Routes		
Development and passportization of tourist routes	Km of routes		
Creation and arrangement of view points	pcs	48.8	20.0
Equipment of recreation and picnic places	pcs	7.0	152.6
Equipment of places for tent camping	pcs		
Organization (and operation) of car parks	pcs	60.6	
Organization (and operation) of car parks	Car spaces		
Maintenance of guest houses and stopping points	pcs	145.2	212.7
Maintenance of guest houses and stopping points	beds		
Conducting excursions for visitors	Groups		
Conducting excursions for visitors	Excursionists	0.5	0.7
Preparation and publication of information materials for visitors: map charts, descriptions of routes, etc.	materials		
Preparation and publication of information materials for visitors:	copies		
Participation in tourist exhibitions and fairs	events		
Conducting conservation, restoration and repair works at the sites of historical and cultural heritage	sites		
Restoration and maintenance of priority cultural and landscape complexes in the traditional condition	sites		
Identification, mapping and certification of the sites of historical and cultural heritage	sites		
Development of recommendations for conservation of natural and cultural monuments	materials		

APPENDIX 4

I. EDUCATIONAL AND SPORTS TOURISM ON THE SITE

One of the main tasks of the Specially Protected Natural Areas of the World Heritage Site is to provide conditions for tourism in respect of the national park, and to develop educational tourism in respect of the nature reserve.

Annually 10-11 thousand of tourists visiting Virgin Komi Forests Site *territory* (Table 1) spend on their travels 142 million rubles, 136 million rubles of which is a share of transport and trade companies and local population, and 6 million rubles is a share of the Specially Protected Natural Areas forming the site[1].

Income share of the Specially Protected Natural Areas from services for tourists amounts from 2.2% of the budget of the natural reserve to 9.4% budget of the national park. The difference is explained by large tourist flow to the national park and more developed range of its services, and also by the fact that services to the tourist flow to the nature reserve buffer zone (third part of the whole flow) are provided by the local population and companies which are not residents of the Republic. Visiting of these regional Specially Protected Natural Areas is regulated by no means and is poorly controlled[2], which resulted in prevalence of resource (procuring) tourism within their territory.

In the structure of the Specially Protected Natural Areas income from services for tourists payment for the services of tourist infrastructure is: 85% in the park, 57% in the nature reserve. Therefore, growth of the Specially Protected Natural Areas income from services for tourists is primarily related to development of tourist infrastructure. Potential of this kind of the Specially Protected Natural Areas services is estimated in 2-3 times higher than for the moment, and the infrastructure deficiency is 50-75%.

The Specially Protected Natural Areas invest income from services for tourists in their tourist infrastructure and other top priority programs of the Specially Protected Natural Areas, however insignificant income flow delays creation of infrastructure complex capable to increase the areas flow capacity and Specially Protected Natural Areas income, provided that visiting is safe for the Specially Protected Natural Areas sites and natural habitat.

In order to develop tourism 30.3% of the site territory are under limited exploitation conditions. There are such areas within the park territory. Concerning the nature reserve, there is possibility to intensify tourist services development only due to the protective (buffer) zone. Moreover, traditional nature management (with exploitation of resources) is allowed within the territory of the buffer zone, what may expand the spectrum of the nature reserve services.

Table 1. Visitors to the site, thousand people

Indicator, year	Number of visitors, thousand people	National park		Nature reserve with buffer zone		
		Visitors to the national park territory	Participants of the actions of the park	Visitors to mountain site of the nature reserve	Visitors to manor sites of the nature reserve	Visitors to the buffer zone of the nature reserve
Total visitors, 2016	45.722	6.383	35.0	4.339		

[1] Assessment of 2016

[2] The forestry members have no power to protect the environment, except for the forest fund, monitoring bodies are financially limited and have no possibility to regularly control the territories of the Republic which are under their control, and the nature reserve as well has no power to protect these Specially Protected Natural Areas.

Indicator, year	Number of visitors, thousand people	National park		Nature reserve with buffer zone		
		Visitors to the national park territory	Participants of the actions of the park	Visitors to mountain site of the nature reserve	Visitors to manor sites of the nature reserve	Visitors to the buffer zone of the nature reserve
Total visitors to the Specially Protected Natural Areas territory, 2016	10.722	6.383		1.414	1.425	1.500

6,383 tourists visited the park in 2016[3], annual growth of visitors flow is 2-3%. The most popular Inta branch is visited on the average by 53% of tourists, Vuktyl site of the park is visited by about 40%, Pechora site by 7%. The structure of preferences of types of rest by tourists on the average was distributed as follows: rafting along the park rivers on non-motorized vessels is 42% of visits; walking and water tourism – 12%, walking – up to 15% of visitors, city break – up to 31% of tourists. Visitors to the park prefer independent travels.

In 2016 the nature reserve was visited by 1,414 people, including visitors to the moose farm and museum (687 people). In the mountain cluster 727 people traveled, most of whom visited the rock pillars of Manpupuner. Compared to 2015, the number of visitors to the nature reserve mountain sites has doubled. Buffer zone of the nature reserve was visited by about 1,500 people in 2016, half of them were the floating tourists who got to the territory by helicopters. The rest were accompanied by the local population on boats.

In order to accommodate tourists and provide services to them within the park territory special infrastructure facilities were equipped and urgent demand for them was estimated - Table 2.

Table 2. Site tourist infrastructure

Infrastructure facility	Quantity, pcs	Demand estimation, min-max, pcs*
Tourist infrastructure		
Places equipped for camping areas, pcs	80	120-130
Stopping points and shelters	100	110-120
Intermediate stopping places (gazebo, restroom, litter bin)	-	160-180
Litter bins	99	150-180
General-purpose infrastructure (security, researches and tourism)		
Cordons and control and security points, pcs	15	16
Ecological tourism infrastructure		
View points, pcs	21	30-35
Information centers, pcs	5	6-7
Ecological routes, pcs (km)	15 (100.5)	20-25
Animal show sites (farms, self-feeding stations)	1	4-5
City break infrastructure		
Equipped recreational areas and "picnic" points, pcs	111	120-130
Stopping (hotel) points at manors	5	6-8
Auxiliary infrastructure		
Car parks, pcs	3	6
Other facilities *(bridges, ladderways): long meters*	1130	5,000
Public catering facilities, pcs	-	2
Household waste collection point (end of raft routes)	-	9

*-calculation of demands is provided in tables 8-12 of this Appendix

For sports and ecological tourists the park maintains and operates 17 prepared (walking and water) routes, as well as 4 winter routes duplicating them, the park maintains 3 fully equipped educational routes lasting for several days, one of which is all-season.

[3] Visitors to the park in 2016: 63% are residents of Komi, 12.8% are from Moscow and St. Petersburg, 22.7% are from other regions of the country, and 1.5% are from 15 countries of the world.

II. RESULTS OF QUESTIONNAIRE SURVEY AMONG TOURISTS[4]

In 2015 questionnaire survey among the visitors of the park was conducted. Results of the survey may be considered when assessing threat, determining demands and expectations of the site visitors with some restrictions (which, as a rule, are related to responses of people living close by the park territory and constituting 2.5% of respondents), and also permits to improve advertisement and work with visitors.

Visitors were offered two types of questionnaires, one of which showed visitors' demands for the park services and willingness to pay for them, the second type of questionnaires was intended to find out motivation of a tourist, who have visited the park, to visit (any) natural areas. The second type of questionnaires permitted to find out which types of outdoor activities are preferred by tourists in order to assess potential threat to its resources and determine potential services of the Specially Protected Natural Areas. In total 81 questionnaires were filled in, 35 of them found out tourists demands and 46 found out motivation to visit (any) natural areas.

Sample approximately corresponded to distribution of visitors according to place of residence - Table 3.

Table 3. Correspondence of totality of visitors to the sample of visitors according to place of residence.

Place of residence of visitors to the park	Share of visitors to the park, on the average, %	Distribution of sample according to visitors categories, %
Settlements of the Republic of Komi	64.7	73.9
Settlements of the Russian Federation	21.3	15.2
Moscow, Saint Petersburg and regions	11.3	10.9
Foreign countries	2.7	0

As the respondents were selected only from the target group of visitors of Yugyd Va National Park, social and demographic characteristics of totality of visitors were not reliably known and the goals did not require the excessive accuracy, the sample criteria were not brought to exact correspondence with the totality.

Figure 1. Visitors age, years old

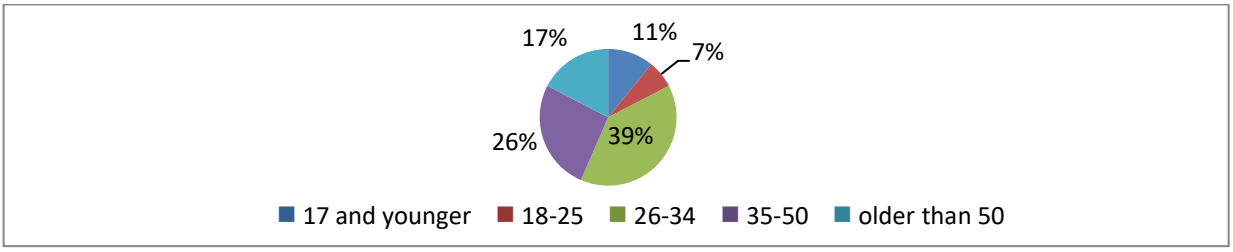


Figure 2. Social characteristics of the respondents

[4] Business plan of "Yugyd Va" National Park" Federal State Budgetary Institution, 2015

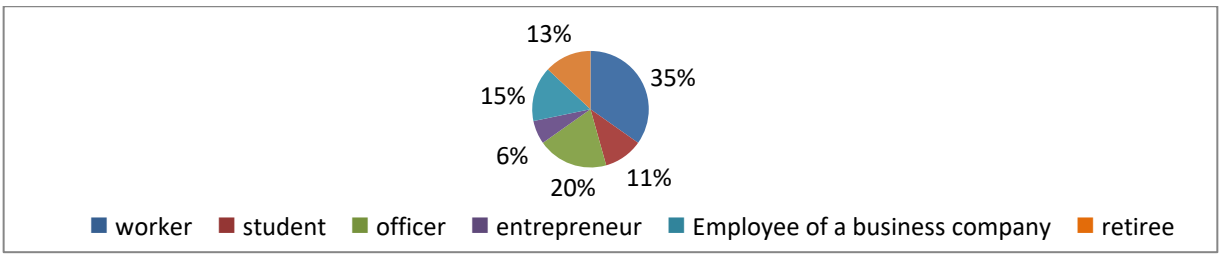


Figure 3. Sex composition of the respondents

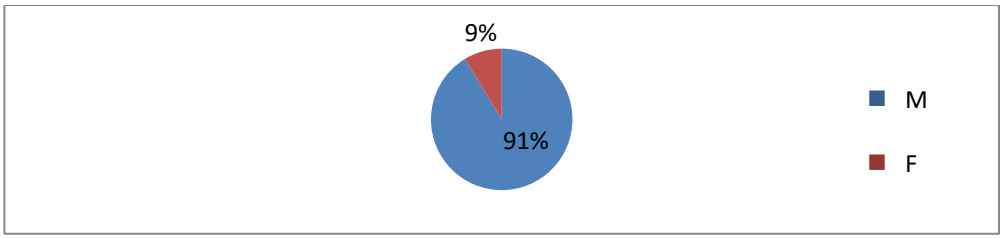


Figure 4. Preferences for visiting the Specially Protected Natural Areas in social groups.

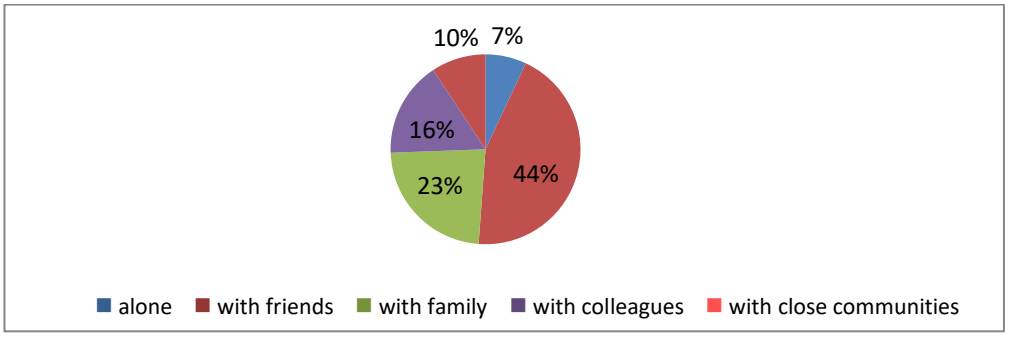
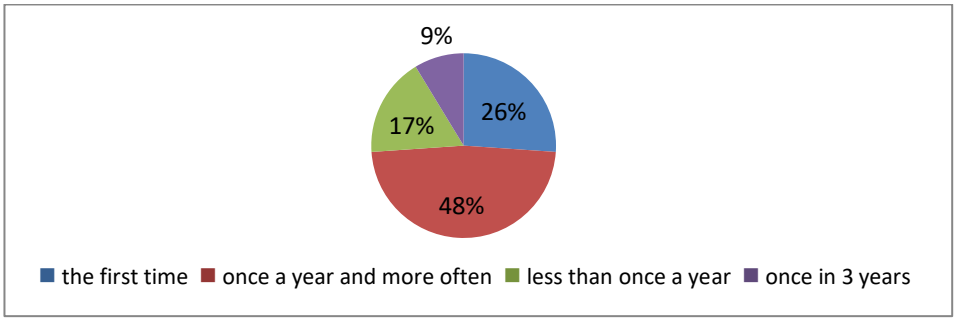


Figure 5. Frequency of visiting the Specially Protected Natural Areas in social groups



Following the estimation of prospects of the park visitors number, significant potential for tourist flow growth has been found out: 26% of the respondents were visiting the park for the first time, 48% of the respondents visit the park once a year and more often, a quarter of the respondents (26%) visit the park less than once a year or occasionally. 90% of the respondents answered in the affirmative to a question concerning further visits to the park.

Use by the Specially Protected Natural Areas of tourists databases in order to notify them about their new products (consent to get such notifications at their personal email addresses gave

12% of the visitors) will conduce further visiting. Development of the Internet communication will conduce getting new clients, considering that the most efficient source of information is the park site (or Internet forums) according to 31% of the respondents. Capabilities of word-of-mouth advertising (tourists who have visited the park earlier engage about 49% of visitors) will be also used after feedback from regular visitors is sought or tourists' reviews are posted on the Internet. Proper communication with visitors (for example, at "VKontakte") by means of discussion of problems, programs and actions of the Sit will conduce the same.

Park printed product was referred to as an information source by about 11% of the visitors. Park guidebooks, apart from engaging clients, perform functions of proper behavior with respect to the park nature, in interview park tourists and workers several times opened a question about demand for interactive version of guidebooks (potentially connected to route tracks, what will have an effect on visitors' safety as well).

Evaluation of existing park services is provided in Table 4 and demonstrates relative satisfaction of clients with services or underestimated expectations of services quality.

Table 4. Visitors' evaluation of existing park services on the basis of 5-point scale ("1" is for poor-quality service, "5" is for good-quality service)

Yugyd Va National Park Federal State Budgetary Institution service	Evaluation of acquired services					Total number of points = popularity of a service = demand a service
	"5"	"4"	"3"	"2"	"1"	
Services of accommodation places	7	6	2	0	0	15
Services of a bath house and bathing point	5	1	3	0	0	9
Transfer	6	2	0	0	0	8
Tourist stopping places	2	4	1	0	0	7
Guides' services	4	0	2	0	0	6
Motormen's services	1	3	0	0	0	4
Guided tours	2	0	2	0	0	4
Accommodation services at entry and exit from the Specially Protected Natural Areas territory	2	1	0	0	0	3
Hire of equipment	0	1	0	0	0	1

Price policy and tourists' expectations

To the question concerning a sum of money which a tourist is willing to pay for the park services, most of respondents set the sum from 1,000 to 2,000 rubles - Figure 6, however, answer to a question concerning willingness to pay for separate (certain) services demonstrates potential for highly-demanded services development - Table 5.

It may be supposed that by the "park services" visitor understood any other things, and in order to ensure that visitor is aware of structure of his/her expenses for visiting, it is necessary to improve information component of tourist product.

For example, online resource for route choice by tourists themselves with detailed plan and description of services at stopping places and services' prices at each stopping place. Moreover, it makes sense to add to the program features execution of payment documents for visitors' convenience and Specially Protected Natural Areas tour creation cost saving.

In order to diversify payments it is necessary to offer several options of payment (plastic cards etc.). It will psychologically support willingness of a visitor to pay more by choosing more services, including guidebooks, interactive applications and other park goods.

Figure 6. Willingness to pay for services, in total, rubles

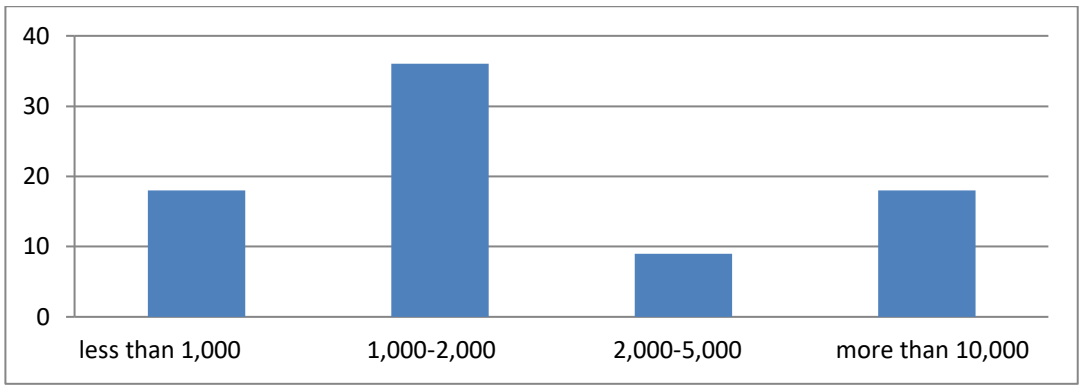


Table 3. Willingness of a visitor to pay for a certain kind of services.

Willingness of a visitor to pay for the national park services.	Meas. unit	Rubles per unit, on the average	Number of responses, (popularity of service)
Services of accommodation places (camps, shelters)	1 day/person	719.4	23
Bath house services	1 service/person	592.9	21
License for fishing	1 animal unit	196.1	15
Conveniences at camps (water and power supply, drainage systems) willingness to pay extra	1 day/person	394.4	9
Escorting by guides	1 day	2,600	5
Stopping places, including firewood	1 day	275	4
Tour guides' services	1 guided tour	750	2
Services of a boat with a motorman	1 day	2,000	1
Services of a snowmobile with a motorman	1 hour	150	1

Demand for services

Within the frame of estimation of tourists demand for park services most of visitors referred to accommodation at camps (20%), stopping places (11%) and services of bath houses and bathing points (11%) as the most popular services. Which is to say that the development of park infrastructure is still a significant factor of its income growth.

Respondents, who answered to the question concerning willingness to pay for the park services with indication of sum, referred to services of accommodation places (23 responses), services of bath house (21 responses) and license for fishing (15 responses) as the most demanded services. 9 visitors are willing to pay 50% of accommodation services cost extra for convenient accommodation (including power and water supply, drainage systems) (Table 5).

Some few proposals to develop park services were obtained. About 30% of tourists' proposals are related to improvement of services quality, that is safety (communications services) and stopping places chain development, more complex furnishing and service at them (Table 4). It may be expected that in the event of conveniences improvement at stopping places and camps, visitors will consider simultaneous increase in the cost of the Specially Protected Natural Areas services reasonable.

Figure 7. Demand for the park services, % of responses

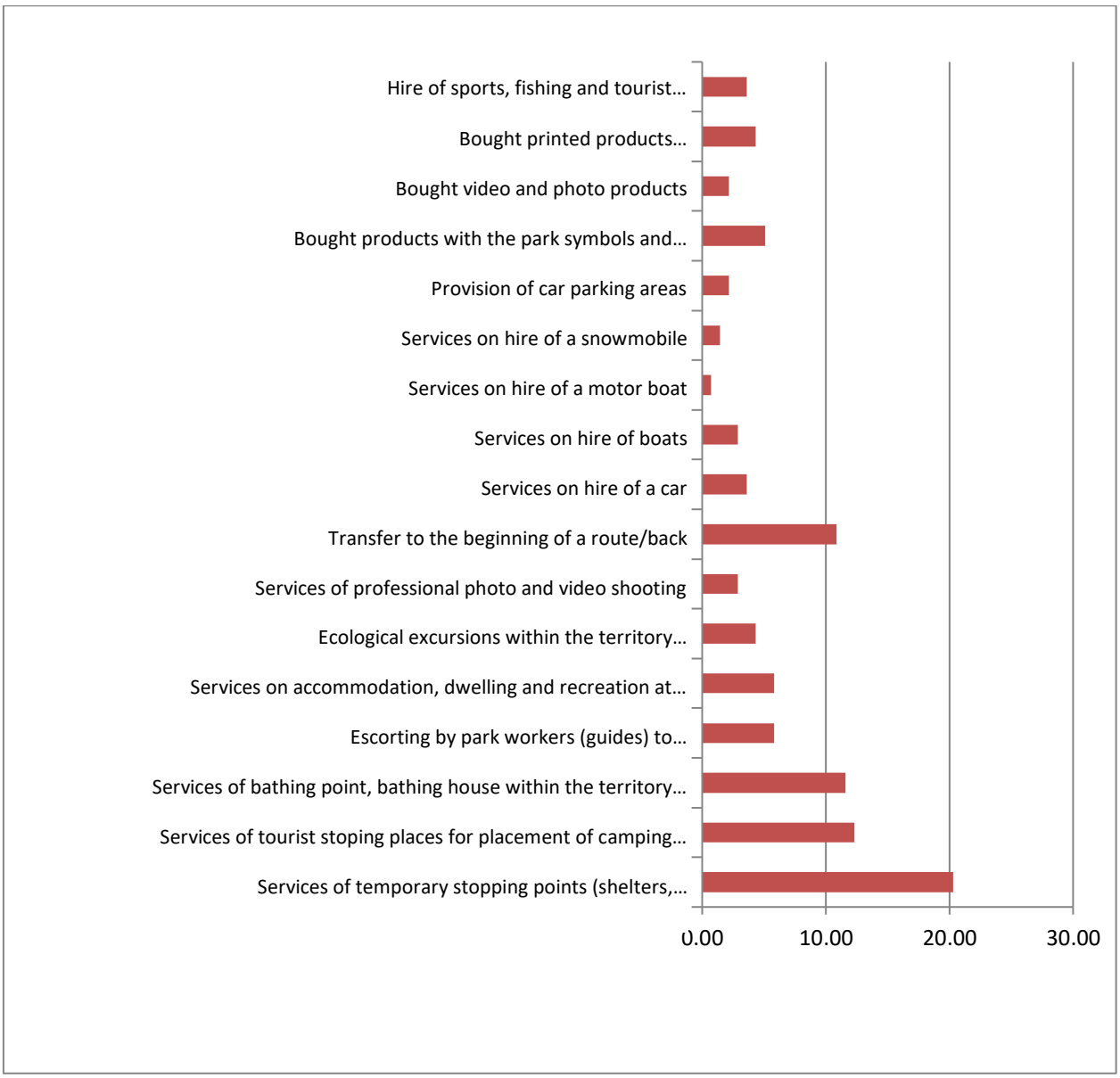


Table 6. Demand for missing park services.

Missing services - demand	Responses
Communications along a route/ satellite communications	2
Improvement of accommodation places	1
New camps along routes	1
Transfer to Ukhta	1
Car parking area	1

Popular goods are souvenir products - 5 % of responses, due to this fact there is motive to broaden the range of souvenir products. On the average, each tourist, who bought some souvenir products, spent on its purchase 870 rubles noticing limited choice of products and deficiency of salespoints of such products.

Also transport services are popular, as well as accommodation services along the routes - 10%. Generally, these services are provided by private carriers (Inta and Pechora branches, Ilych forestries) and the Specially Protected Natural Areas (Vuktyl area and the nature reserve manor). In order to increase the Specially Protected Natural Areas share of income from this type of

services it is necessary either revise policy of provision of such type of services or extend the range of own transfer services, for example, by improving their convenience in order to compete with other carriers and reliability of their provision, or the full range of the service "from the train to the site". About 10% of tourists were willing to pay 25-100% and more of transfer cost extra for high-quality logistics.

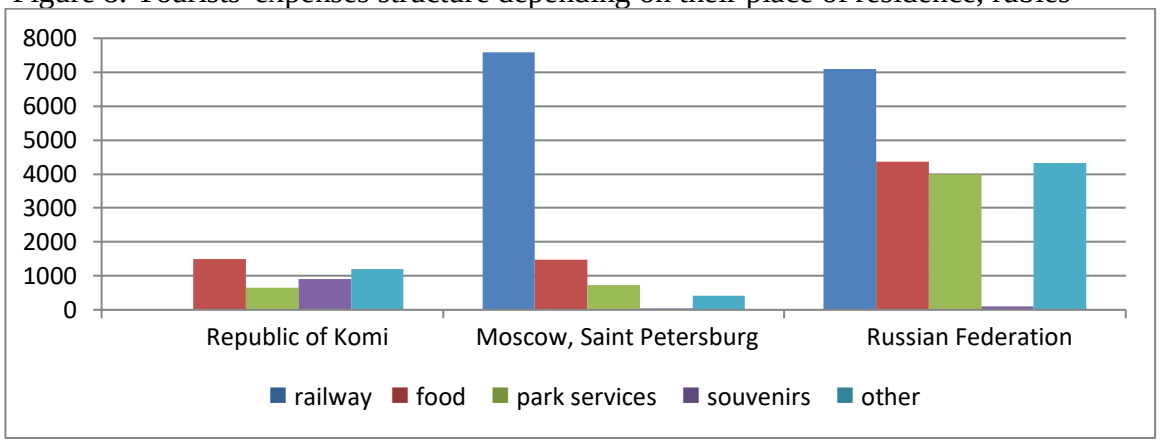
The tourists estimated their actual expenses for the travel - Table 7.

Table 7. Tourists' estimation of their expenses for visit to the park.

Tourist's expenses/ his/her place of residence	**Republic of Komi**	**Russian Federation**	**Moscow**	**Russian Federation, 6 people**	**Russian Federation**	**Russian Federation**	**Republic of Komi**	**Republic of Komi, 8 people**	**Russian Federation**	**Moscow and Saint Petersburg, 4 people**	**On the average, rubles**
Railway and transport		7,000	7900	36,000	15,000	6,000			7,000	30,000	4,356
Food	1,500	8,000	7,400	28,560	5,000	2,000					2,098.4
Park services	600	7,000	3,600	28,436	2,000	2,500	700				1,793.44
Souvenirs	900		200		1,000						84
Other			2,100	41,200	2,000		1,200				1,860
Total	**3,000**	**22,000**	**21,200**	**134,196**	**25,000**	**10,500**	**1,900**	**58,000**	**17,000**	**77,000**	**14,791.84**

Tourists' expenses structure depending on their place of residence is demonstrated in Figure 8.

Figure 8. Tourists' expenses structure depending on their place of residence, rubles

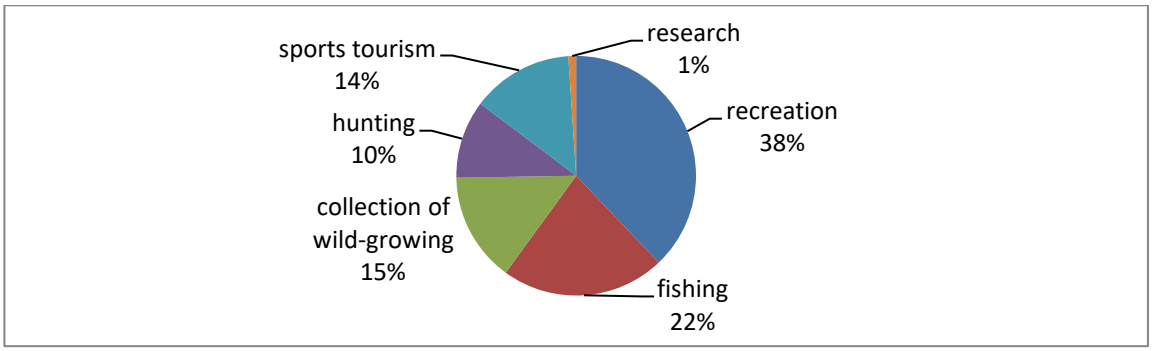


Motives to visit (any) natural areas

Questionnaire assessment of motivation of a person to visit (any) natural areas was used *in order to find out which types of outdoor activities are preferred by visitors* in order to assess potential for tourism within the Special Protected Natural Areas territory and *to find out potential threat to their territories and resources, as well as determine the most dangerous for the park territory and resources visitors segment.*

Resource motivation of tourists have been distributed as follows: 15% of the respondents are interested in the collection of berries and mushrooms when visiting natural areas (not the Specially Protected Natural Areas); 22% of the respondents are interested in the sport fishing and 10% in the hunt. In total resource motivation is important for 47% of visitors. Considering that prohibition on resource use is not always is sufficient impediment to use it, the threat of resource use by tourists is evaluated as significant.

Figure 9. Preferred types of outdoor activities, the respondents were to choose several from 95 answers.



36% of the respondents in total indicated the absence of *any* resource motivation. Resource motivation has no dependence on the place of visitors residence.

About half of visitors are willing to purchase the permission to sport fishing at an average price of 196 rubles per 1 fish, in the context of demand for catching of 21 fishes per a person within a visiting, as set on the average for 10 days.

III. DEMAND FOR THE SITE TOURIST INFRASTRUCTURE

In order to create comfortable conditions for sports and educational tourism, recreation and environmental education, as well as to ensure the safety of visitors and the natural environment of the Specially Protected Natural Areas, special tourist infrastructure, including heated buildings (to be protected from cold and at least - to dry clothes), sheds to be protected from rain, places for tents, sanitary facilities (restrooms, showers and bath houses, litter bins), ladderways and stairs excluding erosion of soil and banks, and a number of other facilities.

The demand for the infrastructure was calculated on the basis of the length and traffic of the Specially Protected Natural Areas routes.

Table 8 shows the characteristics of routes and their preference by visitors.

Within the site territory there are 30 active routes (21 routes for snowless period and 9 winter routes) with a total length of about 4,000 km. Each route was equipped depending on availability of areas and proceeding from financial opportunities of the Specially Protected Natural Areas. The demand for the infrastructure intended to create comfortable conditions for visitors to federal Specially Protected Natural Areas is met by 50-75%, at the buffer zone the routes are equipped with facilities of temporary infrastructure for 10% of the demand. The willingness of visitors to pay for comfortable accommodation was also considered in the calculation.

Table 8. Equipped tourist routes within the World Heritage Site territory

		Water	**Walking**	**Walking and water**	**Ski**	**Oversnow**	**City break**	**Total**
Number of routes, pcs	national park	3	4	7	6	2	10	21
	nature reserve	2	4	-	-	2	3	6
	buffer zone	2	-	1	-	-	1	3
	total	7	8	8	6	4	14	30
Length of routes, km	national park	762	563	1,101	592	315	-	3,303
	Nature reserve	240	45	-	-	15	-	300
	buffer zone	220	-	120	-	-	-	340
	Total	1,222	608	1,221	592	330	-	3,973

Preference to routes by tourists, %	41	15	12	<1%	<1%	31	100

Demand for the infrastructure facilities was calculated separately. Table 9 demonstrates inventory accounting of the national park facilities as of January 1, 2015.

Table 9. National park tourist infrastructure facilities.

Branch / River basin	Forestry / facilities	Shelters, cordons, hotels, dwelling houses	Bath houses	Gazebos	Litter bins	Bridges and cross-walks	Restrooms	Ramps to water and pathways	Scenery spots, grounds	Fire-pits	Places for tents	Mobile housing unit	Direction signs
Vuktyl, Shchugor	Verkhne-Shchugorskoye	1	1	5	3	0	5	0	0	4	5	1	5
	Nizhne-Shchugorskoye	5	1	7	9	1	7	2	1	10	9	0	7
	Patokskoye	13	5	14	16	3	17	14	8	19	13	0	8
Total Shchugor river basin, route of 356 km		*19*	*7*	*26*	*28*	*4*	*29*	*16*	*9*	*33*	*27*	*1*	*20*
Vuktyl, Podcherem	Podcherskoye	8	4	7	8	2	10	6	0	13	13	0	6
Total Podcherem river basin, route of 128 km		*8*	*4*	*7*	*8*	*2*	*10*	*6*	*0*	*13*	*13*	*0*	*6*
Pechora, Synya, Vangyr, Kosyu	Aranetskoye	5	2	3	2	0	3	0	1	4	0	0	1
	Syninskoye	8	4	3	6	0	6	1	3	11	4	2	3
	Kosyunskoye	2	2	0	2	1	2	0	1	2	1	1	0
Total Kosyu river basin, route of 173 km		*15*	*8*	*6*	*10*	*1*	*11*	*1*	*5*	*17*	*5*	*3*	*4*
Kozhim, Balbanyu	Verkhne-Kozhimskoye	15	1	29	26	4	23	13	4	27	20	0	8
	Kozhimskoye	0	1	13	14	0	3	8	1	14	13	0	0
Total Kozhim river basin, route of 230 km		*15*	*2*	*42*	*40*	*4*	*26*	*21*	*5*	*41*	*33*	*0*	*8*
Total, park		**57**	**21**	**81**	**86**	**11**	**76**	**44**	**19**	**104**	**78**	**4**	**38**

Demand for the park tourist infrastructure provided in table 10 is calculated on the basis of the following conditions:

Infrastructure ***reduces pollution of the territory***, that is ensured by availability of a sufficient number of restrooms and litter bins, information signs directing to these facilities;

Infrastructure ***reduces threat to forest stands and landscape***, that is ensured by availability of a sufficient number of places for tents, fire-pits, supplied with firewood, ladderways, ramps to water, gazebos, fire shields and fire lines;

Infrastructure ***improves the safety and comfort of tourists***, that is provided by availability of at least 1 heated building by 10-30 km of the route, as well as of a bath house or shower units supplied with firewood, gazebos, restrooms and a sufficient number of direction signs for these facilities.

Demand assessment of the site for the tourist infrastructure was also conducted with consideration of: the complexity of the route (calculation result of a daily route for walking and complex water tourism is 10-20 km); route convenience (improvement of convenience characteristics of the route is associated with the increase of the infrastructure amount based on daily walking of 8-12 km); and accessibility to the site for the infrastructure construction. Results of the assessment are shown in tables 10 and the second part of table 11.

Table 10. Demand for the park routes infrastructure and the number of annually maintained facilities.

River basin	Shelters, cordons, hotels, dwelling houses	Bath houses	Gazebos	Litter bins	Bridges and cross-walks	Restrooms	Ramps to water and pathways	Fire-pits with fire lines	Places for tents	Direction signs
Total facilities within Shchugor river basin	*19*	*7*	*26*	*28*	*4*	*29*	*16*	*33*	*27*	*20*
Minimum design availability of Shchugor river basin routes infrastructure	12	12	36	36	-*	36	-*	36	36	36
Total demand for construction of new infrastructure within Shchugor river basin	**0**	**5**	**10**	**8**	**-***	**7**	**-***	**3**	**9**	**16**
Total facilities within Podcherem river basin	*8*	*4*	*7*	*8*	*2*	*10*	*6*	*13*	*13*	*6*
Minimum design availability of Podcherem river basin routes infrastructure	10	8	18	18	-*	18	-*	18	36	36
Total demand for construction of new infrastructure within Podcherem river basin	**2**	**4**	**11**	**10**	-*	**8**	**23**	**5**	**23**	**30**
Total facilities within Kosyu river basin	*15*	*8*	*6*	*10*	*1*	*11*	*1*	*17*	*5*	*4*
Minimum design availability of Kosyu river basin routes infrastructure	15	9	18	18	-*	18	-*	18	24	36
Total demand for construction of new infrastructure within Kosyu river basin	**0**	**1**	**12**	**8**	-*	**7**	**-***	**1**	**19**	**32**
Total facilities within Kozhim river basin	*15*	*2*	*42*	*40*	*4*	*26*	*21*	*41*	*33*	*8*
Minimum design availability of Kozhim river basin routes infrastructure	17	3	46	46	-*	46	-*	46	-*	46
Total demand for construction of new infrastructure within Kozhim river basin	**2**	**1**	**4**	**1**	-*	**20**	-*	**5**	-*	**38**
TOTAL facilities within the national park routes	**57**	**21**	**81**	**86**	**11**	**76**	**44**	**104**	**78**	**38**
TOTAL demand for construction of new infrastructure, number of facilities	**4**	**11**	**37**	**27**	**-**	**42**	**-**	**14**	**-**	**116**
Demand for maintenance and servicing of facilities, number of facilities	**61**	**32**	**118**	**113**	**12**	**118**	**66**	**118**	**106**	**154**

-*-(dash) – demand needs assessing

Inventory accounting of the nature reserve tourist facilities as of December 1, 2016 is provided in table 11.

Table 11. Tourist infrastructure of the nature reserve and its buffer zone and estimation of demand for primary (minimum) level infrastructure

Area / River basin	Forestries	Shelters, cordons, hotels, dwelling houses	Bath houses	Gazebos	Litter bins	Bridges and cross-walks, long meters	Restrooms	Fire-pits with fire lines	Places for tents	Ramps to water
Nature reserve manor	Yakshinskoye	12	0	12	0	15	3	11	0	1
Upper reaches of the Pechora river	Verkhne-Pechorskoye	16	10	6	0	2	9	8	0	5
Upper reaches of the Ilych river	Nizhne-Ilychskoye	11	4	0	0	0	4	7	0	1
Ilych river	Verkhne-Ilychskoye	11	4	5	0	1	5	7	1	0
Buffer zone, Unya river	Verkhne-Pechorskoye	4	1	3	1		3	5	0	0
Total available		54	19	26	1	18	24	38	1	7
Demand for tourism infrastructure										
Nature reserve manor	Yakshinskoye	1	0	2	0	1	3	0	1	0
Pechora	Verkhne-Pechorskoye	3	1	1	8	5	3	3	2	2
Ilych	Verkhne-Ilychskoye	8	1	8	4	6	4	8	2	0
Ilych	Nizhne-Ilychskoye	2	0	2	0	6	3	0	1	2
Buffer zone, Unya river	Verkhne-Pechorskoye	0	1	5	7	0	7	3	0	0
Total demand for new infrastructure		14	3	18	19	18	20	14	6	4
Total demand for servicing and maintenance of the infrastructure		68	22	44	20	36	44	52	7	11

Total site infrastructure amount is provided in table 12.

Table 12. Site infrastructure and demand for it.

River basin	Shelters, cordons, hotels, dwelling houses and general-purpose infrastructure	Bath houses	Gazebos	Litter bins	Bridges and cross-walks	Restrooms	Ramps to water and pathways	Fire-pits with fire lines	Places for tents	Direction signs
Facilities available within the national park routes	57	21	81	86	11	76	44	104	78	38

River basin	Shelters, cordons, hotels, dwelling houses and general-purpose infrastructure	Bath houses	Gazebos	Litter bins	Bridges and cross-walks	Restrooms	Ramps to water and pathways	Fire-pits with fire lines	Places for tents	Direction signs
Facilities available within the routes of the nature reserve and buffer zone	54	19	26	1	18	24	7	38	1	0
Total infrastructure available, facilities	**111**	**40**	**107**	**87**	**29**	**100**	**51**	**142**	**79**	**38**
Demand for construction of new infrastructure, national park	4	11	37	27	-*	42	-*	14	-*	116
Demand for construction of new infrastructure, nature reserve	14	3	18	19	18	20	4	20	6	0
Total demand for infrastructure, facilities	**18**	**14**	**55**	**46**	**18**	**62**	**4**	**34**	**6**	**116**
Demand for servicing and maintenance of the facilities, national park	61	32	118	113	12	118	66	118	106	154
Demand for servicing and maintenance of the facilities, nature reserve	68	22	44	20	36	44	4	52	7	11
Total servicing and maintenance of the infrastructure, facilities	129	54	162	133	48	162	70	170	113	165

-(dash) – demand needs assessing

Resource estimation for the construction and maintenance of the site infrastructure is conducted on the basis of the actual costs of the Specially Protected Natural Areas (Appendix 3), as well as of the projects for construction of infrastructure on the site for the period from 2013 to 2015 using the prices index.

Calculation of demand for resources required for construction of the site infrastructure is provided in Table 13.

Table 13. Assessment of demand for resources for minimum (primary) supply of the site routes: Construction of missing infrastructure

	Quantity, units	Price per unit, thousand rubles	Total cost, thousand rubles
Construction: shelters, cordons, hotels, accommodation blocks	18	2,200	39,600
Construction: Bath houses or shower units (1 bath house = 3 shower units)	14	800	11,200
Construction of car parking areas	2	526.3	1052.6
Construction of view points	1	41.1	41.1
Construction: Gazebos	55	45	2,475
Construction: Litter bins	46	40	1,840
Construction: Restrooms	62	25	1,550
Construction: Fire-pits with fire lines	34	3	102
Construction: Places for tents	6	37.9	227.4
Installation: Direction signs	116	31.4	3642.4
TOTAL			**61730.5**

Demand for financial resources for annual maintenance and repair (renewal) of the existing infrastructure is provided in Table 14.

Table 14. Demand for financial resources for annual site maintenance

	Quantity, units	Price per unit, thousand rubles	Total cost, thousand rubles per year
Maintenance of shelters, including firewood counting 10 cubic meters per year	129	25	3,225
Maintenance of bath houses (including firewood counting 10 cubic meters)	54	10	540
Maintenance and repair of gazebos (recreation areas)	162	1	162
Cleaning of litter bins and waste disposal	133	0.53	70.49
Maintenance and repair of restrooms	143	0.15	21.45
Ramps to water and pathways, maintenance (repair)	70	0.2	14
Provision of stopping places with firewood (counting 5 cubic meters for a stopping place) and cleaning of fire lines and grounds (counting 100 meters)	162	0.254	41.148
Maintenance and repair of places for tents	113	2	226
Repair and renewal of banners and direction signs	165	1	165
TOTAL			4465.1

APPENDIX 4

PROSPECTIVE PLAN FOR DEVELOPMENT OF THE SITE FOR THE PERIOD UNTIL 2031

Predicting the development of the Specially Protected Natural Areas it is possible to assume with high probability that the Specially Protected Natural Areas and the site are expected to suffer in the future the following threats, which consequently imply the following types of activities compensating them and able to bring income to the Specially Protected Natural Areas:

- as far as the environment's quality deteriorates and urban population grows, flows to the reference natural areas will increase;
- as far as fauna and flora resources get impoverished, pressure on resources of protected areas will increase and this may occur by means of removal of legislative restrictions (for example, through the compulsory lease of the Specially Protected Natural Areas parcels, permission for limited use of resources of the Specially Protected Natural Areas, etc. by legal means);
- introduction of payments for ecosystem services (e.g. carbon sequestration or payment for the preservation by the Specially Protected Natural Areas of water sources) is not expected in the foreseeable future because the tax burden on business is already excess, and it is not possible to rely on sufficient funds for the Specially Protected Natural Areas at the expense of compensation for their ecosystem services;
- investments in regional tourism projects and in natural areas are reduced, and private investors refrain from investing in regional nature tourism, especially in its nature species due to their low profitability and long payback period, as well as typical for nature tourism susceptibility to resources, weather conditions and other factors, and also due to the continuously evolving legislation.

Given these threats, step-by-step implementation of a complex tourist product of the Specially Protected Natural Areas, associated with the traditional nature management of the local population and its cultural traditions inscribed in the general concept of tourism development of the region and the country, is able to provide protected natural areas for the inevitable growth of this market and the growth of threats to the Specially Protected Natural Areas.

In addition, the program allows to keep positive features of the territories and attractiveness of these territories both for future generations and for future sustainable tourism development.

Development of a complex product of the Specially Protected Natural Areas involves the following conditions:

- an important component of a complex tourist product (with elements of ethnographic and nature tourism) is traditions of sustainable nature management of the indigenous population. Therefore, the connection of culture with nature, its resources and traditions of their consumption, as well as with crafts may be asserted as a lost heritage preserved and restored by the Specially Protected Natural Areas;
- use of traditional means of transport – horses, deer, boats, traditional tools and appliances, household items - can be a powerful mean for tourists attraction, increase flow, expand the offer, occupy the local population and maintain "ecological" image of the Specially Protected Natural Areas;
- demand of tourists for processed non-timber forest products (berries, mushrooms and nuts, and medicinal raw materials) is small, but minimum demand for such practical "souvenirs" has been estimated by tourists as about 5 tons per year, and this volume can increase population's income and ensure its loyalty to the restrictions within the Specially Protected Natural Areas.

Table 1 demonstrates schedule plan of the site long-range programs designed to integrate the site into economy of districts which adapt activities of the local population to restrictions of the Specially Protected Natural Areas, preserve cultural traditions and reduce expenses of the Specially Protected Natural Areas.

Table 1. Long-range site's programs, schedule plan, approximate demand for investments, million rubles

Site's programs	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
1. Management: investments raising into sustainable nature management				**0**	**0**	**0**								
2. Management: regulating nature management ar the buffer zone			**0**	**0**	**0**	**0**	**0**							
3. Nature conservation: innovative forest fires and violations control technology		**3**	**3**											
4. Security improvement: reorganization of the cordon service: watch and general-purpose infrastructure use				**0**	**0**	**0**								
5. Security improvement: establishment of protective zones, assistance zones, methodological support and monitoring	**0**	**0**	**0**	**0**	**0**									
6. Security improvement: buffer zone security infrastructure	**2.3**	**1.1**	**1.1**											
7. Researches: sustainable nature management at the buffer zone system testing - design - investments - monitoring - maintenance		**0**	**0**	**0**	**0**	**0**								
8. Environmental monitoring: forest schools, children camps: "polar Artek"; "taiga camp"				**1**	**1**	**1**								
9. Environmental education: museum development: video sequences, interactive exhibitions"mobile museum"		**0**	**0**	**0**										
10. Environmental education: interactive guides for people with disabilities	**0**	**0**	**0**	**0**										
11. Environmental education: Grants for people to produce souvenir and practical products and souvenirs				**1.9**	**0.9**	**1.9**	**0.9**	**1.9**						
12. Tourism: moose farm - pasture rotation and tourist products*			**24**	**2.25**	**2.25**									
13. Tourism: investments to the tourist infrastructure - nature reserve, Tourism: investments to the tourist infrastructure - park	1.0 10	**3.39** **5**	**3.39** **5**	 **5**	 **5**									
14. Nature restoration: restoration of the natural environment and historic and cultural complexes (facilities), facilities and evidences collection		**1.0**	**1.0**	**1.0**										
15. Nature restoration: Waste management program: payment for waste disposal, system of separate collection, household waste collection points at the end of routes														
16. Preservation of traditional nature management: scientific and methodological support of nature management: publication of guidelines														
17. Preservation of traditional nature management: financial support, investments and cooperation			**0.8**	**2.3** **0.3**	**2.3** **0.3**	 **0.3**	 **0.3**							
18. Preservation of traditional nature management: local population initiatives support (agriculture, collection and processing of wild plants, cooperation and selling)					**1.2**	**1.2**	**1.2**							
19. Preservation of traditional nature management: activities of red book plants nurseries, processing of products, selling														
20. Preservation of traditional nature management: investments into model territories with the purpose of preservation and demonstration of traditions to visitors														
21. Machine and tractor passages maintenance		**4.5**	**0.5**	**0.5**	**0.5**	**0.5**								

*- Financing assessment is provided for programs funding source of which is determined; "0" - event does not require any investments

Long-range programs of the nature reserve

Table 2 demonstrates assessment of costs for implementation of the nature reserve long-range programs, explanations are provided in the explanatory note.

Table 2. Rapid assessment of cost of long-range development programs for Pechora-Ilych Nature Reserve

No.	Name of programs/subprograms	1st year of implementation			2nd-3rd year of implementation		
		Assessment of programs cost, thousand rubles per year	Available funding, thousand rubles per year	Required funding, thousand rubles per year	Assessment of programs cost, thousand rubles per year	Available funding, thousand rubles per year	Required funding, thousand rubles per year
	1	2	3	4	5	6	7
	Long-range programs of the nature reserve	**28,640**	**1,560**	**27,080**	**9,415**	**3,780**	**5,635**
1	**Moose farm development, including:**	**25,470**	**1,470**	**24,000**	**5,850**	**3,600**	**2,250**
1.1	Protective zone of the moose farm - foundation, improvements and security	**2,000**	**0**	**2,000**	**2,000**	**1,000**	**1,000**
1.2	Reduction of expenses on maintenance of the moose farm, total	**8,120**	**120**	**8,000**	**2,500**	**1,250**	**1,250**
1.2.1	Establishment of pastures	8,000	0	8,000	2,000	1,000	1,000
1.2.2	Volunteer programs	120	120	0	500	250	250
1.3	Development of profitable programs of the moose farm, total	**15,350**	**1,350**	**14,000**	**1,350**	**1,350**	**0**
1.3.1	Health tourism	9,850	500	9,000	500	500	0
1.3.2	Educational tourism		350		350	350	0
1.3.3	Moose farm product	5,500	500	5,000	500	500	0
2	**Development of the nature reserve biosphere polygon, including:**	**3,170**	**90**	**3,080**	**3,565**	**180**	**3,385**
2.1	Biosphere polygon infrastructure	**2,080**	**0**	**2,080**	**800**	**0**	**800**
2.2	Biosphere polygon territory security	**340**	**90**	**250**	**445**	**110**	**335**
2.3	Sustainable nature management testing and support to the local population	**750**	**0**	**750**	**2,320**	**70**	**2,250**
2.3.1	Assistance to sustainable nature management and crafts	630	0	630	1,200	0	1,200
2.3.2	Monitoring / resources in use condition/	70	0	70	70	70	0
2.3.3	Population training program	50	0	50	50	0	50
2.3.4	Historical buildings and sites reconstruction	0	0	0	1,000	0	1,000

1. Development of the moose farm

Moose farm of Pechora-Ilych Nature Reserve is the world's first farm where moose is domesticated. During the period of its activities from the date of its official approval in 1949 the problem of domestication of moose was successfully solved, the technology of breeding and keeping was developed and improved, the foundation of selection work was laid. A lot of aspects of moose biology were found out and clarified on the basis of the farm, more than 200 scientific papers were published. Experience of the farm circulated in Russia and abroad, more than 60 domesticated mooses were sold to create new moose farms which were methodologically supported. A lot of moose farms established thanks to the experience and number of mooses from the nature reserve farm exist well at the present time.

List of products existing in the world of moose farms includes: communication of visitors with mooses (for example, Kostroma moose farm is visited by over 30 thousand of excursionists annually), alive domesticated mooses (their market appeared after creation of private hunting entities chain in Russia), moose milk (which is considered curative and included in the medical menu of I. Susanin Health Resort in Kostroma region, which is given up to 1,000 visitors, more than 95% of whom recover from gastrointestinal tract illnesses) and moose milk derivatives (for example, cheese made of moose milk of Swedish private moose breeders).

Interest in the moose farm of the nature reserve as in the tourist object is confirmed by about 700 visitors a year. Moose farm sells milk in limited amounts without purposes of treatment. Therefore, the potential of the nature reserve moose farm is undervalued and poorly used which is caused by supporting financing of the farm for more than 25 years, which has allowed to avoid farm liquidation by keeping the minimum number of moose and experienced staff, but not allowed to implement its further development programs.

The purpose of the nature reserve moose farm can be than selling of mooses, tourism and medical purposes. On the basis of the farm and the nature reserve research department it is possible to provide scientific support to moose breeding, for example: study of optimal structure of moose pastures, their accelerated pasture rotation, implementation of fodder procurement and conservation technologies, study of the moose's response to new fodder plants while tracking changes in milk composition and physiological state of the animals.

1. 1. Protective zone of the moose farm - foundation, improvements and security

The moose breeding was conceived in the hope of the unlimited moose fodder base, however, further experience showed that actual moose fodder base is limited, natural reproduction of preferred by moose fodder is not wide, and the natural rotation of moose pastures without felling is unpredictable.

In view of this, moose breeding requires the creation of artificial pastures with a high density of fodder plants and accelerated pasture rotation, search of methods to preserve natural succulent moose fodder for winter period and mechanization of fodder procurement. To implement these tasks forest areas on lease (for the purpose of breeding wild animals) or proprietorship are demanded. The second is more preferable.

Availability of the moose farm protective zone, approved by the Decree No. 322[1] of the Council of Ministers of Autonomous Soviet Socialist Republic of Komi dated September 12, 1960, partially contributes to fulfillment of the moose farm potential

Protective zone mode is subject to the purposes of moose breeding, but the protective zone is not equipped and the double subordination of these Specially Protected Natural Areas to

[1] Decree No. 322 of the Council of Ministers of Autonomous Soviet Socialist Republic of Komi dated September 12, 1960 "On establishment in forests of the state forest fund of Troitsko-Pechorsky District of protective zone of the experimental moose farm of Pechora_Ilych Nature Reserve". (Assurance of protective zone mode shall be responsibility of the nature reserve, forest harvesting and forestry operations are available with the agreement of the nature reserve, construction within the territory of the protective zone is prohibited, except for buildings for the moose farm use, visiting of the protective zone with guns and dogs is prohibited.) Melnichuk A.V. moose farming prospective// Vestnik Instituta Biologii, N4 2012 pp.30-35

the nature reserve (coordination of forest exploitation) and to forestry (protection and control over exploitation) may serve as conflicts of interest source.

The expenses on foundation, improvements and security of the moose farm protective zone territory consist of: expenses on registration of the territory ownership transfer to the nature reserve, designation of the protective zone on the ground, creation of fire breaks, roads and paths system, maintenance of bridge crosses and infrastructure facilities, salary budget of the worker monitoring the territory and infrastructure facilities.

Rapid assessment of cost of the events – 2 million rubles per year.

1.2. Reduction of expenses on maintenance of the moose farm

To fulfill the moose farm potential, reduce prime cost of goods and services of the farm and achieve self-financing in future, it is necessary to increase the number of mooses at least up to 20 milch female mooses what is possible upon condition of existing permanent staff.

The main impediment to expand the farm is the shortage of fodder. Close to the farm moose pastures are depleted because of young forests growth after logging of 60-70s recovery and damage to the undergrowth by mooses, the share of manual labor in the course of fodder procurement at remote sites is as large as the expenses on fuel upon condition of constant supply of fodder, mooses are fed with commercial mixed cattle feed and potatoes, which is economically unjustified upon condition of number increase.

Thus, the increase of the number of moose is restricted because of: large share of manual labor (mainly in the course of fodder procurement and delivery) which rises moose breeding in price; lack of proper moose pastures near farms and at yards; disturbance of mooses by people and predators, which impedes to apply the method of semi-free pasturage that expands pastures geographical spread and reduces labor costs.

Given that the largest amount of work on fodder procurement and delivery accounts for the lactation period of female mooses and growth of young stock (May-August), the task can be implemented by the involvement of volunteers on fodder procurement and young stock pasturage.

Long-range program of reduction of expenses on maintenance of the moose farm includes:

- formation of pastures with a high density of fodder plants and accelerated pasture rotation;
- search for new types of fodder, which can be cultivated under forest canopy (due to a shortage of croplands), with high nutritional properties for moose, suitable for winter storage;
- introduction of mechanized fodder procurement technologies, its processing and storage (e.g. granulation of branches and needle obtained during wood procurement);
- managed pasturage at pastures formed during winter period.

Additional effect of the program of pastures formation implementation:

- the event will allow to refuse expensive yards of large area;
- the experiment will allow to circulate the experience and technologies, and, if it is necessary and there is an abundance of it – complete moose fodder.

Rapid assessment of cost of the events set, machines, equipment, electric power and fuel - 8 million rubles.

1.3. Development of profitable programs of the moose farm

Moose breeding is not widely developed in the world as after the experiment and foundation of moose farms no further challenging tasks were set, capable to turn a moose farm into profitable business, such as:

- to develop mass moose breeding as a segment of taiga agriculture on the basis of unlimited woody fodder;

- to circulate the experience and technologies in order to create new mini farms for the purpose of selling mooses and complete fodder, to support opening of moose farms and train moose breeders;

- to develop complex year-round programs of recreational and educational tourism based on the moose farm.

1.3.1. Health tourism based on the farm is associated with the development of convenient infrastructure for accommodation of tourists, tourists servicing staff, prepared varied programs, including, in addition to health-improving practices (up to 10 litres of milk per course), excursions, hiking, boating and cycling, fishing, moose feeding and other events. Cost of the infrastructure, which includes a 20-place hotel, bath house, equipment and communications, is estimated at 9 million rubles, its maintenance and operation at 500 thousand rubles per year. The period of tourists service with health-improving purposes is limited to 100-120 days, the maximum flow capacity is 200 people per season. In order to provide them with milk 10-15 milch female mooses are required. At the cost of the course including set of events of 15 thousand rubles for 10 days, the revenue will amount to about 3 million rubles per season.

1.3.2. Educational tourism is aimed to fill the infrastructure (hotel) during the off-season and winter periods. The period of service is 35-90 days a year (weekends, vacations, holidays). At hotel occupancy level of 50% and cost of service constituting 1.5 thousand rubles a day per person (accommodation and excursions), the revenue will be from 525 thousand rubles per year at a cost of 350 thousand rubles.

1.3.3. Moose farm products. List of the products includes: moose milk (frozen); alive domesticated mooses; technologies and services on establishment of farms and training of moose breeders; complete fodder; souvenir products; derivatives. Program costs include equipment for milk freezing, equipment for manufacture of granulated fodder (industrial shredder and granulator), equipment for the production of souvenir production, payment for electric power, salary budget of workers, ordering of ready-made souvenirs, printed materials, allowing to promote technologies of moose breeding, marketing activities. Costs are estimated at 4 million rubles for equipment and 1.5 million rubles per year for events and salary budget.

2. Development of the nature reserve biosphere polygon

Pechora-Ilych nature reserve is a biosphere reservation included in the international system of biosphere reservations carrying out global monitoring. Functions of biosphere reservations are aimed at preserving the natural environment, demonstrating approaches to the environmental conservation and sustainable development – economic, social, cultural and environmental. For the purposes of the sustainable development a biosphere polygon *is attached* to the nature reserve; within its territory environmentally-friendly activities (including traditional crafts of the local population) are carried out.

Up to the present day the biosphere polygon exists as regional Specially Protected Natural Area with the forests regime of group I. Protection of separate elements of the natural environment of the polygon is carried out by sectorial inspections and structures (fish and hunt inspections, forestry). Nature reserve determines the rules of some kinds of nature management according to the Regulations.

There are cordons of the nature reserve and Komsomol forestry, as well as 3 settlements with population of about 100 people, within the territory of the biosphere polygon. Unemployment level among working-age population is over 80%. Lack of job offers makes the local population hostage to traditional nature management, and at the same time, the majority of citizens consider this nature management as a preferred activity. Natural resource tourism, which fell for rapid development in the early 2000s, allows the local population to provide transporting services to tourists whose interests are limited to fishing. Flow of fishing tourism through the village of Ust-Unya within the territory of the buffer zone is about 800 people per year. About 600 people more visit the upper reaches of the river Unya by helicopters.

The traditional way of life of the biosphere polygon local population, which is maximally inscribed in the natural cycle, includes a group of seasonal manageable kinds which can become a basis for sustainable development of the polygon.

Following the importance for the local population the following traditional activities are specified:[2]

Fishing occupies a leading position in a row, the vast majority of people associate their welfare with fish resources. However, assessment of water biological resources of the river Unya[3] showed catastrophic state of populations.

Agriculture is the basis of survival of the local population, it is present in those volumes that provide the needs of the population.

Hunting has a large proportion in respect of time in the cycle of nature management, but a small proportion in respect of income of the population.

Eco-tourism was developed within the territory of the buffer zone in 1997 and has been being developed with the direct participation of most of working-age residents of the village of Ust-Unya, its flow is not significant, but the predominant is tourism resource (associated with resource withdrawal).

Ancient way of life, lack of roads, crafts are closely associated with domestic **tools production** for life and activities of the population.

Possibilities to fulfill the biosphere polygon potential by the nature reserve follow from the Provision on Nature Reserve[4] and meet its objectives, which are: "development, testing and implementation of methods of animal reproduction and rational nature management not damaging the environment and not depleting biological resources within the biosphere polygon".

2.1. Biosphere polygon infrastructure[5]

There are nature reserve cordons located within the biosphere polygon along the Pechora river, thanks to which more than 50% of its northern border is under control. At the Unya river, 65 km from its mouth, there is a cordon (of the Komsomol forestry) "Chameiny ples" allowing to control fully the flow of visitors to the upper reaches of the river by motor boats and partially flow of visitors from helicopters.

The eastern border of the biosphere polygon is not controlled, near to the mouth of the river B. Khozya there is "Lotoshnikov camp site" (Gorniy Khrustal, LLC), along the eastern border of the polygon there is a popular route to Manpupunyor, some tourists visit Otorten mountain located at the polygon territory.

The polygon's border is not indicated anywhere on the ground, there are no banners with its mode due to complete lack of funding.

2.2. Biosphere polygon territory security

Given that fixed security allows to control more than a half of the resource tourists flow, provide them services and ensure the safety of tourists, model of fixed security was chosen as the most cost-effective[6] and allowing year-round implementation of monitoring programs.

Table 3. Schedule plan of infrastructure development and biosphere polygon security programs implementation

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[2] Assessment of non-timber forest resources usability. The PDF report for the B phase of the UNDP/GEF project. Syktyvkar, 2006

[3] V.I. Ponomarev, private message, 2013

[4] subclauses 2.1.zh. and 8.1 of the Provision on Nature Reserve approved by the order of the Ministry of Natural Resources and Environment of the Russian Federation No. 48 dated February 27, 2009.

[5] A.K. Blagovidov Report on completion of work on development of medium-term management plans for model regional Specially Protected Natural Areas of the Republic of Komi. 2011/UNDP/GEF project for the Specially Protected Natural Areas of the Republic of Komi

[6] T.V. Tikhonova Report: Business plan of the state nationally significant complex wildlife sanctuary "Uninsky". 2012/UNDP/GEF project for the Specially Protected Natural Areas of the Republic of Komi

Program	Period of implementation and expenses, thousand rubles		
	1st year	*2nd year*	*3rd year*
Total	**2,490**	**1,820**	**810**
Infrastructure programs, including:	**2,080**	**1,350**	**250**
Maintenance and fitting of Chameiny ples cordon	1,000	500	0
Fitting of stopping points and fire prevention measures	50	250	100
Maintenance and fitting of tourist infrastructure of Chameiny ples cordon	1,000	500	0
Mode's information provision (banners, campaigns, display stands)	30	100	150
Security programs, including:	**340**	**400**	**490**
Cordon service staff	250	300	370
Nature reserve operational groups raids up to 6 times per year	90	100	120
Monitoring programs, including:	**70**	**70**	**70**
Monitoring	70	70	70

2.3. Testing of sustainable nature management

Program may include support to sustainable crafts of the local population in the field of:

- **agriculture** in the form of subsidies and grants for purchase of animals, fodder and seeds, greenhouses and their parts, etc. or their supply with the aim of providing tourists with food and assistance in selling of food products manufactured by them;
- **hunting** in the form of subsidies for purchase of ammunition, means of transport, machinery, fuel, etc., assistance in selling of hunting products;
- **manufacture and repair of tools** (boats, skis, sleds, machinery and equipment) in the form of subsidies for purchase of machine tools, machinery and consumables, electricity and fuel payments, etc. in order to provide the nature reserve staff, tourists and local people with inventory;
- **environmental and natural tourism** in the form of subsidies for improvements of guest houses in the polygon's villages, purchase of inventory and equipment to serve the tourists, manufacture of bath houses, shower units and temporary buildings along tourist routes, etc., as well as assistance in promotion of services of the local population in the market.

Costs include subsidies (grants) to the people for implementation of programs of sustainable nature management in the fields of (2018): agriculture (2 subsidies 60 thousand rubles each), hunting (3 subsidies 60 thousand rubles each), manufacture of equipment (1 subsidy in the amount of 150 thousand rubles) and ecological tourism (6 subsidies 30 thousand rubles each).

Program is implemented through existing mechanisms (Non-commercial Partnership "Union of the Specially Protected Natural Areas of the Republic of Komi", founders are federal Specially Protected Natural Areas and regional environmental authorities, as well as the Institute of Biology).

Training programs include training of local people in the field of natural and environmental tourism, costs include guide's certificate. This activities will improve the quality of services and increase the income of the local population and improve the safety of visitors.

Restoration of historic constructions, items and facilities are intended to keep historic objects, including as objects for demonstration to visitors.

Long-range programs of the national park[7]

[7] Description of perspective and priority programs of the national park with assessment of expenses is provided in the national business plan of the park, 2015

A set of the programs of the park (Table 4) is aimed to reduce damage to the nature from tourist exploitation of its territory through the development of services, which increases the capacity of the routes and accordingly increases the income of the park.

Implementation of activities increasing the income of the park shall be subject to special attention due to the permanent deficit of the budget of the park and with the purpose of further decrease of load on the federal budget.

Analysis of the Russian experience in the field of creation of profitable flows to the Specially Protected Natural Areas shows that among all the available for SPNA financial mechanisms the greatest economic effect brings own service sector of the SPNA.

Development of tourist camp sites and service sector does not contradict to the objectives of conservation of the SPNA nature by concentrating tourists at the prepared sites, which allows to increase their flow without increasing damage to the territories and offer new types of paid services.

In the conditions of legislation of Russia on the SPNA being under improvement, concessions to their territories and facilities do not involve the responsible nature management by the concessionaires yet and require excessive costs for monitoring activities.

Table 4. Investments into tourism development program in the national park

No.	Activity (program)	Total investments, thousand rubles	Demand for investments, year of implementation, thousand rubles					Supposed source of financing
			1st year	2nd year	3rd year	4th year	5th year	
Development of special tourist products								
1	Elaboration of tourist products with participation of interested parties, including researches, descriptions and improvements of the routes (without accommodation means)	1,100	700	100	100	100	100	Federal budget
2	Development of infrastructure and service sector (including accommodation means)	30,000	10,000	5,000	5,000	5,000	5,000	Federal, regional and local budgets, business, sponsors
3	Machine and tractor passages maintenance	6,500	4,500	500	500	500	500	Regional and local budget
4	Tourists safety and safety facilities	750	150	150	150	150	150	Federal budget
5	Souvenir products of the park, guidebooks	3,000	1,000		1,000		1,000	Federal budget
Assistance in development of small business entities in the field of tourism and services in the park and nearby								
6	Training in the field of tourism and related services, conferences, guides' training	1,000	200	200	200	200	200	Federal budget
7	Legal and business consultations to small tourist business entities and other services	2,000	400	400	400	400	400	Business
8	Grants to small business entities (in the field of tourism and related services)	4,500	900	900	900	900	900	Regional budget, business
9	Assistance in promotion of joint goods and services of small business entities and park	1,200		300	300	300	300	Federal budget
	TOTAL	**50,050**	**17,850**	**7,550**	**8,550**	**7,550**	**8,550**	