3. ANALYSIS OF DELIMITATION OF HCV AREAS AND ASSESSMENT OF REPRESENTATIVENESS OF PROTECTED AREA NETWORK IN NORTHWEST RUSSIA

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3.1. Network of existing protected areas

3.1.1. Distribution of protected areas by category

The network of protected areas in the six administrative regions of northwest Russia(four regions, one republic and City of St. Petersburg) that are included in this study is described in Chapter 1. Below we will discuss the representativeness of the areas of high conservation value (HCV areas) in the protected area network in each of these regions.

The total number of protected areas (federal and regional levels) in the study area is 641:

- 8 strict nature reserves or zapovedniks (five with protected buffer zones)
- 5 national parks (one with protected buffer zone)
- 2 nature parks
- 175 zakazniks (specific Russian category of nature reserves, see 1.3)
- 316 nature monuments
- 1 botanical garden and 1 healing resort area.

The Russian Federation law on specially protected nature areas (Federal Law…1995) also delegates to the competent authorities the right to establish other protected area categories in addition to those listed in the law. Vologda Region is the only region in northwest Russia which has made use of this right, establishing three new protected area categories, i.e.:

- 118 protected mires and 13 other protected areas of the local level
- 2 tourism-recreational areas
- 1 protected nature complex.

In order to reduce the number of fractional types of protected areas in the analysis, these regional categories of small protected areas will be considered together with the zakazniks to which they are closest and have similar status and protection regime. A complete list of protected areas in the six regions of this study is presented in the Appendix, with total surface areas and year of establishment. Titles of protected areas on the maps correspond to those in the list of protected areas of Arkhangelsk Region (A), Vologda Region (B), Leningrad Region (C), the City of St. Petersburg (D), the Republic of Karelia (E), and Murmansk Region (F).

It should be noted that the data on the total area of protected areas with respect to the total area of the administrative region are approximate, as the exact boundaries for several nature monuments in Arkhangelsk Region, as well as for some protected areas in Vologda Region and the Republic of Karelia, were not determined at the moment of writing for various reasons (see notes in the Appendix). These protected areas are not included in the analysis. Similarly, we do not include protected areas of local level established by municipalities because their status may differ by regions, or may be undefined.

Thus, the analysis includes 570 protected areas, covering altogether 57,600 km^2, or 6.7% of the studied area. It should be noted that their areas are calculated by the authors using GIS-based contours of protected areas on the maps. In addition, protected areas comprise 2,100 km^2 of water surfaces of the Barents, White and Baltic Seas. These figures may differ, sometimes greatly, from those indicated in their official regulations (applies only to protected areas which have official State regulations).

At first glance, the area covered by protected territories in the study area is large enough. However, is this proportion – nearly 7% of the total studied area – enough to perform the tasks of the network of protected areas, i.e. conservation of biological diversity and natural environmental systems?

One requirement is to estimate the exact share of any territory, or of the entire area of any particular type of the biogeocenosis that must be taken under protection, to prevent it from further degradation and loss of biodiversity. This question has not been answered so far, but there is clear evidence that each type of natural ecosystem has its own threshold in the protected part percentage of the total area. There are only rough, generalized estimations which may vary considerably in each case. Reymers & Shtilmark (1978) suggested the following ratios for anthropogenically transformed and natural ecosystems for different vegetation zones:

- Arctic and tundra zones: natural ecosystems (including reindeer pastures) should constitute at least 98%, transformed areas no more than 2%. In the most vulnerable biotopes, intact parts must constitute 100%.
- Northern boreal, middle boreal and southern boreal forest sub-zones (or northern and middle taiga zones), all mountain taiga areas, as well as mountain forests in the southern part of the former Soviet Union: natural ecosystems should constitute 80-90%, transformed areas no more than 20% of the area.
- Hemiboreal forest zone (or southern taiga): transformed areas should constitute no more than 50%.

It is clear that these recommended limits of the transformed areas are greatly exceeded for all vegetation zones in northwest Russia, which may lead to gradual degradation of many types of natural ecosystems and consequent loss of biological diversity. However, in the existing socio-economic situation, creation of protected areas with a fairly strict regime of protection on such huge areas seems absolutely impossible. **Therefore, we must note with regret that full preservation of natural biodiversity in northwest Russia is not a realistic target**. However, we can define the most urgent task: **to prevent the total degradation of the most valuable natural HCV areas**. It is also difficult to assess accurately the proportion of each type of HCV area selected in this study which must be taken under protection to exclude the risk of extinction of this particular type of HCV area. The maximal share should be 100%. This would allow preserving HCV areas in their natural state despite negative effects from adjacent transformed areas. As a **minimum proportion** requiring protection, one can use the protocol adopted by the Conference of the Parties to the Convention on Biological Diversity at its tenth meeting on 29 October 2010 in Nagoya, Japan (Report of the tenth meeting ... 2010), which recommends 17% of terrestrial areas and inland waters to be protected. Achievement of this figure does not imply that the protection status of HCV areas is good, but a share of less than 17% suggests that the situation of a given HCV area is critical. Below, we will use this threshold value to show the types of HCV areas which are in the most urgent need of protection. This value seems quite realistic in northwest Russia, because in some European Union countries, this threshold has already been reached and even exceeded. By the beginning of 2011 the area of protected areas was already 18% of the surface part of the European Union as whole (More details ... 2011).

Figure 3.1 shows that nature reserves, or zakazniks, constitute the most significant (in terms of area) category of protected areas in northwest Russia. Together with special categories of regional protected areas in Vologda Region (protected nature

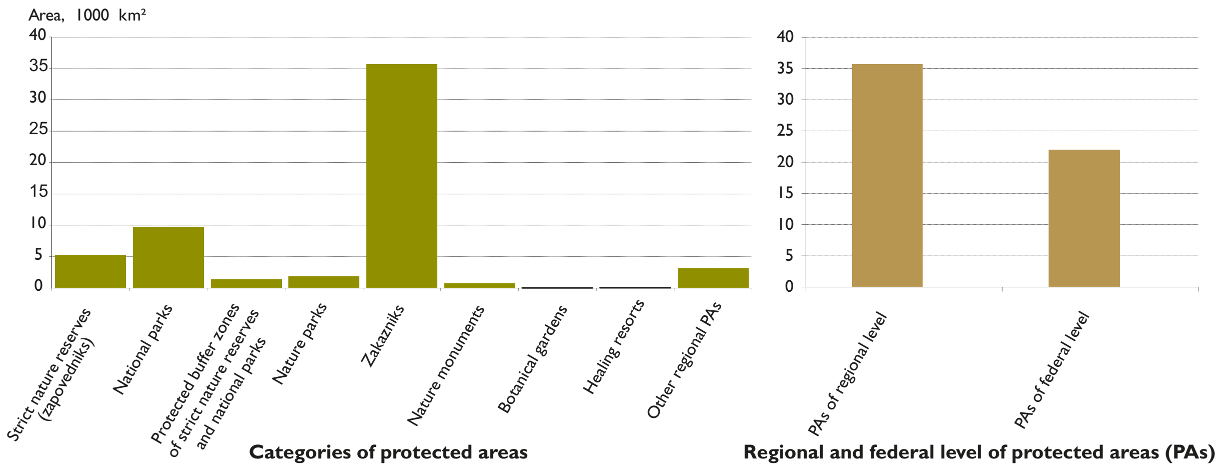


Fig. 3.1. Total area of protected areas (PAs) in northwest Russia according to PA categories.

complexes, tourism and recreational areas, protected wetlands) which have similar protection regimes and legal status, they constitute 67.1% of the total area of protected areas in the studied territory. The area of regional level protected areas exceeds by about a one-third the area of federal protected areas. Despite this, however, most regional zakazniks, due to peculiarities of their protection regimes, do not make the largest contribution to nature protection and are not of principal importance in the regional network of protected areas.

Fig. 3.3 shows that Arkhangelsk Region provides the largest contribution to the acreage of protected areas. Here are two of the largest protected areas in the study area, Vodlozero National Park (area of 468,000 ha, with 341,000 ha in Arkhangelsk Region, the remainder in the Republic of Karelia),

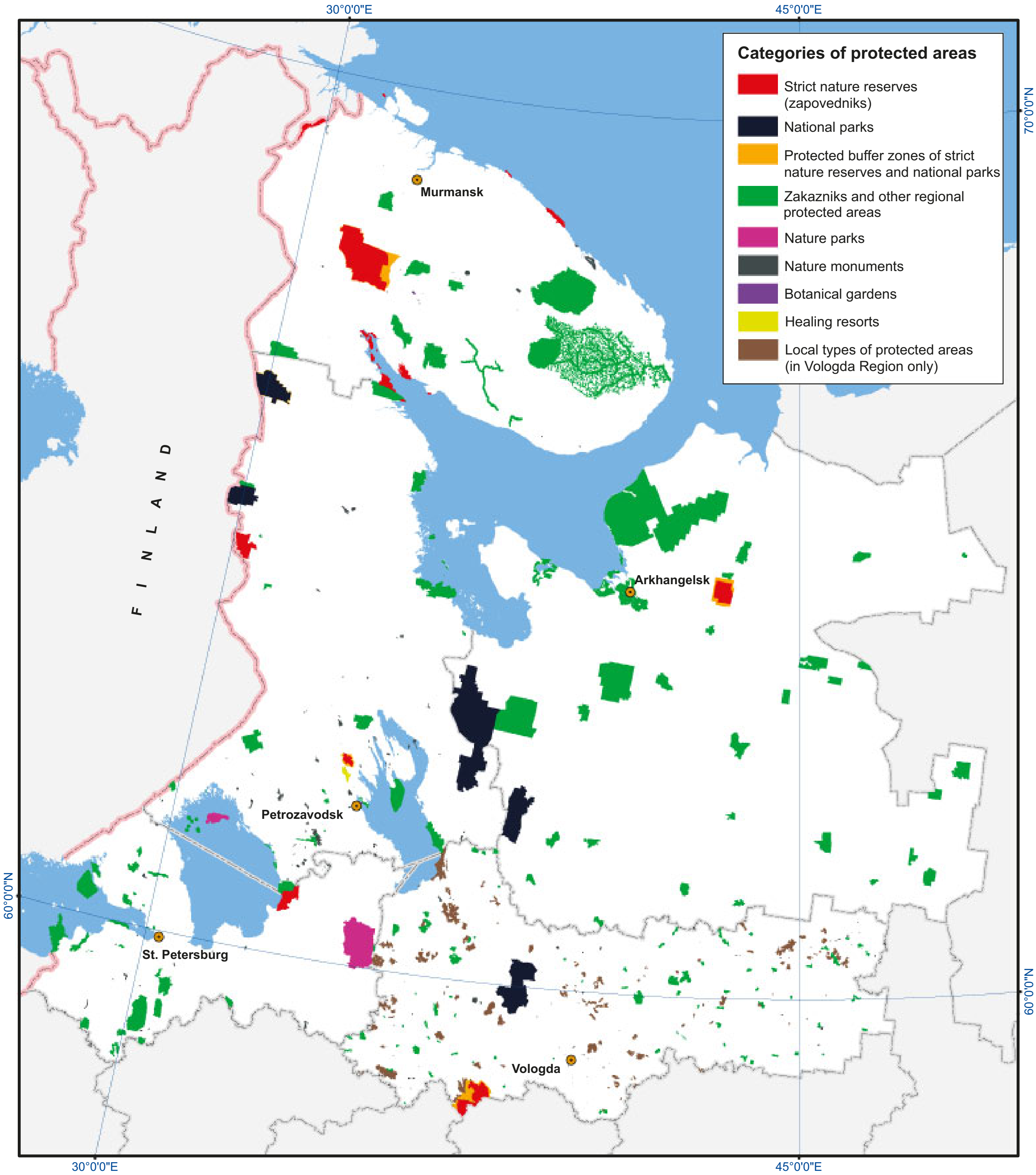


Fig. 3.2. Categories of protected areas in northwest Russia.

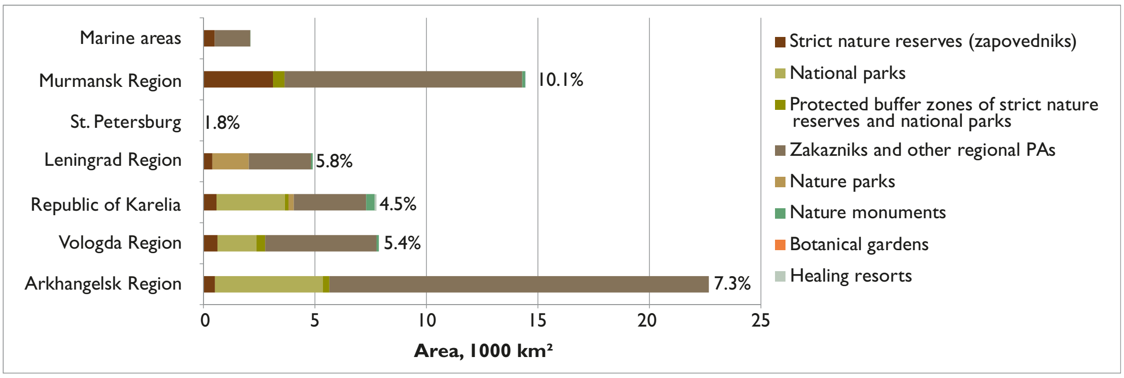


Fig. 3.3. Areas of protected areas as a percentage of total administratve region area.
Note: Arkhangelsk Region hereafter is considered excluding Nenets Authonomous District.

and the State zakaznik Primorsky (440,000 ha). Protected areas constitute 7.3% of the entire area of Arkhangelsk Region, which is similar to the average values for the entire northwest Russia. The highest coverage of protected areas (10.1%) is in Murmansk Region. The Ponoi fisheries zakaznik, the third largest protected area in the study area, is situated in Murmansk Region. In Leningrad Region, Vologda Region, and the Republic of Karelia the percentages of protected areas are lower than in the study area, as a whole. The lowest value, 4.5%, is in the Republic of Karelia.

In the territory of St. Petersburg, the proportion of protected areas is only 1.8%. Although the estimations of the desired proportion of protected areas given both by Shtilmark & Reimers (1978) and the Nagoya protocol are not applicable to the urban area, we can describe this figure as low, because existing protected areas do not cover all natural complexes still existing in St. Petersburg which are in urgent need of protection.

Thus, we can describe the general situation regarding conservational measures of intact HCV areas as critical. Territories occupied by protected areas total less than half the current average global value, which is 15% of land area and inland waters (Report of the tenth meeting ... 2010), and even less in comparison with the recommended value of 17%. The situation may be corrected by establishing in the immediate future of planned protected areas in each region. This option will be discussed in more details below.

3.1.2. Distribution of protected areas by vegetation zone and elevation level

Existing maps of vegetation zones are of fairly small scale, showing only generalized contours of vegetation zones. For this reason, we prepared a working version of the map of zonal vegetation types on the basis of vegetation maps of the European part of the USSR (Soviet Union) (Isachenko & Lavrenko 1979). This map indicates all zonal and intra-zonal vegetation types: tundra, forest-tundra, northern boreal combined with middle boreal, southern boreal and hemiboreal forests (Fig. 3.6). All further calculations concerning protected and unprotected areas of different types of HCV areas in different vegetation zones are made on the basis of this map.

The share of protected areas in different vegetation zones gradually decreases from north to south (Fig. 3.4). Theoretically, this corresponds to the notion that northern ecosystems are more vulnerable, and therefore need a greater proportion of their area to be taken under protection. However, this is simply a consequence of the fact that, at present, territories situated in the northern parts of the studied area are much less developed economically than in the south. Most of the tundra and forest-tundra ecosystems have remained in their natural state well beyond the limits of protected areas, and the risk of further deteriorations of intact tundra and forest-tundra biogeocenoses in the immediate future, although it exists, is not alarming so far. The situation in the southern parts of the studied territory is different, the existence of protected areas being the only obstacle preventing the extinction of the last small areas of natural biogeocenoses and their complexes. Most of the HCV areas which are presently situated outside protected areas are under immediate threat. Therefore, the task of creating new protected areas to increase the representation of the southern types of vegetation in the whole protected area network is a priority.

Fig. 3.5 and Fig. 3.7 show that the territory included in this study is rather uniformly divided by elevation from 0 to 300 meters asl, in steps of

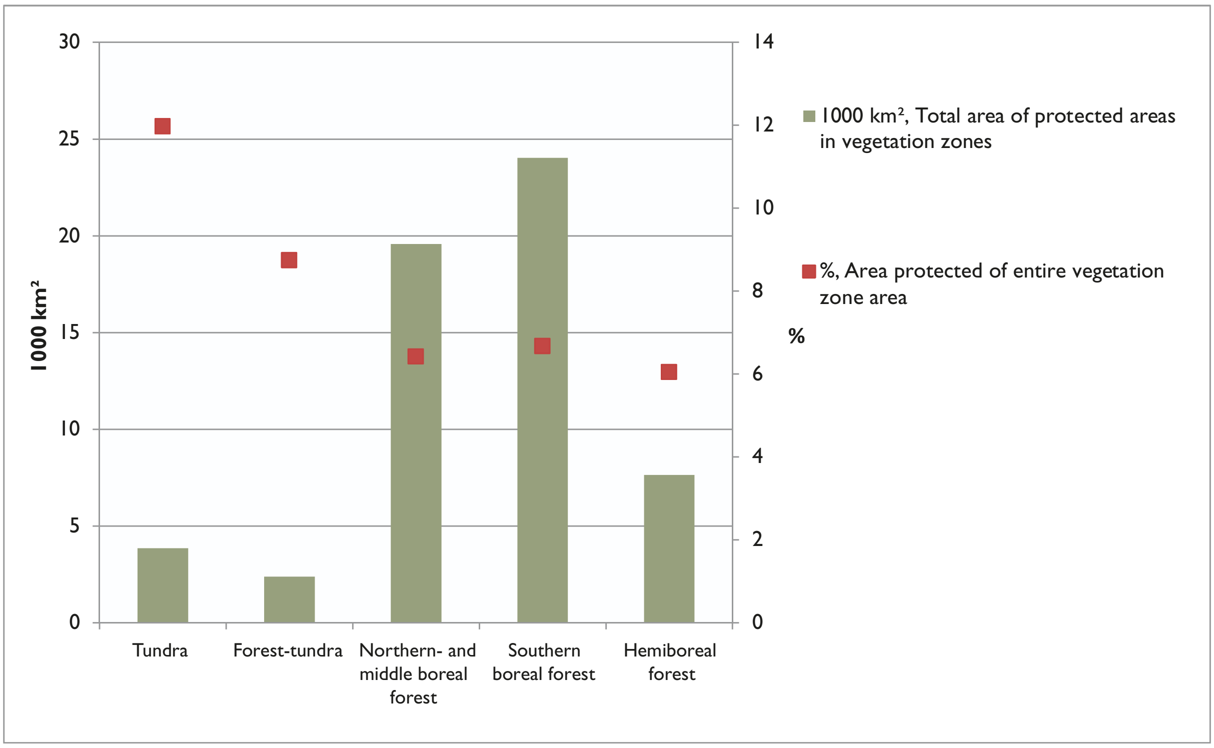
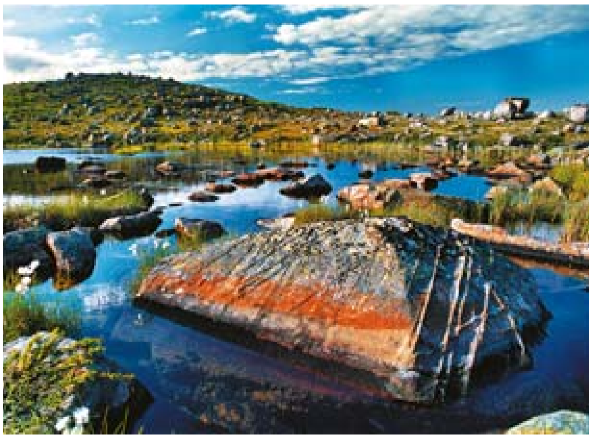


Fig. 3.4. Total areas of protected areas in each vegetation zone.
Left Y-axis – total area of protected areas in the vegetation zone, 1000 km^2
Right Y-axis – total area of protected areas as percentage of entire vegetation zone area.

50m. Similarly, different altitude levels are more or less evenly represented in the existing protected areas. The only exception is the lowest level (0-50 m), whose share in protected areas is less than in the entire studied territory. This may be due to the lowland areas along the shores of seas, large lakes and river valleys being the most convenient for settlements and consequently colonized primarily. Areas of intact natural biogeocenoses and their complexes suitable for the establishment of protected areas are quite small there in comparison with more elevated sites. However, lowlands usually harbor the most productive ecosystems, characterized with the highest levels of biodiversity. Therefore, these areas deserve the most urgent protective measures to preserve the last HCV areas which still remain unprotected and under threat of extinction.



Slightly hilly plateau is typical landscape in the Murmansk tundra zakaznik. Photo: Gennady Aleksandrov.

Old-growth spruce forest with high amounts of dead wood in different stages of decay. Zakaznik Ashchozero in the Nature Park Veps Forest. Leningrad Region. Photo: Maria Noskova.

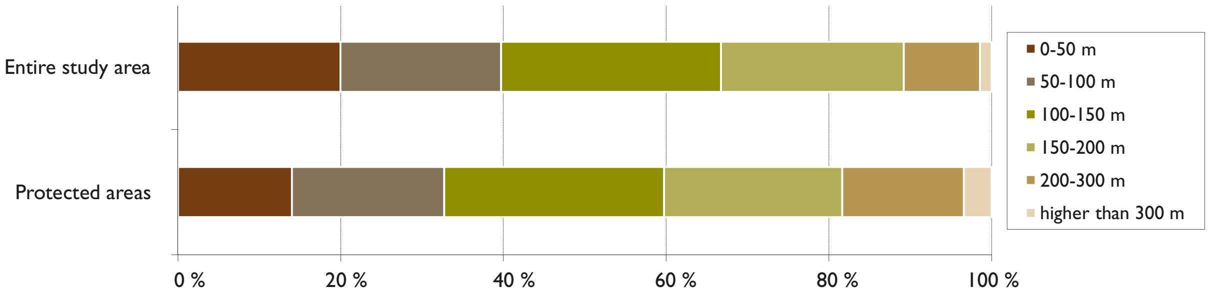


Fig. 3.5. The study area by elevation (m.asl.): upper bar shows total territory (excluding water); lower bar shows protected areas.

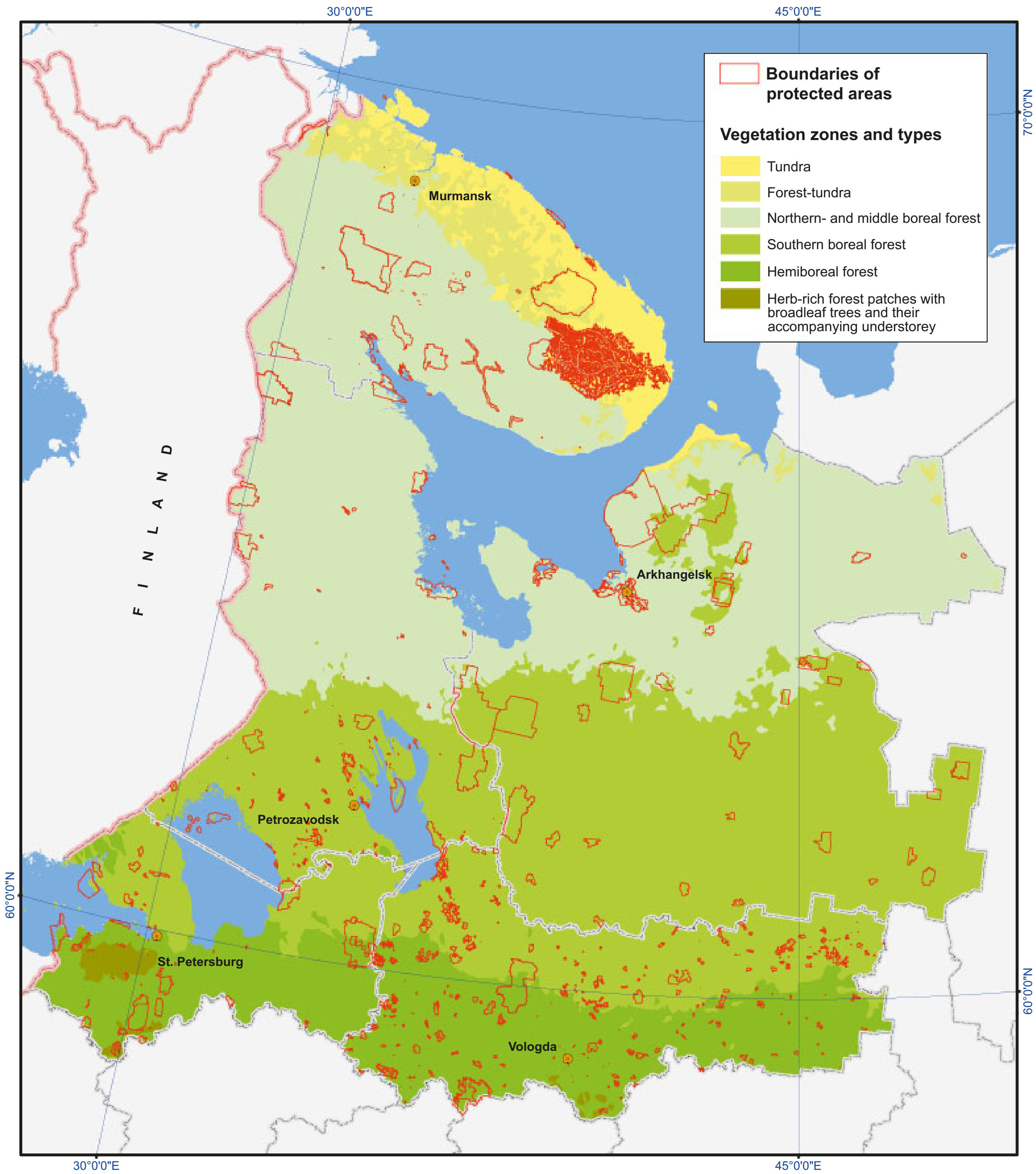


Fig. 3.6. Distribution of protected areas in different vegetation zones.

3.1.3. Distribution of protected areas by type of vegetation (by interpretation of satellite images)

Fig. 3.8 shows that all groups of vegetation types selected by semi-automatic identification of *Landsat* satellite images (see section 2.3.2) that occur in the studied territory are represented in both existing and planned protected areas, and the ratios between them in protected areas correspond with those in the entire studied area (hereafter "average"). Naturally, shares of open spaces with no vegetation in protected areas, especially in the existing ones, are relatively small, because most of the territories that fall into this class are usually anthropogenically disturbed areas, densely populated and having infrastructure and industrial facilities. In contrast, tundra and mires are over-represented in protected areas compared with the average.

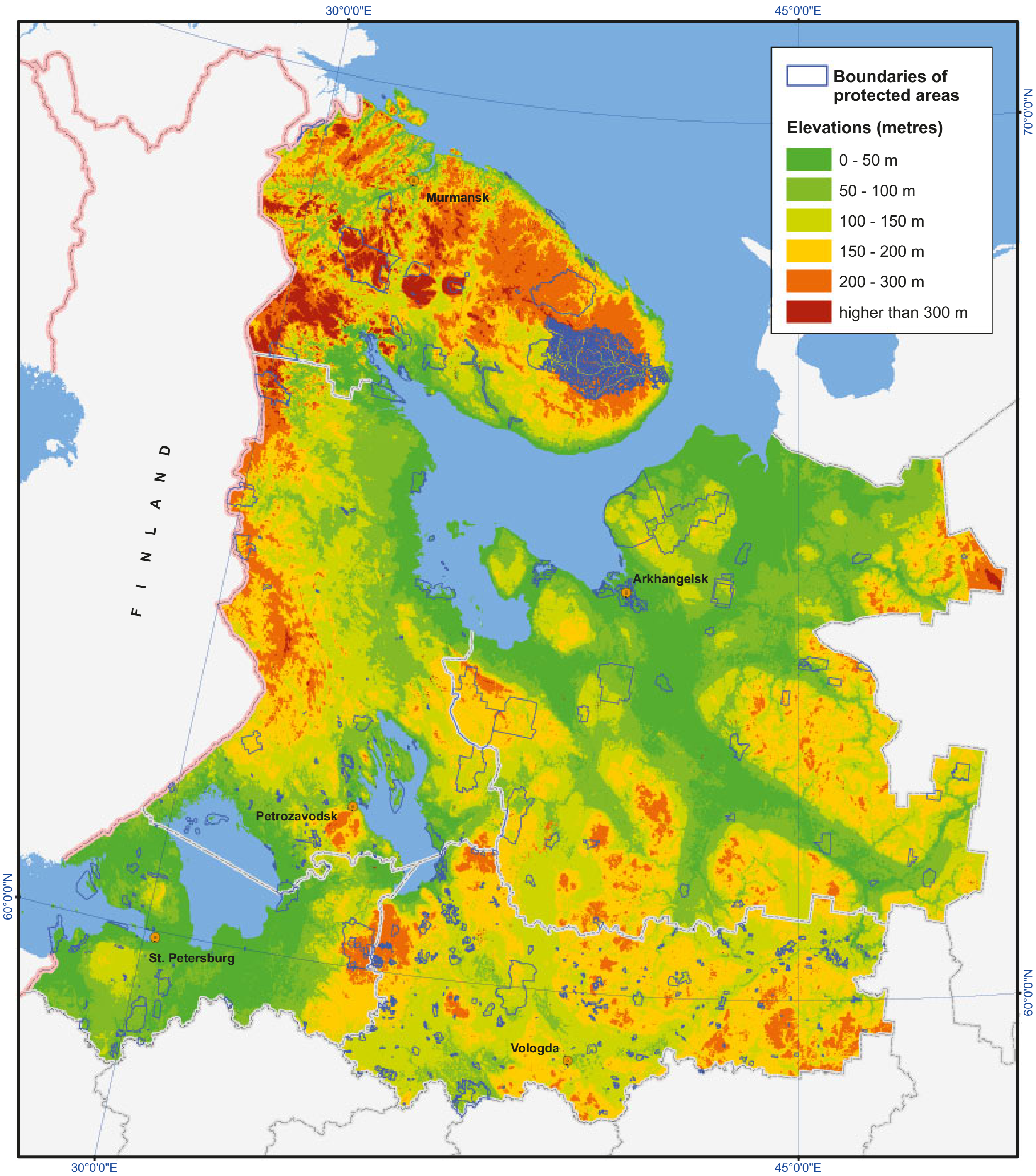


Fig. 3.7. Distribution of protected areas by elevation.

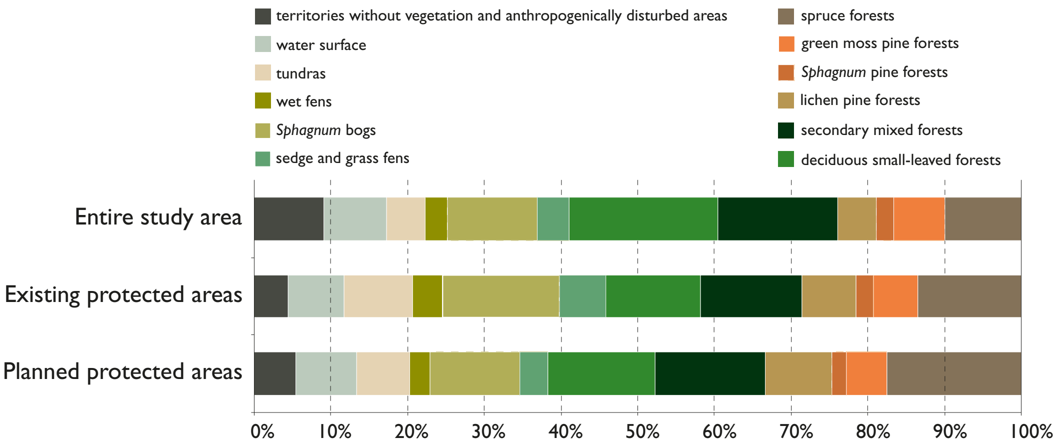


Fig. 3.8. Distribution of existing and planned protected areas by vegetation type (data obtained using semi-automatic identification from Landsat satellite images).

The proportion of forest in protected areas is also relatively high. Generally, pine-dominated forests are represented in both existing and planned protected areas to the same degree as in the entire studied area. Pine forests with green mosses (*Pleurozium, Hylocomium*) are slightly under-represented in protected areas in comparison with unprotected areas, because of their intensive use in timber production. Conversely, dry pine forests, having less economic value and more extended intact areas, have greater representation in protected areas.

The proportion of deciduous forests in protected areas is slightly less than average because they occur mostly in secondary forest types. In contrast, the proportion of spruce-dominated forests in the existing protected areas, and especially in the planned protected areas, is much higher than average. This is because much of the intact forest landscapes are spruce-dominated and there is still a possibility to keep them in the minimally transformed state by excluding them from forestry development plans in each region.

3.1.4. Protection regimes of existing protected areas

The common features of the various protection regimes in protected areas are defined in the federal law "On Specially Protected Natural Areas" (Federal Law … 1995). However, they are clearly defined only for strict nature reserves (zapovedniks) and for national parks. For all other protected area categories, only very general guidelines are given, so their protection regimes are mainly determined by the State document "Regulations of State protected areas" for each specific protected area. These may be very different even for protected areas in the same category. For example, some zakazniks may be allowed to perform any economic activities other than hunting for hoofed mammals in specified periods. Some protected areas, especially nature monuments, have no indication of the protection regimes in their regulations. Obviously, protected areas with undefined protection regimes may contribute to environmental conservation. However, many of these protected areas, aimed at solving specific problems, can not be considered as part of a complete system for the conservation of intact nature areas.

The objective of this study was to identify how effectively each category of protected area can preserve different types of identified HCV areas. Therefore, we used separate classifications for protected areas with different protection regimes. We determined protection regimes in all existing protected areas in accordance with their regulations. For protected areas that have different functional zones (in northwest Russia they are primarily national parks and nature parks), the protection regime was determined for each zone separately.

We identify the three most harmful types of economic land use, which in most cases lead to significant deterioration or loss of natural systems and further loss of conservational value of the entire area. They are:

a) logging;
b) geological activities including mining, extraction of coal, ore, peat, and sapropel;
c) construction outside urban areas, including buildings, roads, pipelines, power lines and other linear structures and communications (excluding construction of the objects which are essential to the operation of the protected areas).

Then we considered whether at least one of these three most harmful activities is prohibited in each protected area or its functional zone. After that, for purposes of the analysis, protection regimes which occur in the existing protected areas were grouped as follows:

I. Strict protection regime. All human activities prohibited, including visits by tourists, which are restricted to guided excursions in open zones only. In practice only strict nature reserves (zapovedniks) and strictly protected zones of national parks have this type of protection regime.

II. Sufficient protection. All three main destructive activities (i.e. logging, mining and construction) are strictly prohibited. In protected areas which are situated in the tundra zone in treeless landscapes only mining and construction need to be prohibited.

III. Medium protection. At least one of the three main destructive activities is strictly prohibited.

IV. Weak protection. None of the three main destructive activities is prohibited.

It is clear that only protected areas which have protection regimes belonging to groups I and II can provide full preservation of natural systems and conservation of biodiversity, which is the main purpose of the establishment of the protected area network. And, vice versa, protected areas in group IV obviously cannot be regarded as full members of the protected area network. Although their protection regimes aim at restricting certain types of economic use (for example, hunting or fishing), the HCV areas, if they are situated in these protected areas, are constantly under risk of destruction. Protected areas with group III protection regimes occupy an intermediate position. HCV areas situated there are protected against one or two types of destructive activities as listed above, but remain threatened by activities not prohibited by the regime.

Of course, we should recognize this estimation is only approximate. Besides the above-mentioned threats, which are usually the most harmful, there are also many others such as reindeer grazing, unregulated recreation, fire, etc., which could be more significant both in terms of area and intensity of

Logging and forest road in the buffer zone of Kostomuksha Strict Nature Reserve. Republic of Karelia. Photo: Alexander Markovsky.

Exploration work in the biological zakaznik Soyana. Arkhangelsk Region. Photo: Artyom Stolpovsky.

Open-cast mining of quartz sand in a hydrological zakaznik Northern part of Mshinskoe mire. Leningrad Region. Photo: Dmitry Kovalev.

Illegal logging in the biological zakaznik Varzuga. Murmansk Region. Photo: Konstantin Kobyakov.

effect. However, the frequency score of these factors are much lower. Another circumstance which makes our estimation of the significance of threats approximate is that protection regimes indicated in protected area regulations may be quite formal, i.e. in practice, they are easily circumvented. On the other hand, logging, for example, may be limited for some other reasons. But in most cases, protection regimes are indicated in federal and regional law and, therefore, respected. This allows using our analysis as a basis for assessing the state of the protected area network of northwest Russia.

Data presented in Fig. 3.9 and Fig. 3.10 allow characterizing the situation of territorial nature conservation in the study area as a crisis. Although ca. 7% of the total area is included in protected areas, only 1.23% is covered by protection regimes belonging to groups I and II that ensure real preservation of natural systems. Thus, further development of the protected area network should be not only in the direction of increasing the area occupied by protected areas, but also towards the optimization of protection regimes in the existing protected areas.

Among the regions and within the studied territory, Vologda Region is in the most favorable situation with regard to protected area protection regimes. About 45% (by area) of all protected areas have protection regimes of groups I and II, and only a few protected areas have protection regimes belonging to group IV.

The most alarming situation is in Arkhangelsk Region. Protected areas with protection regimes of groups I and II constitute only a minor fraction, i.e. 6.3% of all protected areas, while the majority (73.9%) belong to group IV. In practical terms, they are unprotected. This group includes almost of all regional zakazniks in this region. As a consequence, the proportion of protected areas with only group IV protection regimes in the entire studied area is largely determined by the huge area occupied by regional zakazniks in Arkhangelsk Region. Protected marine areas in the Republic of Karelia, Leningrad and Murmansk Regions are quite similar in terms of ratios between well-protected and weakly protected protected areas: 12.8-24.1% of protected areas belong to protection regime groups I and II, and 16.8-33.2% belong to group IV.

Taking into account significant differences in the protection regimes between individual protected areas within the same official category of protected area (excluding strict nature reserves, where protection regimes are very similar), we found it insuf-

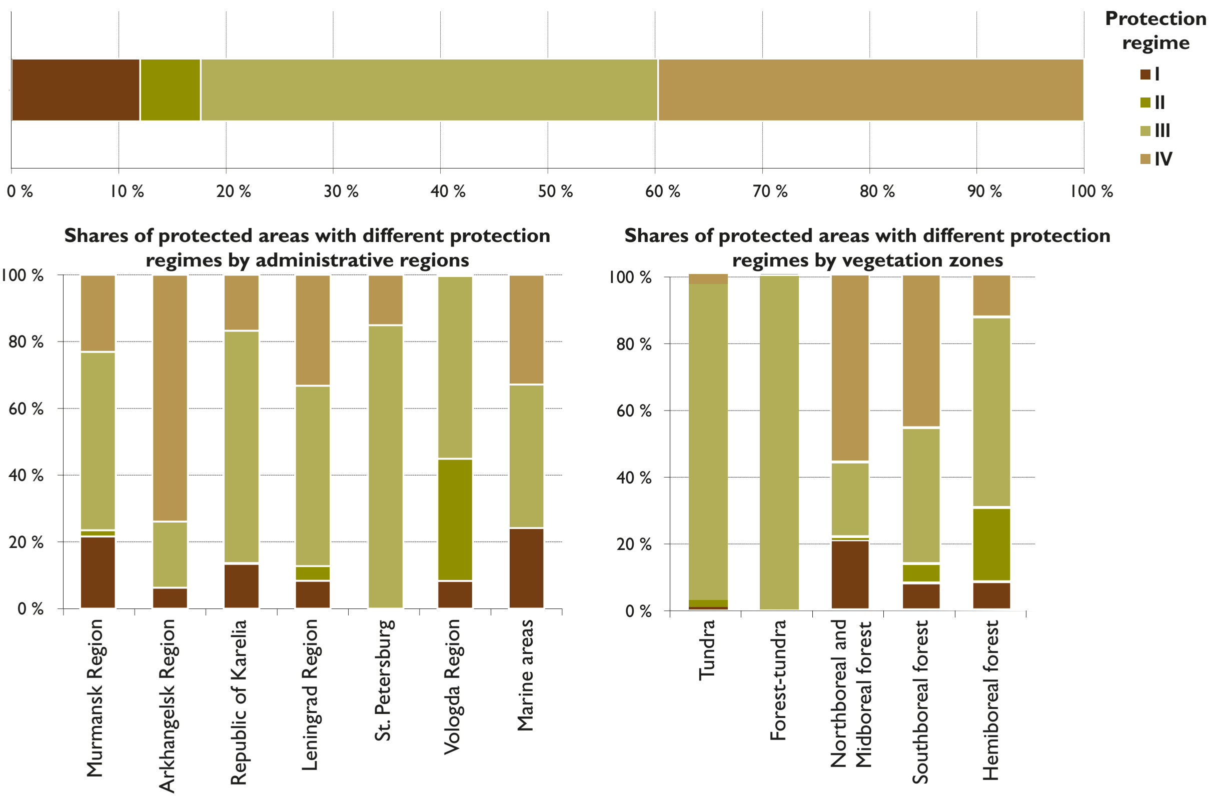


Fig. 3.9. Distribution of protected areas by protection regime (% share of the total area of protected areas) in the entire study area (upper bar), by regions and vegetation zones (lower bars).

ficient to make analysis of the state of protection of HCV areas by protected area categories only. To reflect the real situation, we split protected areas not only into categories, but also (and primarily) into groups of protection regimes.

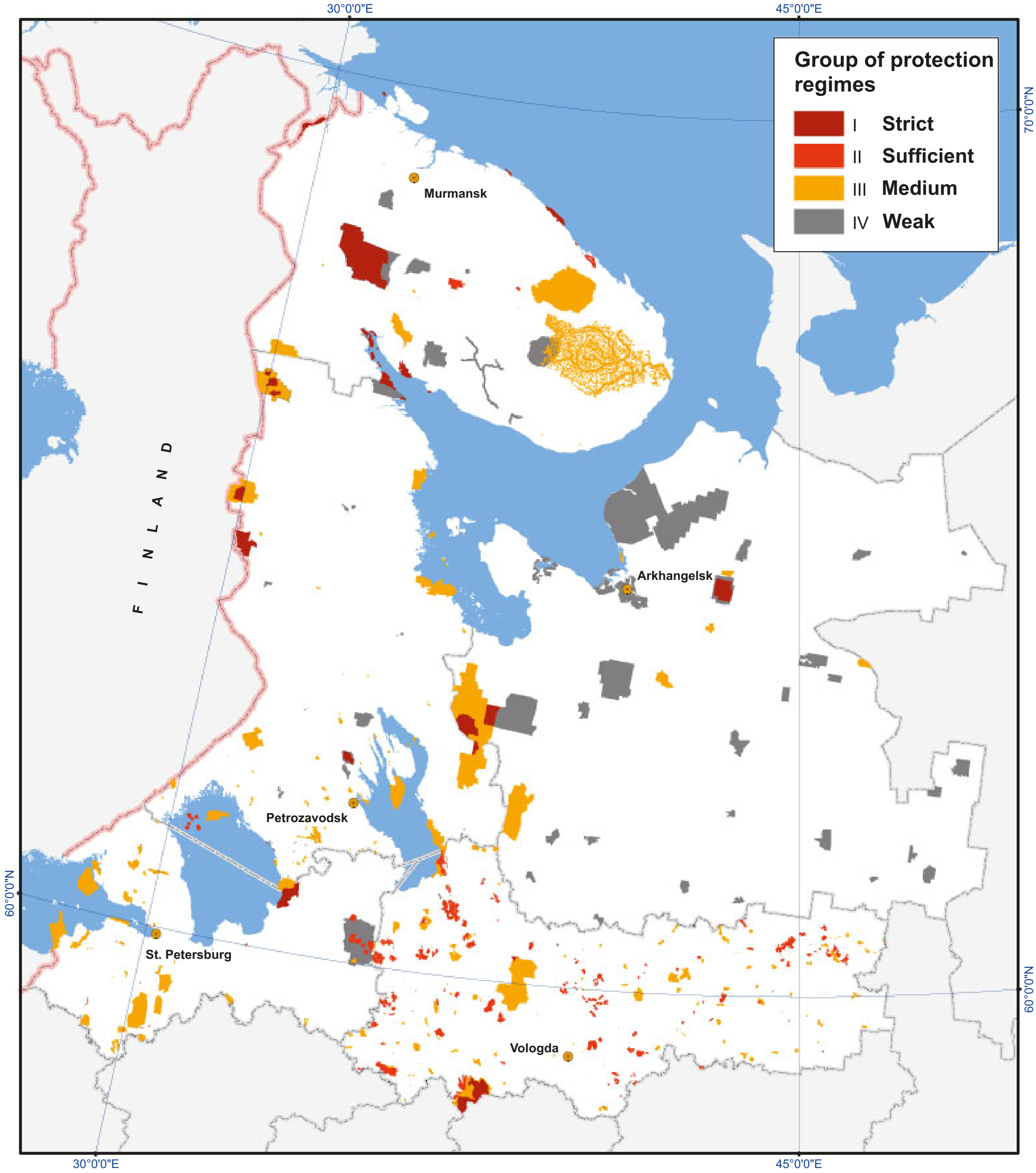


Fig. 3.10. Distribution of protected areas by protection regime.

3.2. Planned protected areas

Regional programs on the development of the protected area network exist in practically every region of the Russian Federation. These plans are usually prepared by various organizations and institutions, and often there may be several different and conflicting programs for the same region. This makes it difficult to understand the real situation.

All administrative regions included in this study have programs on the development of the regional protected area network. These programs are approved in various official planning documents signed by the leaders of local administrations. In this study, we collected and combined all these programs and plans in each region and the results are presented here as "planned protected areas." We used the following normative documents and their projects:

Murmansk Region:

- Forest Management Plan of Murmansk Region for the period 2009-2018, approved by Yuri Yevdokimov, Governor of Murmansk Region, 29 December 2008. (http://www.gov-murman.ru/power/comit/forestry/forest_plan_2018.rar
- Draft Scheme for the spatial development of Murmansk Region, prepared by the Federal State Unitary Enterprise "Russian State Research and Design Institute of Urbanism" (St. Petersburg), commissioned by the Ministry of Construction and Spatial Development of Murmansk Region (State contract № 1 from 03.09.2007).
- Concept of the development of the regional protected area network in Murmansk Region until 2018 (http://nature.gov-murman.ru/ecology/oopt/) and further until 2038, commissioned by the Committee for Natural Resources and Ecology of Murmansk Region (approved by the Government of Murmansk Region № 128-PP dated 03/24/2011).

Arkhangelsk Region:

- Forest Management Plan of Arkhangelsk Region prepared by the Federal Forestry Research Institute of St. Petersburg and approved by I.F. Mikhalchuk, the Head of the Arkhangelsk Region administration on December 29, 2008.
- Forest Management Plan of Arkhangelsk Region (adjusted in 2010), prepared by the Roslesinforg Company (Moscow) in accordance with state contract № 49 with the Agency for Forestry and Hunting of Arkhangelsk Region, on May 31, 2010.
- Draft scheme of spatial planning of Arkhangelsk Region, prepared by the Federal State Unitary Enterprise "Russian State Research and Design Institute of Urbanism" (St. Petersburg) for the Government of Arkhangelsk Region. At time of writing (spring 2011) this project is in progress.
- Draft of the Concept Note of the Protected Area Network in Arkhangelsk Region and Nenets Autonomous District, approved by decision of the Ministry of Natural Resources and the Timber Industry Complex of Arkhangelsk Region, on December 28, 2010 (Directive of the Ministry of Natural Resources and the Timber Industry Complex of the Arkhangelsk Region № 1p, January 12, 2010).

Pure white lily (*Nymphaea candida*) in the planned zakaznik Poryi Forest. Murmansk Region. Photo: Gennady Aleksandrov.

A lady's-slipper orchid (*Cypripedium calceolus*) in the planned nature monument Erin Mountain. Murmansk Region. Photo: Gennady Aleksandrov.

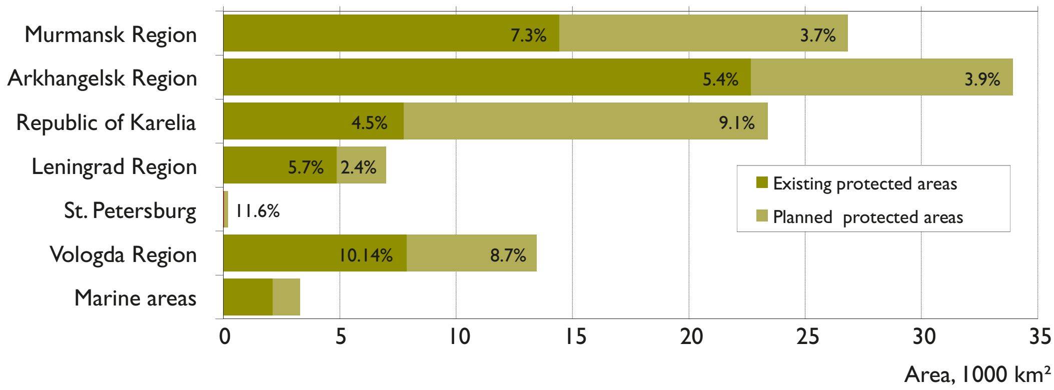


Fig. 3.11. Areas (1000 km^2) of existing and planned protected areas showing also their coverage in % of total areas of regions.

Republic of Karelia:

- Scheme of Spatial Planning of the Republic of Karelia (section 4.7. Proposals for the development of natural and ecological framework. Subsection 4.7.1. Activities towards developing a network of protected areas). Approved by the directive of the government of the Republic of Karelia, № 102-P, July 6, 2007.

Vologda Region:

- Regulation "On the reservation of land for the establishment of protected areas", approved by the Heads of 26 municipalities of Vologda Region in 2008.

Leningrad Region:

- Red Book of Nature of the Leningrad Region. V.1. Protected areas. (1999)
- Directive of the Committee on Natural Resources and Environmental Protection of Leningrad Region, February 25, 2005 № 12 "On the rules and regulations of the Red Book of Nature of Leningrad Region."
- The regional law on the regional target program "Support and development of specially protected natural territories of Leningrad Region for the period until 2010" adopted by the Legislative Assembly of the Leningrad Region, 3 February 2004 (Laws of the Leningrad Region on 18.11.2004 - № 91-oz, on 5.4 .2005- № 23-oz, on 28.07.2005- № 63-oz, on 18.05.2006- № 31-oz, on 06.02.2007- № 6-oz.)

St. Petersburg:

- St. Petersburg law "On the Master Plan for St. Petersburg and the boundaries of the protection zones of cultural heritage in the territory of St. Petersburg" on December 21, 2005.

Fig. 3.11. shows that the highest increment of protected areas, in both area and their share of the entire territory, is planned in the Republic of Karelia. Indeed, among the regions included in this study, Karelia currently occupies last place regarding the share of protected areas. Thus, the requirement is to increase the area of protected areas in Karelia, as well as in other regions (except the City of St. Petersburg) in order to reach the minimal level of 10% of their total areas.

Only Murmansk Region has plans by which it will achieve the Nagoya Convention on Biological Diversity ((Report of the tenth meeting ... 2010) recommended figure of 17% as the share of protected areas relative to total territory. Therefore, the lists of new protected areas presented by this study should not be regarded as a maximal program. In the Republic of Karelia and other regions, especially in Leningrad and Vologda Regions, further work towards the creation of new protected areas, additionally to our lists, is necessary.

The analysis of the distribution of existing and planned protected areas in different vegetation zones (Fig. 3.12 and Fig. 3.13) has revealed a significant imbalance in the plans for the establishment of new protected areas. The acreage of the planned protected areas in the northern, middle and southern boreal forest sub-zones, where they are expected to be doubled, look disproportionately large. These figures are, however, quite adequate, taking into account the current degree of conservation and threats to natural communities in these vegetation zones. In tundra and forest-tundra, the planned increase of the areas occupied by protected areas is less. This is explained by these sub-zones being basically very under-developed, so there are no significant threats to natural communities in most parts of them. Therefore, the program for the establishment of new protected areas must be focused on the most valuable HCV areas, or on the areas with clearly indicated potential threats.

The situation regarding optimization of the share of protected areas in hemiboreal forest zone is not so optimistic. Proposed increases in the area of protected areas are relatively small and definitely insufficient to protect natural diversity. The hemiboreal forest types are the most endangered natural communities which are under risk of extinction in the whole Europe. In this regard, we emphasize the urgent need for further work towards the establishment of new protected areas in the southern parts of Leningrad and Vologda Regions.

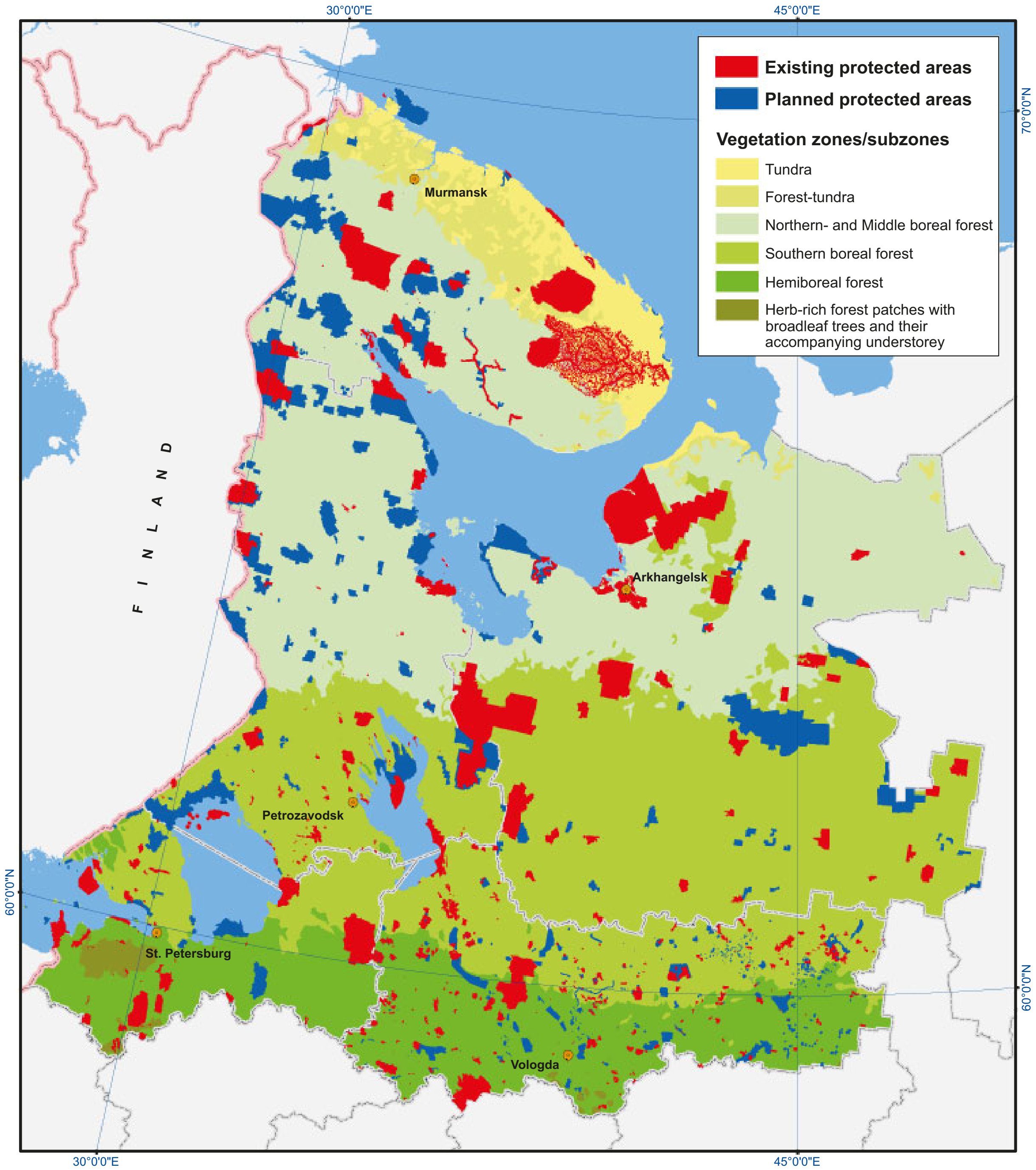


Fig. 3.12. Distribution of existing and planned protected areas in different vegetation zones.

The planned zakaznik Poryi Forest. Murmansk Region. Photo: Gennady Aleksandrov.

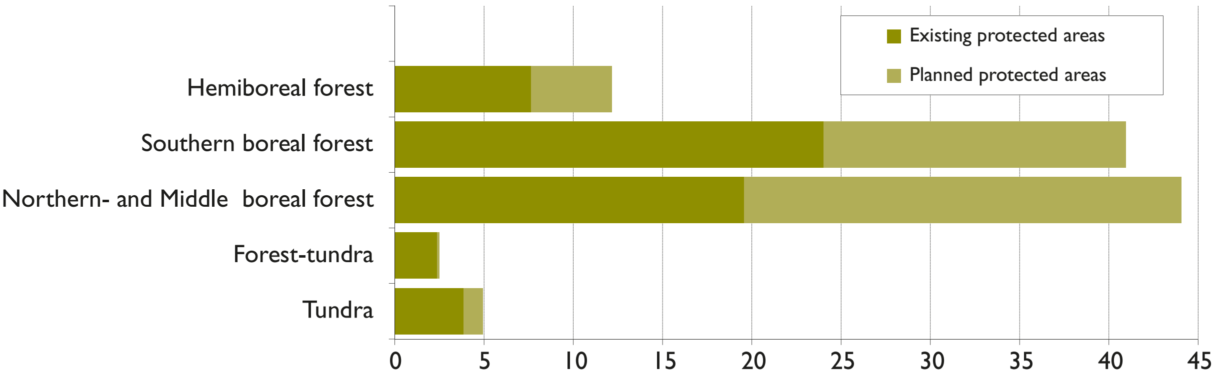


Fig. 3.13. Areas (1000 km^2) of existing and planned protected areas in different vegetation zones.

3.3. Current situation with protection of HCV areas selected and mapped in this study

3.3.1. Intact forest landscapes

The total area of intact forest landscapes selected and mapped in this study amounts to 147,700 km^2, or 17.2% of the entire study area. Their percentage of total areas of administrative regions and percentage of different vegetation zones are shown in Fig. 3.14.

It is clearly evident that the area of intact forest landscapes decreases from north to south because the southern areas are much more developed and large areas of old-growth forests no longer exist in the southern part of northwest Russia. There are absolutely no intact forest landscapes in Leningrad Region or in St. Petersburg. In Vologda Region there is only one intact forest landscape between the two rivers Mologa and Suda, which could be also classified as mire because most of it is highly paludified, with forests covering only 1.9% of this area. However, it has significant conservational value since it is the only surviving intact natu-

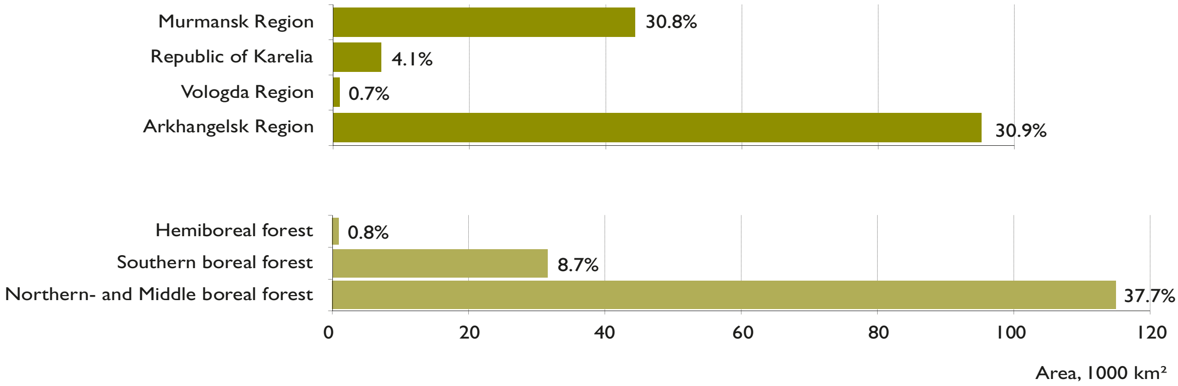


Fig. 3.14. Areas (1000 km^2) of intact forest landscapes, with percentage of total areas of administrative regions (upper chart), and percentage of total areas of different vegetation zones (lower chart).

ral landscape in the study area which is situated south of the 62° parallel and the only intact forest landscape in the hemiboreal forest zone. A small portion of this intact forest landscape is situated in the zakaznik Otnensky. In the long-term program for the development of protected areas in Vologda Region, enlargement of this zakaznik and the establishment of two new zakazniks, Talitsky and Semizerskaya Chist, are planned. Under these measures, 41.5% of the entire intact forest landscape between the Mologa and Suda rivers will be put under protection.

The second priority is to protect intact forest landscapes in the southern boreal forest sub-zone which are characterized by highly productive forest types maintaining especially high biodiversity. In the studied area, intact forest landscapes cover 8.7% of the entire southern boreal forest sub-zone. Most of them are located in Arkhangelsk Region. A part of the intact forest landscape in the Vodlozero National Park belongs to the Republic of Karelia.

The share of protected intact forest landscapes in the southern boreal forest sub-zone is now 25.9%. The largest protected intact forest landscape is in Vodlozero National Park. Large areas of intact forest in Arkhangelsk Region are included in the extended zakazniks Kozhozero, Soyana, etc., but their protection regimes do not prohibit logging, so they cannot be regarded as relevant for this type of HCV area. Among the planned protected areas, zakazniks Verhneyulovsky, Uftyugo-Ileshsky, Puchkomsky (the latter already existing, but expansion is planned) in Arkhangelsk Region, and zakazniks Yangozero and Chukozero in the Republic of Karelia will play a significant role. If they are established according to existing programs, the share of protected intact forest landscapes in the southern boreal forest sub-zone will reach 52.7%.

Of the area of intact forest landscapes in the middle boreal and northern boreal forest sub-zones only 15% is actually protected. In the northern boreal sub-zone, most of the intact forest landscapes be-

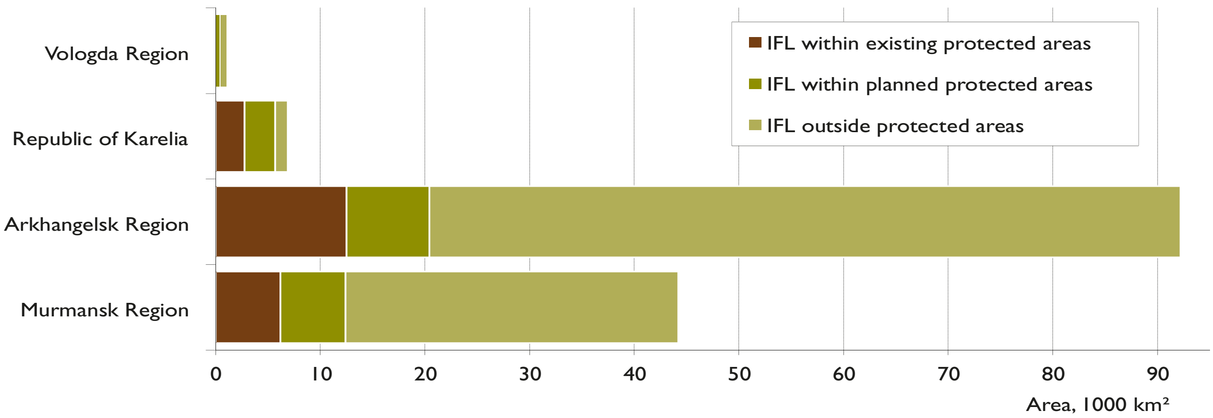


Fig. 3.15. Distribution of intact forest landscapes (IFL) in existing protected areas, planned protected areas, and outside protected areas by administrative regions.

long to the forestry category of "protective forests along the timberline". Unfortunately, although final felling here is prohibited, other types of commercial logging may be allowed, e.g. under the guise of thinning. This threat, however, is not so dangerous, because in this category of protected forests timber quality and volume are usually low, making harvesting economically unfeasible. These forests are therefore less threatened than in more southern areas, and the first priority for the protection of intact forest landscapes in the northern boreal forest sub-zone should be given to areas outside the "protective forests along the timberline".

If we exclude protective forests along the timberline from the calculations, the share of intact forest landscapes included in protected areas in the middle boreal and northern boreal forest sub-zones is 18.2%, and if all planned protected areas are established, this figure will reach 46%. The optimal approach to the protection of intact forest landscapes in these sub-zones is observed in

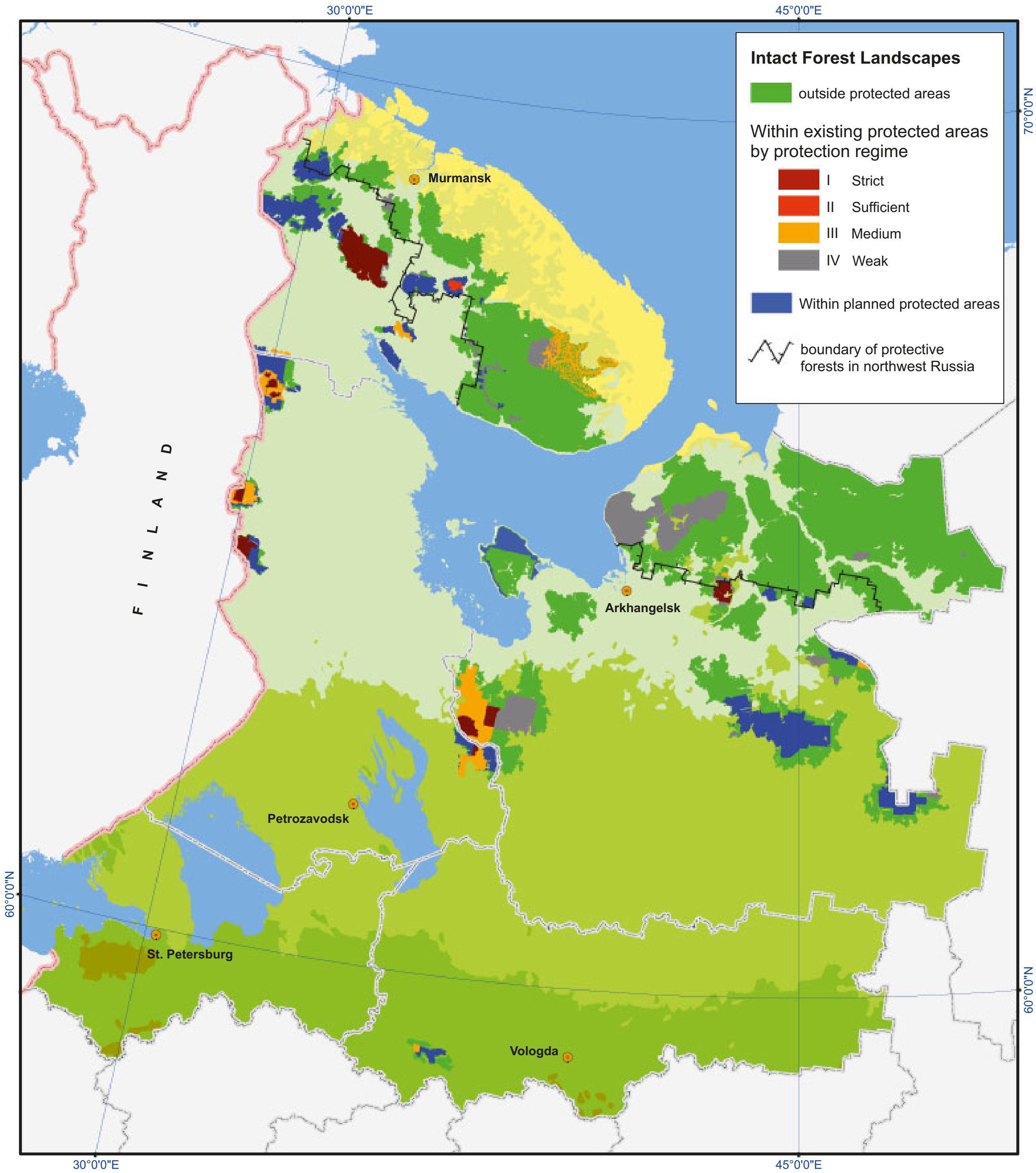


Fig. 3.16. Distribution of intact forest landscapes and their protection regimes.

Large intact forest landscape, located partly in the Paanajärvi National Park. Northern part of the Republic of Karelia. Photo: Sergei Filenko.

The Upper Kuchema River winds through mountains. View from the Great Cornice. Large intact forest landscape on the White Sea-Kuloi plateau. Arkhangelsk Region. Photo: Viktor Mamontov.

the Republic of Karelia where existing protected areas protect 39.7% of three large intact forest landscapes. Each of them is included, at least partly, either in the Paanajärvi and Kalevala National Parks, or in the Kostomuksha Strict Nature Reserve, or in the regional landscape zakaznik Voinitsa. The establishment of two planned extended zakazniks, Pyaozero and Spokoynyi, and the buffer protection zone of the Kalevala National Park would raise the share of protected intact forest landscapes to 79.7%. In Murmansk Region, the Lapland Strict Nature Reserve is the most important for the protection of the existing intact forest landscapes. There are also relatively large intact forest landscapes in zakazniks Kolvitsa and Kutsa. The overall share of protected intact forest landscapes in Murmansk Region is currently 30.3%. At present, there are ongoing projects on the planning and establishment of four extended zakazniks, Lapland Forest, Ion-Niyugoive, Poryi Forest, and Alla Akkajärvi spruce forest, as well as the expansion of the existing zakaznik Kolvitsa and the creation of the new nature park Kutsa to replace the existing zakaznik Kutsa. If all these projects are implemented, the overall share of protected intact forest landscapes in Murmansk Region will be 60.5%. The worst situation is in the middle boreal and boreal forest zones of the Arkhangelsk Region. Currently only 4.3% of intact forest landscapes are included in the existing protected areas. These are small areas of intact forest landscapes in Vodlozero National Park, in Pinega Strict Nature Reserve and in regional zakaznik Puchkomsky. After the creation of new protected areas according to the official regional programs,

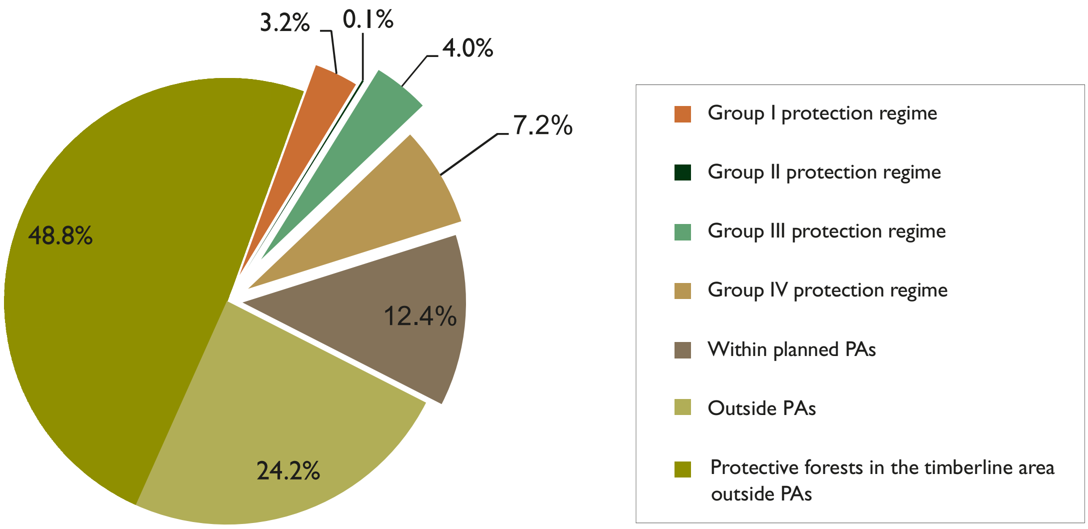


Fig. 3.17. Shares of intact forest landscapes in protected areas (PAs) with different protection regimes as percentage of total area of mapped intact forest landscapes.

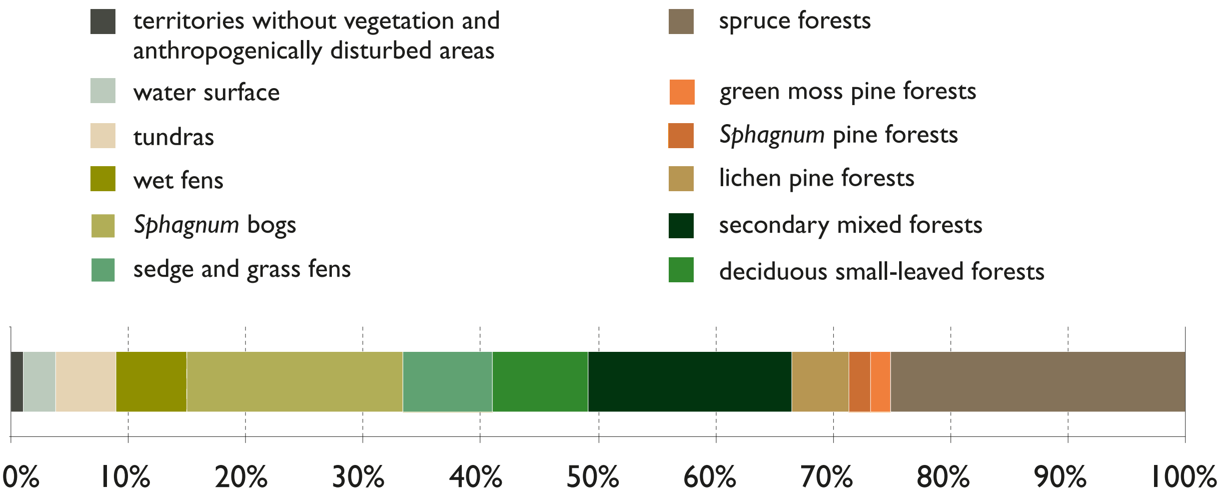


Fig. 3.18. Distribution of mapped intact forest landscapes by vegetation type (data from semi-automatic identification, using Landsat images).

the total of protected intact forest landscapes will reach 16.2%. This will be increased by the creation of the Onezhskoye Pomorye National Park, which will protect about a third of the territory of the unique intact forest on the Onega Peninsula of the White Sea. Although this will improve the situation to some extent, the other two thirds of this outstanding intact forest landscape will remain unprotected. Obviously, Arkhangelsk Region needs to take further steps towards including the rest of the existing intact forest landscapes in protected areas.

In the entire study area perspective, currently two huge protected areas, Vodlozero National Park and Lapland Strict Nature Reserve, have the greatest importance for the protection of intact forest landscapes. Extended intact forest landscapes are also included in three large regional zakazniks, Primorsky, Kozhozero, and Soyana in Arkhangelsk Region, but their protection regimes do not prohibit logging. Establishment of planned protected areas will significantly increase shares of protected intact forest landscapes throughout northwest Russia. The only exceptions are two relatively large intact forest landscapes in Arkhangelsk Region which have remained unprotected, and are not included in planned protected areas in the near future (see Fig. 3.16).

The analysis of vegetation types in the intact forest landscapes (Fig. 3.18) shows that a significant portion (33.5%) of their area is occupied by wetlands. Spruce forests have the largest share of the forested area of intact forest landscapes, whereas the share of pine forests is relatively small. The reason is that the timber industry was historically orientated to use primarily pine. Therefore old-growth pine forests, although not totally extinct as in many countries of Western Europe, have strongly declined in area. The few old-growth pine-dominated stands left in the studied area need immediate conservation measures.

3.3.2. Intact forest tracts, and forest tracts with high restoration potential

Generally, selection for mapping of the forest tracts with high restoration potential was carried out in order to identify areas where they form a single massif with scattered patches of old-growth forests. As a result, they are often presented together. Criteria for the selection of intact forest tracts were quite similar to those for intact forest landscapes, except for size criteria. Therefore further intact forest tracts will be considered additional to intact forest landscapes.

The total area of intact forest tracts selected and mapped in this study (40,500 km^2) is 4 times smaller than that of intact forest landscapes. The majority of the selected intact forest tracts, either in terms of area or in their percentage share of total areas of administrative regions, are situated in Murmansk Region (Fig. 3.24). This is due to the history of forestry, which is much shorter here than in other regions. Many relatively large stands which have remained minimally transformed and are therefore considered intact forest tracts, are found throughout Murmansk Region, not only in remote and inaccessible places, as in most of the other regions of this study. In Arkhangelsk Region, intact forests are distributed unevenly. Huge areas of intact old-growth forests (in this study chiefly characterized as intact forest landscapes) exist in

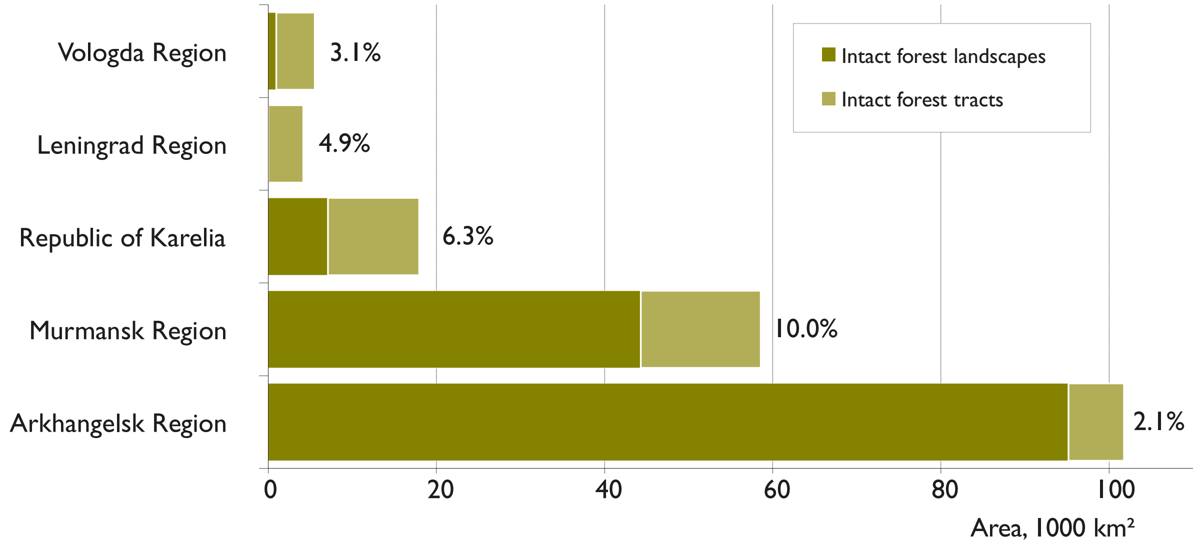


Fig. 3.19. Areas (1000 km^2) of mapped intact forest landscapes and intact forest tracts and their % share of total areas of administrative regions.

its northern part, from the Onega Peninsula to the Leshukonsk region; and also in the eastern parts of the Pinega and Verhnetoemsk administrative units. In contrast, forests in southern and central areas of Arkhangelsk Region are mostly secondary stands formed after final felling and planted managed pine forests, with intact forest sites occurring only as small fragments less than 10,000 hectares in area, some of which meet the size criteria of intact forest tracts.

In the Republic of Karelia, the areas of the mapped intact forest landscapes and intact forest tracts are about the same. However, the overall area of both types is relatively small. In Vologda and Leningrad Regions, where intact forest landscapes are absent (excepting only the highly paludified area in Vologda Region), intact forest tracts together with rare forest types constitute the primary target of nature conservation. Their total area is small due to economic development and the resulting high degree of anthropogenic transformation of these territories. However, these forest types situated in the hemiboreal and southern boreal forests harbor the highest biodiversity and are under the highest risk of extinction due to economic development.

Fig. 3.20 shows that the share of protected intact forest tracts in the studied area is disproportionately small, and much less than that of the intact forest landscapes (cf. Fig. 3.18). The proportions of intact forest tracts which are included in ex-

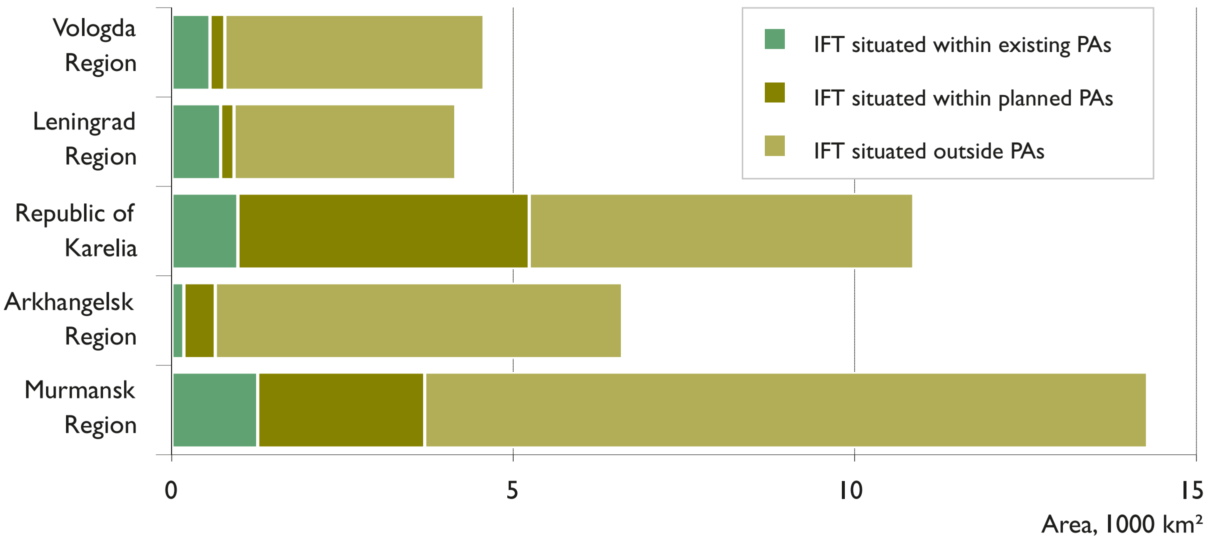


Fig. 3.20. Areas (1000 km^2) of mapped intact forest tracts (IFT) in existing protected areas (PAs), planned protected areas, and outside protected areas by administrative regions.

Minimally transformed old-growth spruce forest in the territory of the planned nature park Zaonezhye. Republic of Karelia. Photo: Oleg Kharchenko.

Intact forest in the basin of Soyana River, below Mt. Yves. Arkhangelsk Region. Photo: Viktor Mamontov.

isting protected areas compared with the total areas of the regions vary from 0.06% in Arkhangelsk Region to 0.9% in Murmansk Region. For the northern regions this is explained by the fact that the protection of old-growth forest has always focused on the largest intact forest landscapes. However, in Leningrad and Vologda Regions, where intact forest tracts are practically the only remaining areas of intact forest ecosystems, the measures taken for their protection are definitely inadequate. Establishment of the planned protected areas, as shown in Fig. 3.20, will not improve the situation substantially. Only in the Republic of Karelia, the increase of the share of protected intact forest tracts is planned to reach ca. 50%. Urgent measures towards the establishment of new protected areas to include the existing intact forest tracts are necessary in all the other regions.

Only a very small proportion of protected intact forest tracts are situated in protected areas with protection regimes of groups I and II (Fig. 3.21). The largest areas of protected intact forest tracts are located in the Ponoi Fisheries zakaznik and Kanozero zakaznik in Murmansk Region, belonging to category IV. In Leningrad Region, relatively large areas of intact forest tracts are included in the Nature Park Veps Forest, where logging restrictions apply to only a small area.

Selected and mapped forest tracts with high restoration potential include two groups: birch-aspen, and spruce-aspen forests. The latter represent a more valuable type, since they possess higher restoration potential. Forest tracts with high restoration potential were selected almost exclusively in the southern part of the study area (Fig. 3.24) belonging to the hemiboreal and southern boreal

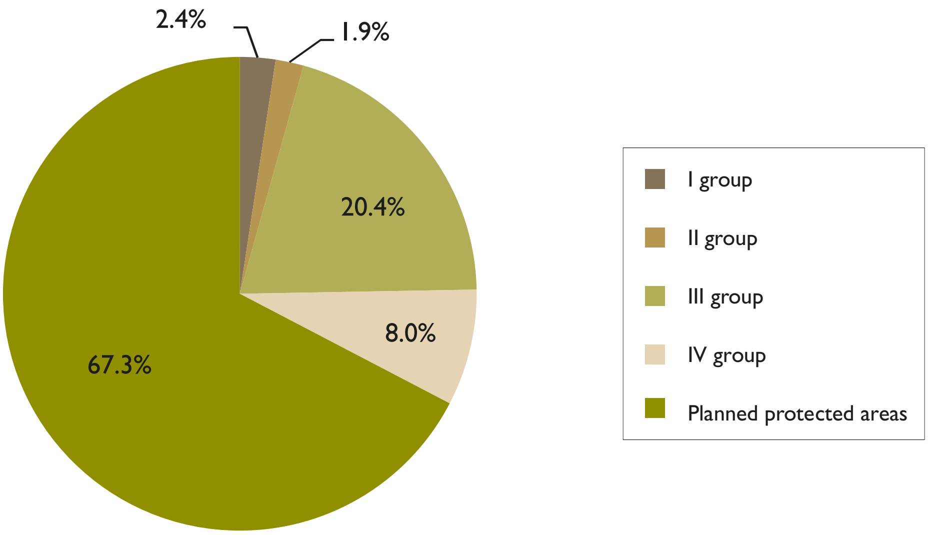


Fig. 3.21. % shares of the areas of intact forest tracts in existing and planned protected areas with different protection regimes.

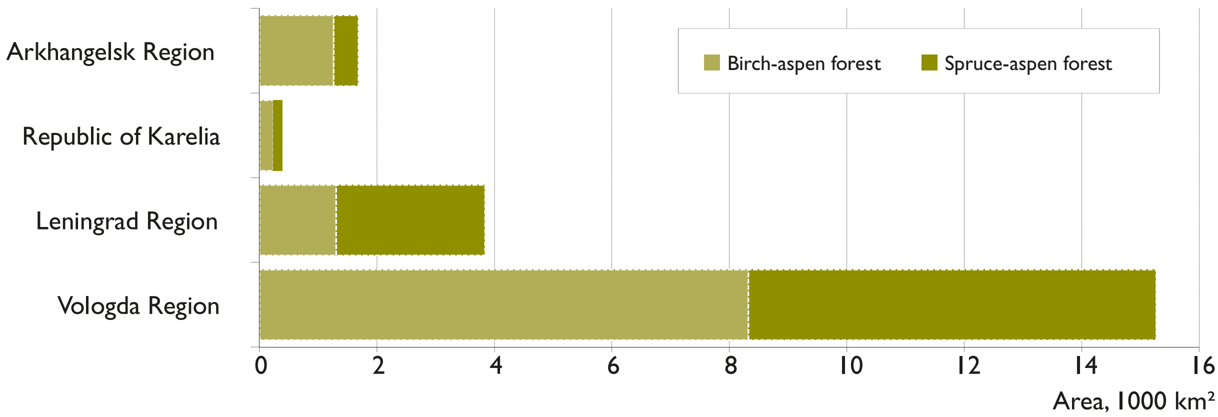


Fig. 3.22. Areas (1000 km²) of mapped forest tracts with high restoration potential by administrative regions.

sub-zones, where the area of intact forest tracts is relatively small, so even secondary forests capable of recovering to the natural state are of value. The priority in establishing of new protected areas should be given to forest tracts with high restoration potential adjacent to intact forest tracts, which may serve as dispersal centers of the species typical of natural forests. Also, forest tracts with high restoration potential surrounded by strongly disturbed areas have less conservation value.

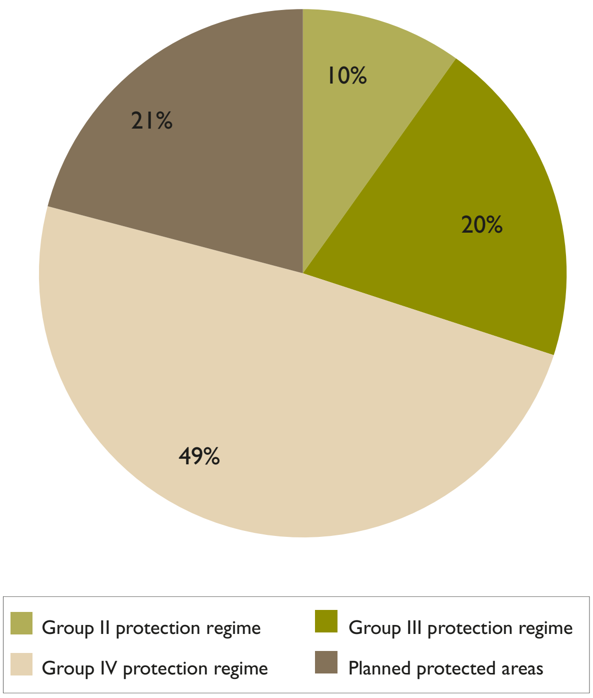


Fig. 3.23. % shares of forest tracts with high restoration potential in existing and planned protected areas with different protection regimes.
Note: forest tracts with high restoration potential areas were not mapped in strict nature reserves and national parks. Thus Group I protection regimes are excluded from calculations.

In total, only 5.7% of the area of all selected and mapped forest tracts with high restoration potential is situated in the existing protected areas. Establishment of new protected areas will bring this share to 7.2%. In fact, only the Veps Forest Nature Park in Leningrad Region incorporates a large territory where core zones of intact forest tracts are surrounded by forest tracts with high restoration potential. This fascinating area has a long history, including long-term care by the best Russian forestry specialists, but has still not achieved the status of a strictly protected territory, belonging instead to the category of zakazniks with inadequate protection. Moreover, the Veps Forest Nature Park covers less than half of the area of the intact forest tract core sites surrounded by forest tracts with high restoration potential, and its expansion is urgently needed. Other similar forest sites which have much smaller areas are located mainly in Vologda Re-

Mixed spruce and aspen-dominated forest tract with high restoration potential. Vilegodsky Zakaznik. Arkhangelsk Region. Photo: Artyom Stolpovsky.

gion. Many of them will be included in planned protected areas, the zakaznik Unzhensky and the nature monument Lesnoye Ozero. However, in general, judging by the extremely small areas of the forest tracts with high restoration potential which have been proposed for inclusion in the planned protected areas, the efforts to preserve these valuable forest sites are insufficient.

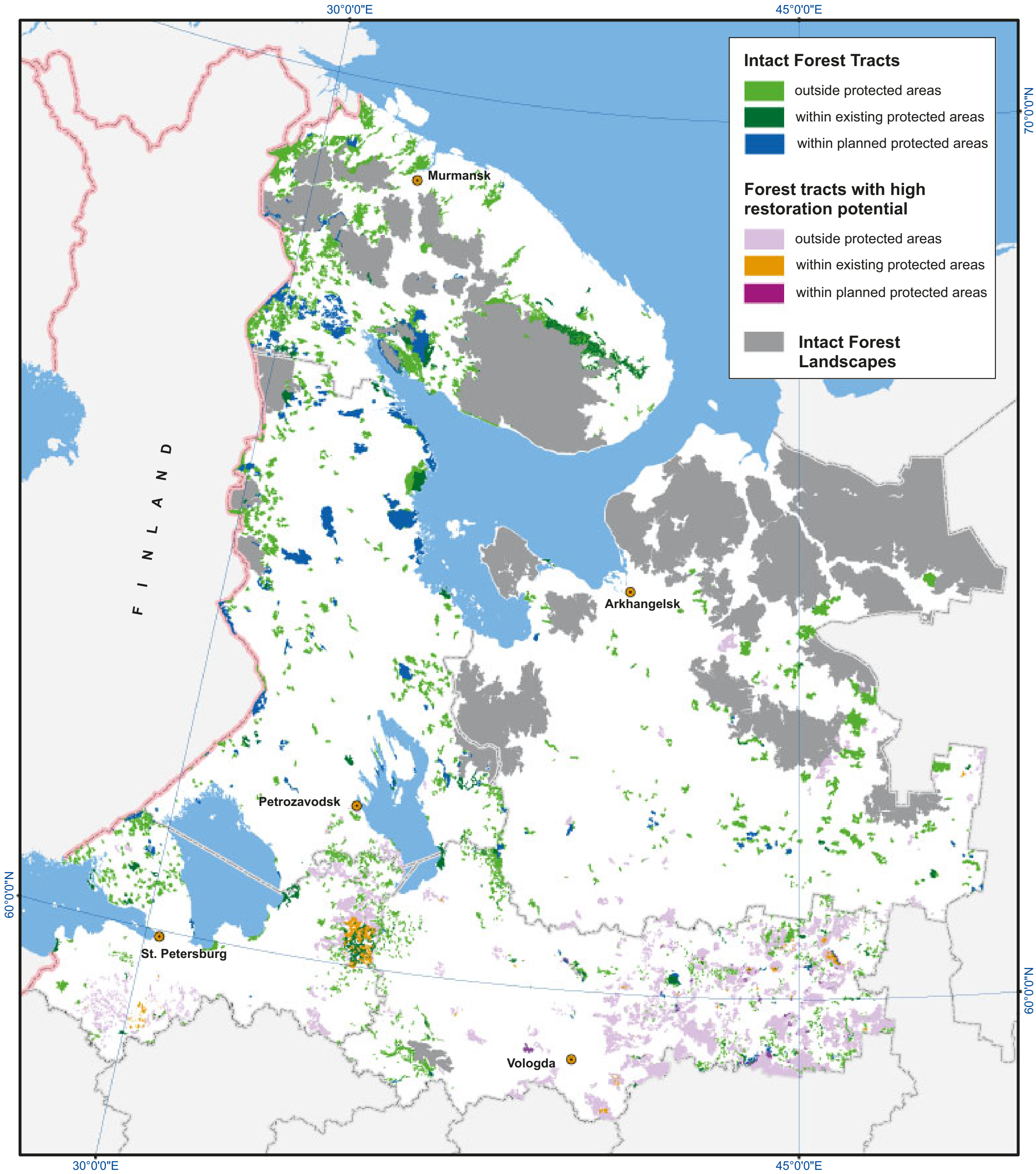


Fig. 3.24. Intact forest tracts, forest tracts with high restoration potential and intact forest landscapes within existing protected areas, planned protected areas, and outside protected areas.

3.3.3. Intact mire massifs and rare mire types: aapa mires outside their distributional area (aapa-province), spring fens and sloping fens

Spring fens were selected in Arkhangelsk, Murmansk, Leningrad and Vologda Regions. In St. Petersburg they are probably absent, and in the Republic of Karelia there were not enough field studies to find and define the exact locations of these small objects hardly visible in the satellite images. Everywhere but in Murmansk Region they are very rare. In total, 10 spring fens were mapped in Vologda Region, 28 in Arkhangelsk Region, 67 in Leningrad Region, and 1 in the Republic of Karelia. In Murmansk Region the number of mapped spring fens is the greatest: 354. This can be explained by the natural rarity of spring fens in the areas situated south of Murmansk Region and the northern part of Karelia, but also may be the result of faults in the selection procedure due to the shortage of field survey data (see Chapter 2). In all cases, spring fens are indicated in the overview map by points. On the slopes of hills, where spring fens often exist as components of sloping fens, they were not separated, but mapped together.

Early marsh orchid *(Dactylorhiza incarnata)* growing on spring fen. Murmansk Region. Photo: Gennady Aleksandrov.

In Murmansk Region, 72 spring fens (or 20.5% of the total number selected and mapped in this study) are situated in protected areas. Most of them are located in the Murmansk Tundra federal zakaznik and biological (zoological) zakaznik Ponoi, and two spring fens are located in Lapland Strict Nature Reserve. This is due to the fact that most of the selected spring fens are located in the east part of the region belonging to the tundra zone. The establishment of all planned protected areas in Murmansk Region will give protected status to another 19 spring fens in its southwestern part where this type of mire is much rarer.

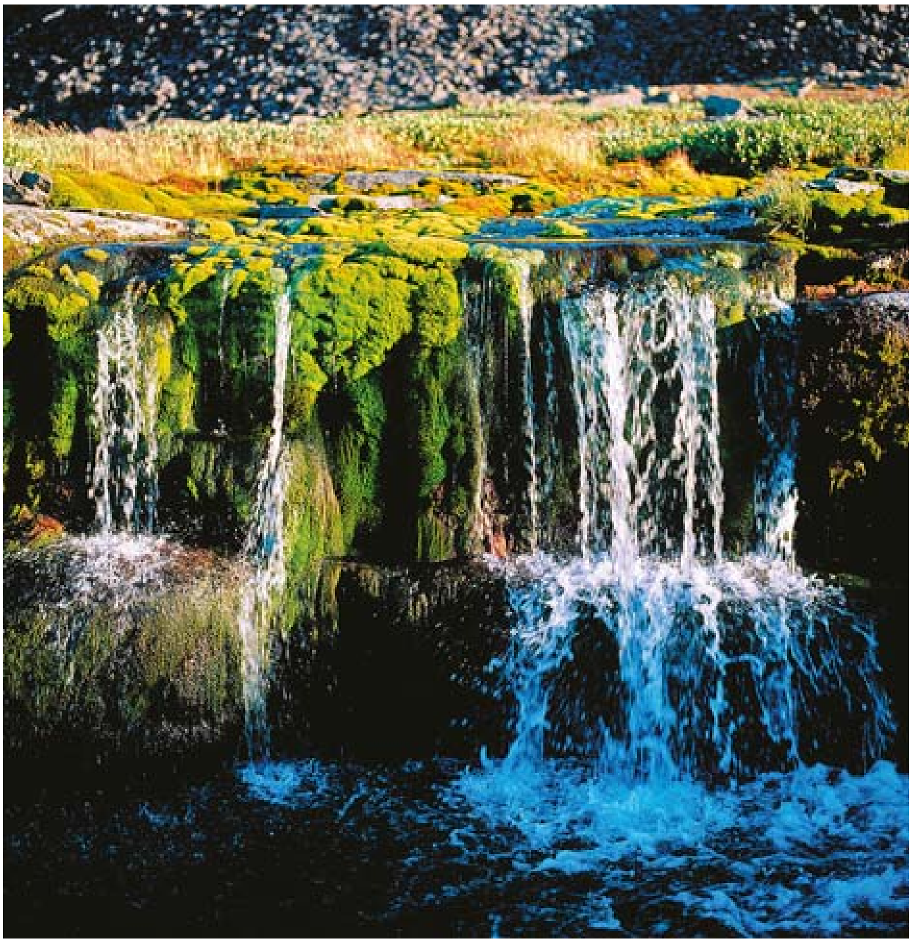
In Arkhangelsk Region, 11 spring fens (39.3% of the region total in this study) are situated in existing protected areas, including 3 spring fens in the Pinega Strict Nature Reserve. The planned zakaznik Verhneyulovsky will include another 13 spring fens so its creation will bring the percentage under protection to 85.7%.

In Leningrad Region 11 of the 67 mapped spring fens (16.4%) are protected in existing protected areas. None of the mapped spring fens are situated in planned protected areas either in Leningrad Region or in the Republic of Karelia. The establishment of the planned protected areas in all these regions will include one more spring fen in Vologda Region only.

Sloping fens (total: 62) are selected and mapped only in Murmansk Region, mostly in the Khibiny and Lovozero Tundras. Only three of them are located in the Lapland Strict Nature Reserve, and all the rest will be protected with the creation of the planned National Park Khibiny.

Aapa mires situated outside their main distributional area (or aapa-provinces) constitute another rare mire type (hereafter "southern aapa") which is characterized with high species richness in vegetation. They are selected and mapped in most of the territory of the Republic of Karelia, Arkhangelsk and Vologda Regions (Fig. 3.28).

The greatest area by the southern aapa is situated in Arkhangelsk Region, which also has the largest area of southern aapa located in existing protected areas, primarily in the Vodlozero National Park and in the adjacent Kozhozero landscape zakaznik. In Vologda Region, the main part of the southern aapa is within existing protected areas which belong to the special local category of protected mires (e.g. Dobroozerskoye, Lupozerskoye, Shem-mire, etc.). Fig. 3.25 shows that neither in Vologda nor in



Spring area in Khibiny. Murmansk Region. Photo: Sergey Konyaev.

Arkhangelsk Regions will there be any significant increase in the proportion of protected southern aapa in planned protected areas. Conversely, in the Republic of Karelia where only 5.7% of the mapped southern aapa is included in existing protected areas, the planned regional zakaznik Vygozero will almost completely include one of the largest massifs of southern aapa in the middle part of the republic.

Intact mire massifs were selected in all regions and republics. Due to great differences in the size criteria for their selection in different geographical areas, the comparison of their sizes by regions is not correct. In the southern part of the study area, where intact mires have become rather rare, we selected intact mire massifs even of small size, whereas in the northern parts only large or very

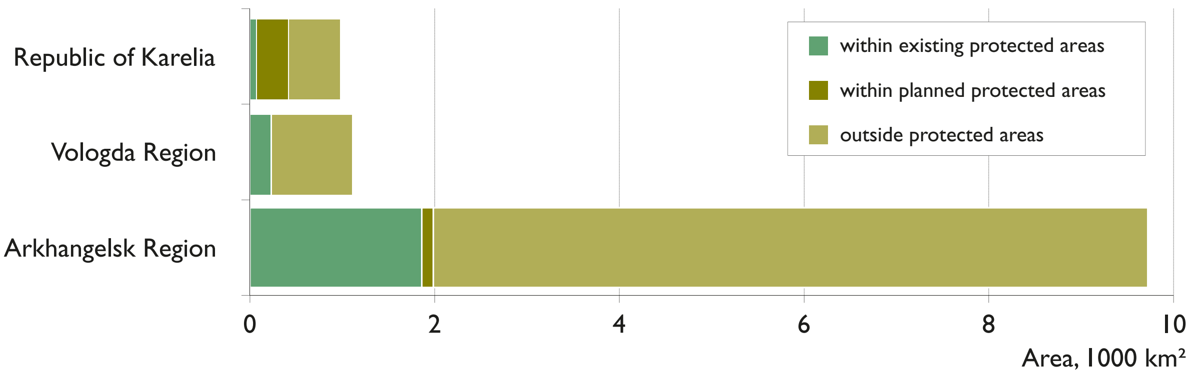


Fig. 3.25. Areas (1000 km^2) of mapped southern aapa mires within existing protected areas, within planned protected areas, and outside protected areas, by administrative regions.

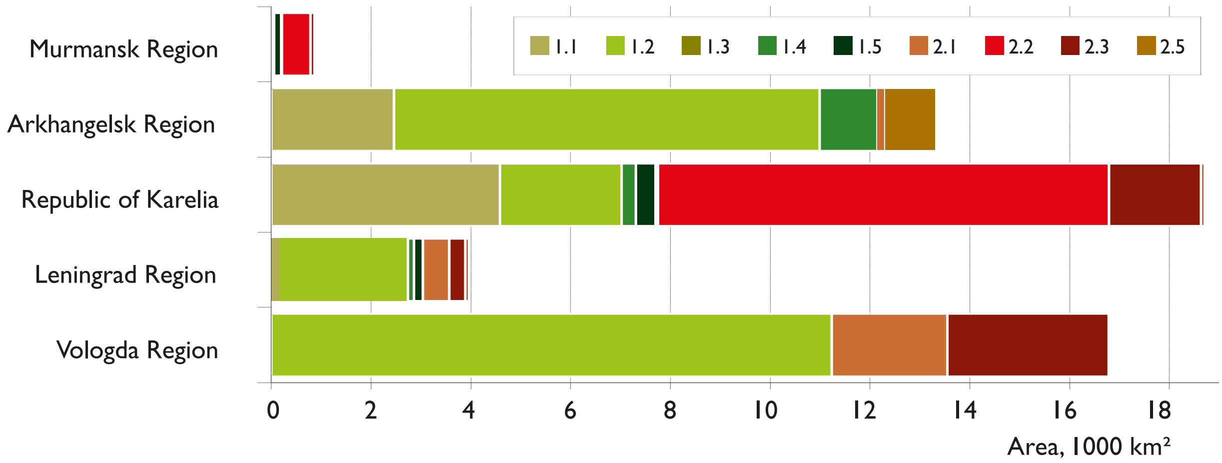


Fig. 3.26. Areas (1000 km²) of mapped intact mire massifs (IMM), by administrative region. See fig.3.28 for the legend of mire types. Note: Intact mire massifs in St. Petersburg area excluded due to small size in comparison with all other regions. Aapa mires outside the Kola and Northern Karelia aapa-provinces excluded.

large ones were selected (see Table 2.6). For instance, in Murmansk Region, with the minimum area criterion of 50,000 ha, we mapped only one huge massif. Consequently, the differences in the areas of intact mire massifs identified for different regions can be explained not only by their actual presence in or absence from this territory, but also are due to differences in the size criteria for their selection.

The situation with the protection status of selected intact mire massifs is not much better than that of intact forest tracts. Currently only 12.5% of the total area of intact mire massifs selected and mapped in this study is situated in existing protected areas. The greatest share of protected intact mire massifs is in Vologda Region, where 23.1% of the area of mapped intact mire massifs is currently located within protected areas. Most of them belong to the regional category of protected mires, which are particularly numerous in Vologda Region (see Appendix). The largest protected mires are: Pyavochnoye, Malakhovskoye / Kobozhskoye, Kondasskoe, Stolypin's ecosite Sokolya Chist, etc. A large area of intact mire massifs is also included in the Darwin Strict Nature Reserve and its buffer zone. In Vologda Region, further efforts towards protecting intact mires are planned, which may lead to increasing the share of protected intact mire massifs to 32.9% of their total area in the region.

In Leningrad Region, 20.7% of the total area of intact mire massifs is protected, mostly in regional zakazniks Mshinskoye mire, Glebovskoye mire, and in the Nizhneswirsky Strict Nature Reserve. The establishment of all planned protected areas

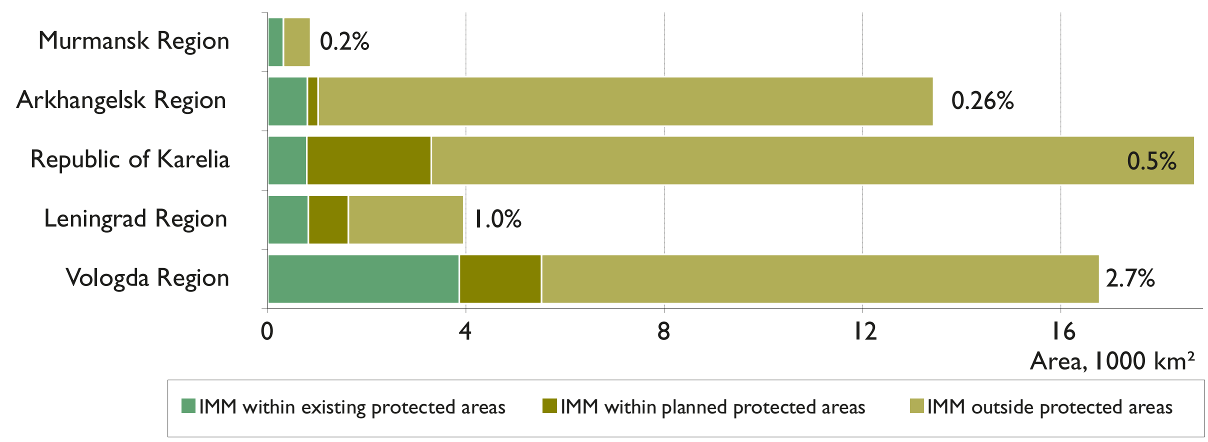


Fig. 3.27. Areas (1000 km²) of mapped intact mire massifs (IMM) in existing protected areas, planned protected areas, and outside protected areas, by administrative regions. Percentage figures show total area of protected areas to total area of region.

Fen between two ridges near Ladoga Lake. Nizhneswirsky Strict Nature Reserve. Leningrad Region. Photo: Maria Noskova.

Pool-ridge bog complex. Hydrological (wetland) zakaznik Ozernoe mire. Leningrad Region. Photo: Maria Noskova.

(primarily zakaznik Southern Ladoga shore) will increase the proportion of protected intact mire massifs to 41%.

In the City of St. Petersburg only two intact mire massifs, Sestroretsk mire and Yuntolovskoye mire, were selected. Both are located in existing protected areas, Yuntolovskoye mire in the Yuntolovsky zakaznik and Sestroretsk mire in the planned zakaznik Sestroretsky. The latter, if and when established, will entirely solve the problem with protection of intact mires in the territory of St. Petersburg.

In the northern part of the study area, namely in Murmansk and Arkhangelsk Regions and the Republic of Karelia, the share of protected intact mire massifs is generally much lower because the threat of deterioration of natural mires resulting from either peat extraction or other activity is usually low. Here we must focus on creating protected areas for those intact mire massifs which are in real danger, especially in the southern parts of Arkhangelsk Region and the Republic of Karelia. In the south of the republic a significant portion of the selected intact mire massifs is already protected, and the establishment of planned protected areas (primarily regional zakazniks Chukozero, Yangozero, Koitajoki, etc.) will further improve the situation towards the optimum. In the south of Arkhangelsk Region, where the most threatened intact mire massifs are concentrated, there are plans to establish the Lekshmoh nature monument. Finally, in Murmansk Region, we selected a large intact mire massif in the remote part of the region where significant threats are not expected in the immediate future and, therefore, creation of a new protected area is not planned there.

3.3.4. Dry pine-dominated forests confined to sandy dunes, rocks, river valleys and shores of large lakes

Moisture-deficient pine-dominated forests are quite rare forest types which harbour a set of species strictly confined to them, including many rare and threatened species. Everywhere except Murmansk Region, where dry pine forest types are not considered rare, they have been included within the boundaries of intact forest landscapes and tracts.

Dry pine forests outside intact forest landscapes and intact forest tracts were identified in Arkhangelsk, Vologda and Leningrad Regions and in the southern parts of the Republic of Karelia. In Karelia they are confined mainly to the coast of lakes Ladoga and Onega; in Leningrad Region to the Baltic Sea coast along Luzhskaya Bay and the Gulf of Narva; in Arkhangelsk Region to the dunes situated in the valley of the Northern Dvina River and the islands of its delta. In Vologda Region most of the selected sites of dry pine forests are confined to the valley of the River Yug.

The total area of the selected sites of dry pine forests is low, only 693 km^2. Most of them (46.9%) are situated in Leningrad Region. The rest are divided in almost equal parts between Vologda and Arkhangelsk Regions, with the smallest portion (6.3%) of the selected dry pine forest belonging to the Republic of Karelia.

Generally, dry pine forests are relatively well-protected in the study area. In total, 30.2% of the area of mapped dry pine forest is situated in existing pro-

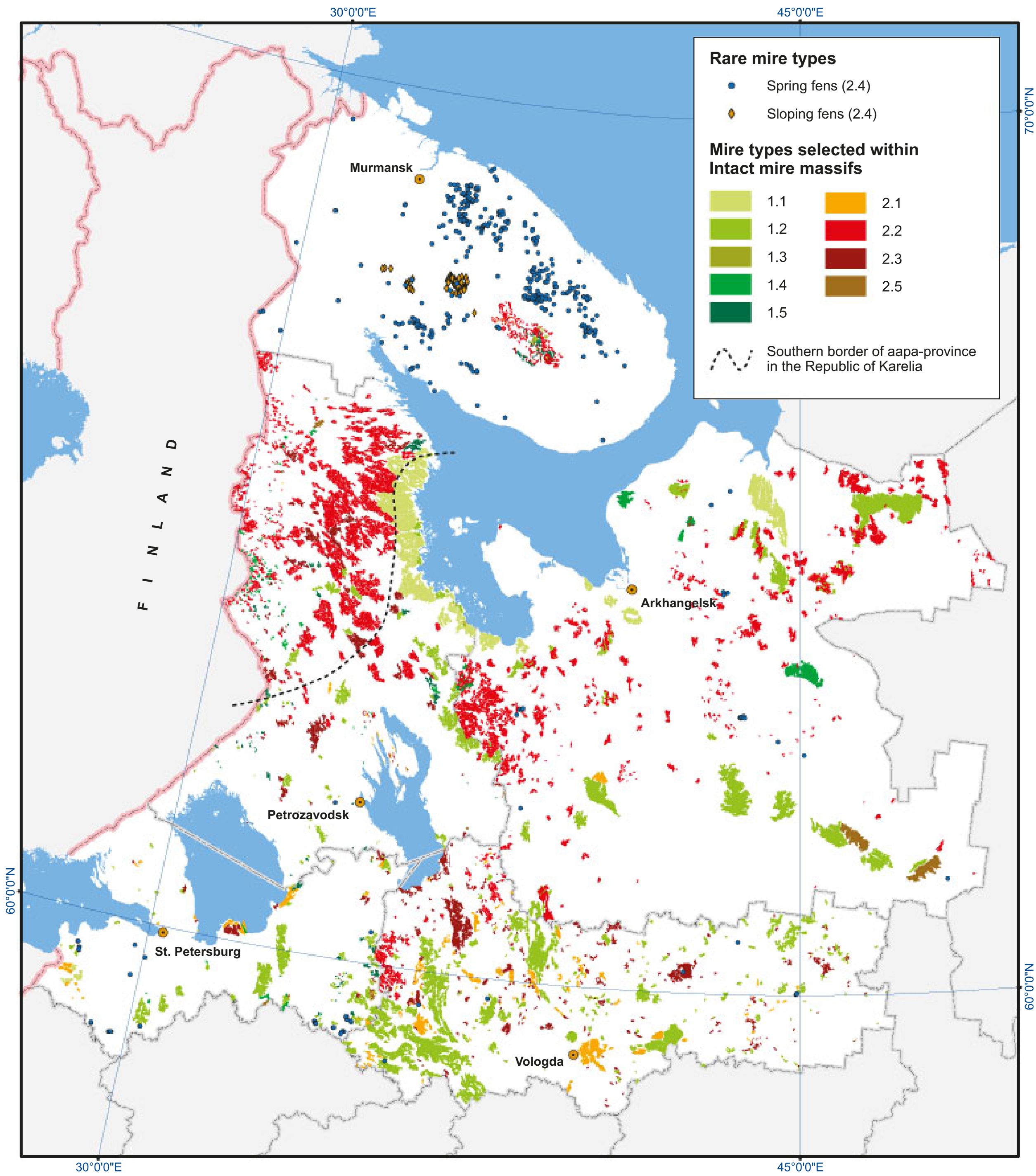


Fig. 3.28. Intact mire massifs (IMMs) and rare mire types mapped in this study

Ombrotrophic mire types: 1.1: liverwort-lichen-sphagnous ridge-hollow-pool bog complexes (White Sea and eastern Baltic Sea coasts); 1.2: sphagnous ridge-hollow bog complexes (continental); 1.3: dwarf-lichen-palsa mires (sporadic permafrost); 1.4: dwarf shrub-sphagnous bogs with pine layer (continental); 1.5: cottongrass-sphagnous bogs (continental). **Minerotrophic mire types**: 2.1: sedge fens and sedge-grass spring fens (eutrophic); 2.2: sedge- and grass-moss stringe-flark-pool aapa mire complexes (excluding Murmansk Region); 2.3: sedge-grass-sphagnum, non-structured, oligo-mesotrophic; 2.4: rich herb-moss unstructured eutrophic spring fens (including sloping fens); 2.5: tree-grass, eutrophic fens.

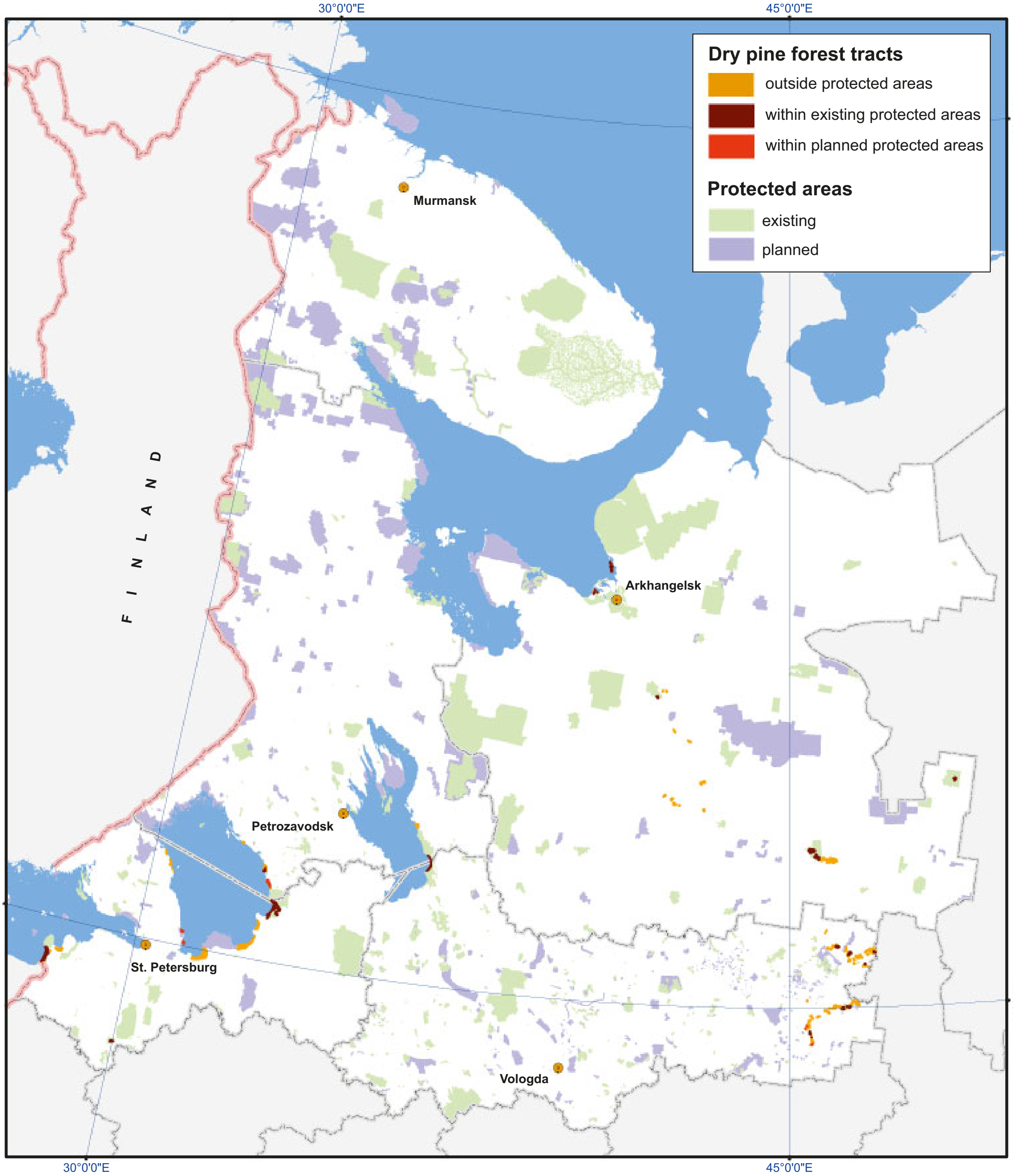


Fig. 3.29. Mapped dry pine forest tracts within existing protected areas, within planned protected areas, and outside protected areas.

tected areas. By administrative regions the shares of the protected areas of dry pine forests are as follows: in Leningrad Region, 37.1%; in Arkhangelsk Region, 37. 1%; in Vologda Region, 17.4%; in the Republic of Karelia, 6.6%. In St. Petersburg HCV areas of this forest type were not selected. In Leningrad Region they are situated chiefly in the Nizhneswirsky Strict Nature Reserve and zakaznik Kurgalsky; in Arkhangelsk Region, dune pine forests on Mudyug Island are entirely included in the regional zakaznik Mudyug, with part of the dry pine forests in the Northern Dvina delta in the regional zakaznik Belomorsky. Regional zakazniks Siysky, Shilovsky and Yarensky also incorporate large areas of dry pine forests. In Vologda Region there is a dry pine forest site on the shore of Onega Lake, within the complex zakaznik Onega, and several dry pine forest stands along the valleys of the Northern Dvina and the Yug, which are partially included in the regional zakazniks Shilengsky pine forest, Palemsky pine forest, Viktorovsky pine forest, Olenevsky pine forest, Kudrinsky pine forest, etc. In the Republic of Karelia, selected sites of dry pine forests are represented by relatively small isolated stands within regional zakazniks: Muromsky, which is situated on the southeastern shore of Onega, and Andrusovsky, on the eastern shore of Ladoga.

Although the proportion of dry pine forests in protected areas is rather high, we have to emphasize that most of these protected areas belong to the category of zakazniks which can not guarantee their protection against logging due to insufficient protection regimes. The establishment of the planned new protected areas - zakazniks Morye and Kokorevsky in Leningrad Region and the nature monument Okhta Cape in the Republic of Karelia - will increase the area of protected dry pine forests to only 33.3%.

Dune pine forests on Mudyug Island in the White Sea. Regional landscape zakaznik Mudyug, Arkhangelsk Region. Photo: Artyom Stolpovsky.

3.3.5. Old-growth, minimally transformed coniferous forests dominated by spruce and fir, broadleaved forests and mixed coniferous-broadleaved forests

All types of old-growth forest which are naturally rare in the study area, namely those dominated by spruce and fir, broadleaved and coniferous-broadleaved forests, are discussed together in this subchapter. These are generally southern forest types and consequently they are present only in the southern parts of the studied area. They cover a very small area in the southern forest sub-zones: 0.7% of the hemiboreal, and 0.1% of southern boreal forest sub-zone. Of these the major part (80.2% of their entire area) is covered with old-growth spruce-fir forests, while the areas covered with broadleaved and coniferous-broadleaved forests are much smaller.

Minimally transformed old-growth forests dominated by spruce and fir are selected and mapped only in the eastern part of Vologda Region and in the adjacent areas of Arkhangelsk Region, broadleaved and coniferous-broadleaved forests in Vologda and Leningrad Regions (Fig. 3.31). In Murmansk Region these forest types are absent. Some fragments of coniferous-broadleaved forests situated in southern parts of the Republic of Karelia, e.g. along northern Ladoga shore, were not included in this study. Vologda Region possesses the greatest area of these forest types – 96.8% of the total area selected in this study. In Leningrad Region old-growth spruce-fir forests were not found, only broadleaved and coniferous-broadleaved forests were selected. In Arkhangelsk Region, vice versa, we selected only a small area of old-growth spruce-fir forest covering about 800 ha in its southeastern part.

The situation with the protection of these forest types can be characterized as highly unsatisfactory. Indeed, at the moment of writing, only 13.2% of the selected broadleaved and coniferous-broadleaved forests, and 2.2% of intact old-growth spruce-fir forests are situated in existing protected areas. This especially concerns Vologda Region, which possesses the main area (84.1%) of these rare forests selected in this study but where only a very small fraction is currently protected (Fig. 3.32). The establishment of the planned protected areas will hardly improve this situation In Leningrad Region and in St. Petersburg, the area of selected broadleaved and coniferous-broadleaved forests is quite small (15.9%) but their protection status is significantly better (cf. Fig. 3.32).

Current protection regimes of these forests situated in the existing protected areas can not be considered adequate in view of their high conservational value. All of these protected areas except one regional nature monument - Canyon of the Lava River in Leningrad Region with group II protection regime - are regional zakazniks (the largest are zakazniks Vanskaya Luka, Talitsky forest and Unzha forest in Vologda Region) where logging is in practice not forbidden. Some selected areas in St. Petersburg and Leningrad Region are in fact parks, most of which require special sanitary forest management. Implementation of this procedure, which involves removal of unhealthy trees and dead wood, is reasonable in city parks but in remnants of natural forest this leads to the loss of their natural structure and species pools.

Thus, the last remaining sites of the southern forest types in boreal and hemiboreal forest zones, which were almost completely destroyed during the economic development of northwest Russia, are now practically unprotected in most of their area. Planned measures for the establishment of new protected areas are inadequate because these protected areas do not coincide with the areas harboring these forests. This poses a real

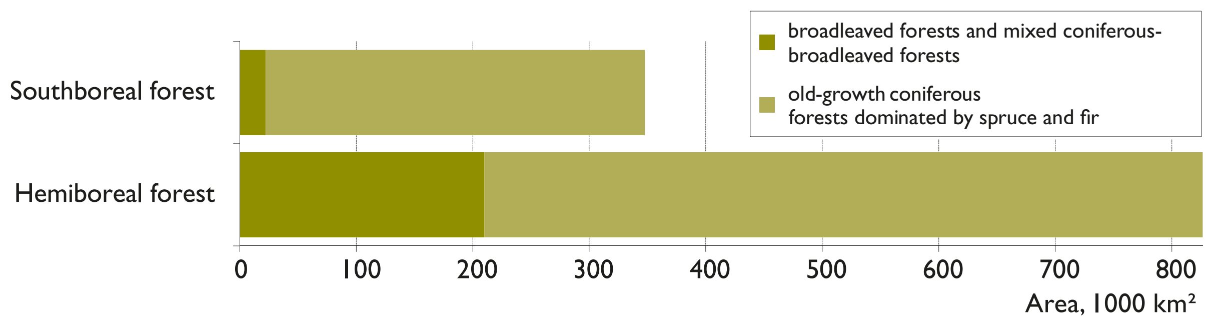


Fig. 3.30. Areas (1000 km²) of the mapped intact tracts of old-growth, minimally transformed coniferous forests dominated by spruce and fir, broadleaved forests and mixed coniferous-broadleaved forests, by vegetation zone.

now rare forest types, with the subsequent loss of those species confined to them which have become threatened due to drastic decline of their natural habitats. Further actions towards their real protection are urgently needed, especially in Vologda Region, as well as further fieldwork to reveal currently unknown or neglected locations of them, especially in Leningrad Region and the Republic of Karelia.

Fig. 3.31. Mapped old-growth, minimally transformed coniferous forests dominated by spruce and fir, broadleaved forests and mixed coniferous-broadleaved forests, by vegetation zone.

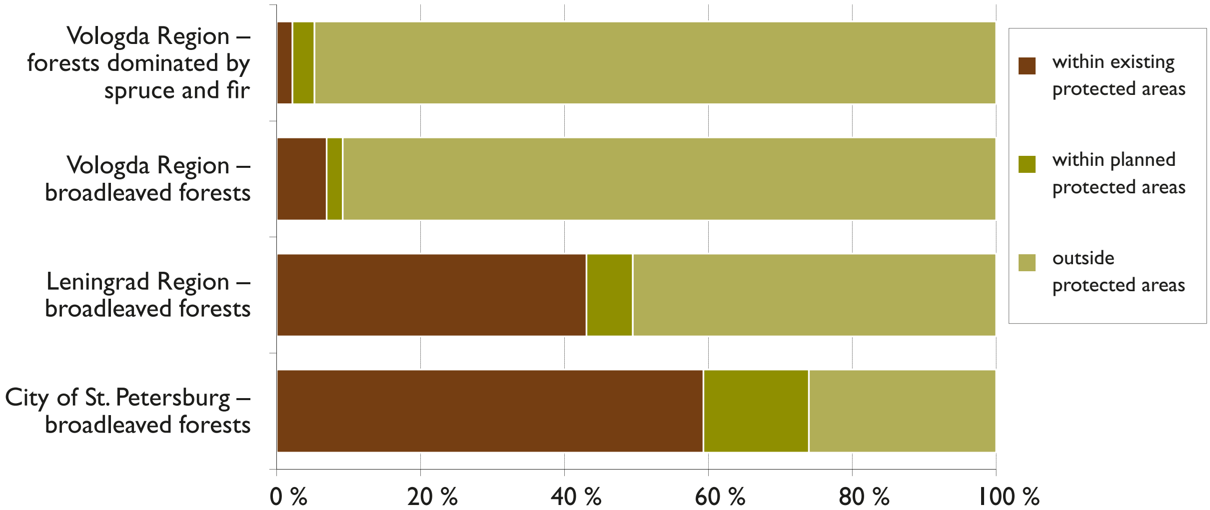


Fig. 3.32. Areas of protected old-growth, minimally transformed coniferous forests dominated by spruce and fir (uppermost bar), broadleaved forests and mixed coniferous-broadleaved forests (lower bars) as percentages of total area covered by these forest types, by region.

Broadleaved forest in the regional complex zakaznik Oak Groves near Velkota village. Leningrad Region. Photo: Olga Volkova.

Linden forest in the floodplain of the Northern Dvina. Vologda Region. Photo: Elena Chyurakova.

3.3.6. Natural larch stands

Old-growth forests that consist primarily of larch were selected only in Arkhangelsk and Vologda Regions (Fig. 3.33). In Arkhangelsk Region, they are widely distributed and occupy an area of 671 km^2, or 0.2% of the total area of the region. In Vologda Region, the area of larch forests is much smaller, only 2.8 km^2, or 0.002% of the area of the region. In Arkhangelsk Region, larch forests occur mainly on the White Sea-Kuloi plateau and in the northeastern areas, while in Vologda Region they are scattered in small sites (the largest is 82 ha) throughout the forested area.

In **Arkhangelsk Region**, 46.5% of the area of old-growth larch forests is situated in existing protected areas, chiefly in the regional zakazniks Soyana and Primorsky, and in the Pinega Strict Nature Reserve and its buffer protection zone. However, in all these areas restrictions on logging are inadequate so the old-growth larch forest there is not reliably protected. For example, old-growth larch with group I protection regime in the Pinega Strict Nature Reserve makes up only 2.3% of the total area of old-growth larch forests in Arkhangelsk Region. Among planned protected areas, only one – the zakaznik Puchkomsky – includes a small area (795 ha) of larch forest. Thus, a significant increase in the proportion of protected old-growth larch forests in Arkhangelsk Region is not to be expected. Intact forest landscapes and tracts with great proportion of larch along the River Mezen and its tributary, Mezenskaya Pizhma in the northeast corner of the Arkhangelsk Region remain totally unprotected.

In **Vologda Region**, 65 hectares of old-growth larch forest (23.5% of their total area in this region) are included in the regional zakaznik Larch Forest. None of the planned protected areas includes larch forest.

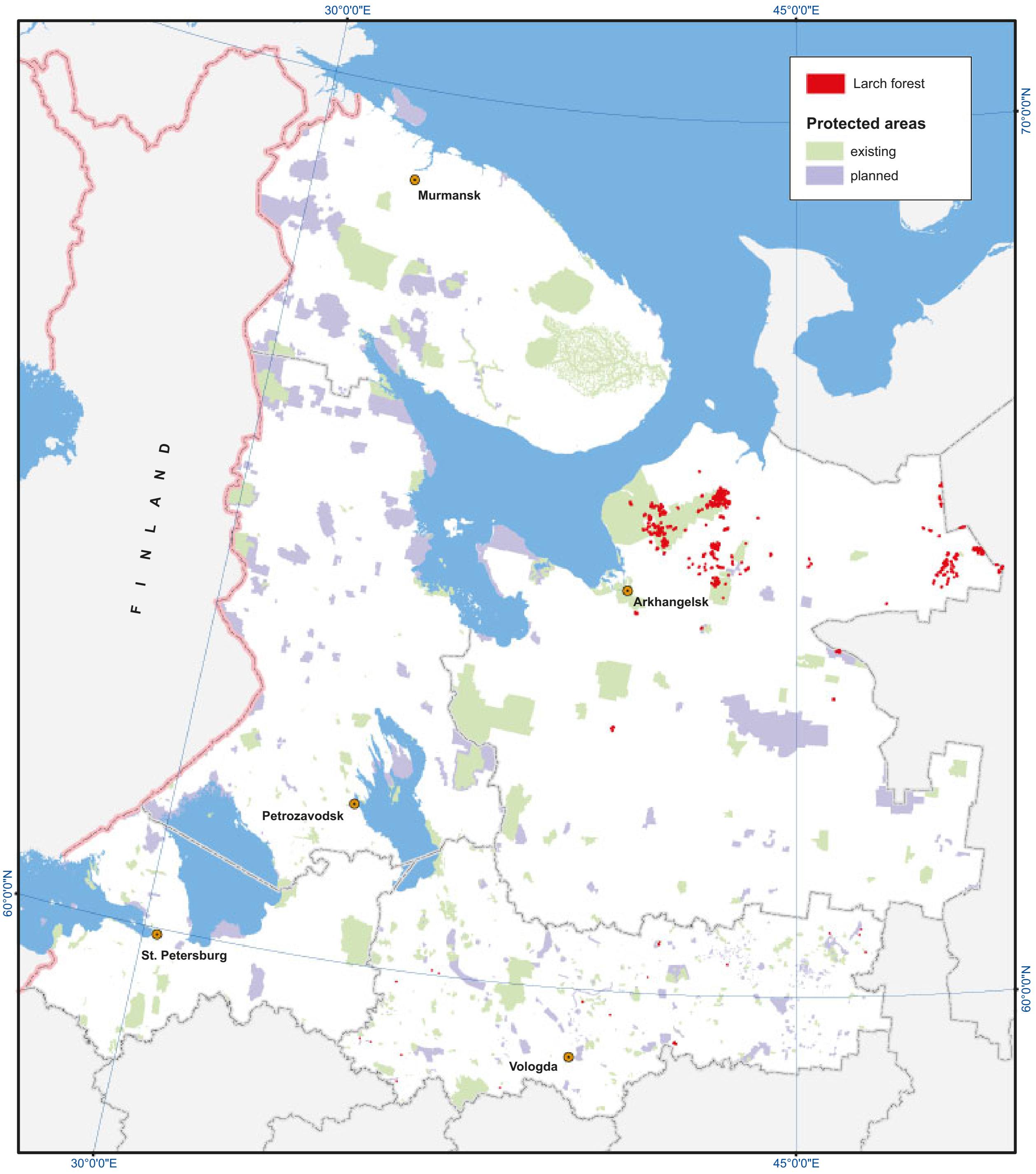


Fig. 3.33 Mapped areas with natural stands of larch forest in Arkhangelsk and Vologda Regions.

3.3.7. Coastal grasslands

Coastal grasslands are selected only for Murmansk Region. All of them are very small, with the largest single site of coastal meadow being 655 ha. No other site exceeds 100 ha. The total area of the selected and mapped coastal grasslands is 2,180 ha, or 0.015% of the area of Murmansk Region. Only 6.3% of them are included in existing protected areas, chiefly in the Kandalaksha Strict Nature Reserve. In addition, small areas of coastal grasslands are mapped in two small protected areas, the nature monuments Ivanova Bay and sea bird colonies in Dvorovaya Bay of the White Sea. The establishment of planned protected areas, primarily the nature park Rybachy Peninsula, will bring the share of protected coastal meadows to 24.7% of the area of Murmansk Region.

Herb-rich meadows of the Ponoi delta on the White Sea coast. Murmansk Region. Photo: Gennady Aleksandrov.

3.3.8. Alpine tundra areas in the forest zone

The total area of alpine tundra in the forest zone selected and mapped in this study is 4.700 km², or only 0.59% of the total forest area in the studied territory. Alpine tundra is found primarily in mountain massifs Khibiny and Lovozero Tundras (mainly within the Lapland Strict Nature Reserve), Volchyi Tundras, Chuna, Monche Tundras, Salnye Tundras and also in Tuadash-Tundr and Saariselkä-tunturi in the west of Murmansk Region.

Almost all the alpine tundra areas selected in the forest zone are in Murmansk Region, which is explained by climatic factors and the more mountainous terrain. In the Republic of Karelia we selected only a very small area of 1.6 ha, which represents 0.35% of the total area of mapped alpine tundra. Most of the Karelian alpine tundra, including the site on Nuorunen mountain, which is the southernmost one in this study, are included in the National Park Paanajärvi and therefore protected. In Murmansk Region the largest share of the alpine

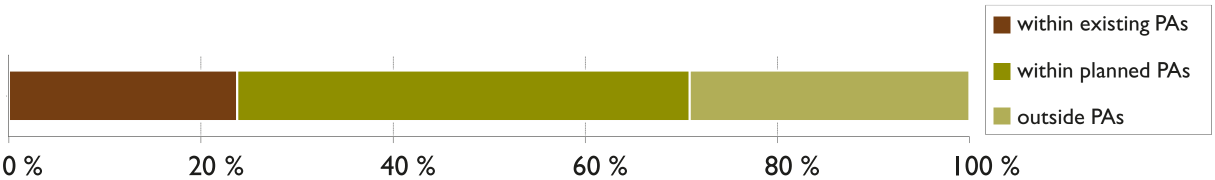


Fig. 3.34 Mapped intact alpine tundra areas in the forest zone within existing protected areas (PAs), planned protected areas, and outside protected areas (%).

The northern limit of spruce and alpine tundra on Kolvitsa Tundras. Murmansk Region. Photo: Gennady Aleksandrov.

Typical alpine tundra vegetation on the plateau of Khibiny mountain massif. Murmansk Region. Photo: Tatyana Kholina.

tundra areas is protected in the Lapland Strict Nature Reserve. Among the planned protected areas which include large areas of alpine tundra, the most significant are National Park Khibiny and zakazniks Lapland Forest, Ion-Niyugoive, Kaita and Poryi Forest.

Fig. 3.35. Coastal grasslands selected in this study. In order to make them visible in this picture, we have built a 2.5 km buffer around each of them.

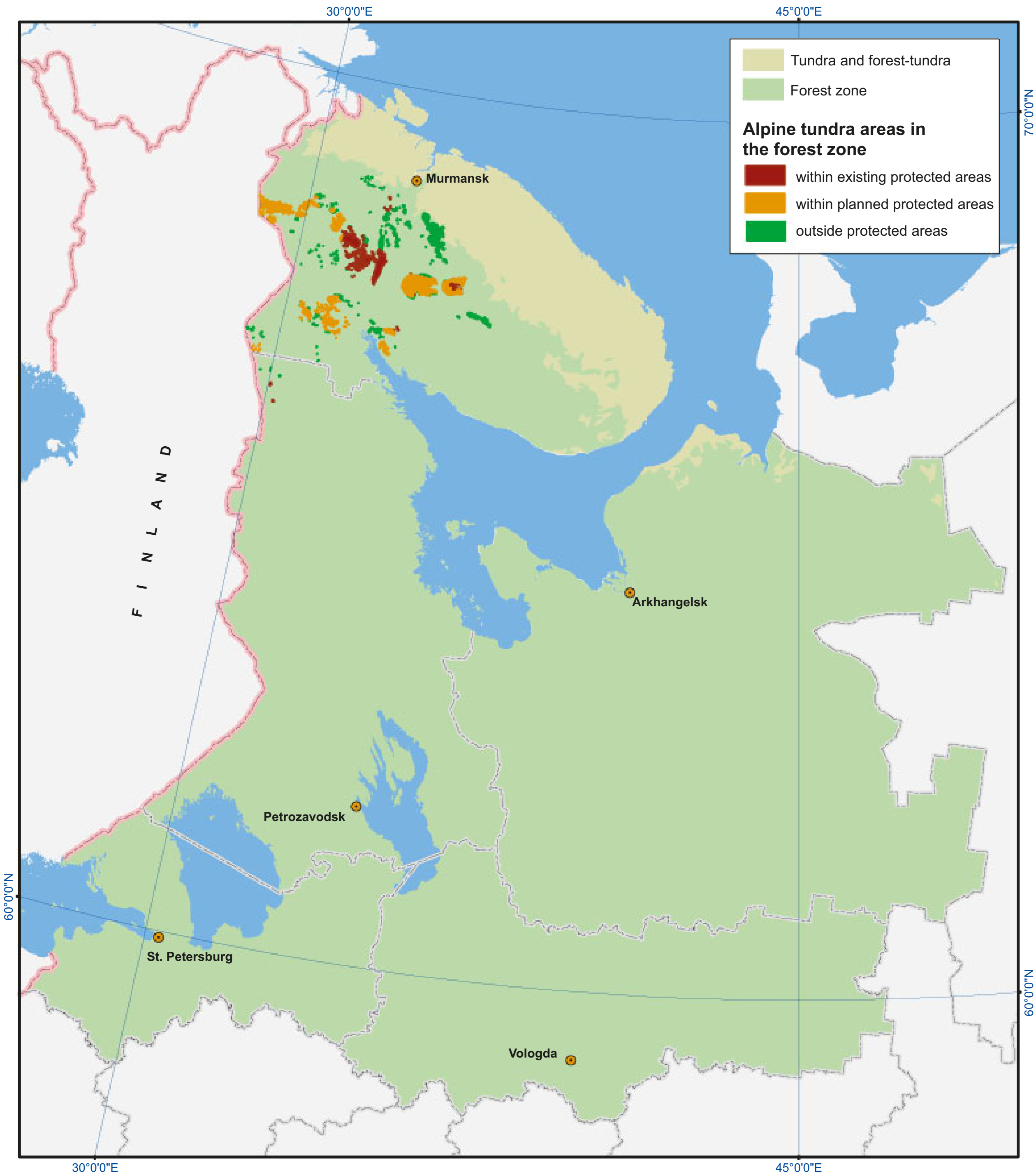


Fig. 3.36. Alpine tundra areas in the forest zone selected in this study.

3.3.9. Gorges, deeply incised river valleys, canyons, ravines, cliffs

Area estimates (i.e. vertical projection of the plane) of such objects as gorges, deeply incised river valleys, canyons, ravines and cliffs are not of great value, because they are almost vertically oriented. For this reason, we present them as percentages of total areas of such features, by administrative region, for an overall view of the relative abundance of these objects in different parts of the study area. They are distributed chiefly in the mountains (Murmansk Region and northwest Karelia), valleys of rivers, sea shores and shores of large lakes. Depending on their origin, they have specific features, but in this study we combined them on the basis of high species richness and the presence of a specific set of species confined to rocky walls (so-called "rocky species").

The fact that these objects are most often found in mountain areas explains their relative abundance in Murmansk Region (primarily strongly dissected mountain massifs Khibiny and Lovozero Tundras) and in the northwest of the Republic of Karelia along the Finnish border (the northwest montane Karelian district extends across a part of Murmansk Region, where the combination of numerous rocky gorges and forest creates an unique landscape). In the rest of the study area, mountain slopes and rock-walled canyons are almost absent. Extensive areas of steep cliffs are situated in the skerries and archipelagoes along the northern shores of lakes Ladoga and Onega, and along the shores of the White and Barents Seas (Fig. 3.38).

The following existing and planned protected areas are considered the most important to preserve these objects:

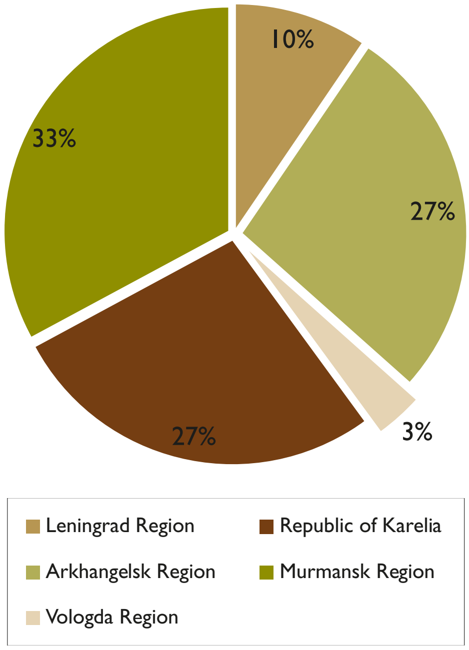


Fig. 3.37. Mapped areas of gorges, rocky walls, deeply incised river valleys, canyons, ravines, cliffs as percentages of total areas of such features, by region.

Murmansk Region: zakazniks Kutsa and Kolvitsa protect gorges Pyhäkuru and Botanicheskoye, unique in the species composition and species richness of their vegetation; the planned National Park Khibiny, which is intended to cover the entire natural complexes of the Khibiny and Lovozero Tundras mountain massifs.

Republic of Karelia: Paanajärvi National Park, which includes much of the unique forest landscape in northwest montane Karelia and the planned zakaznik Pyaozero, which will include the remainder and will connect National Park Paanajärvi with zakaznik Kutsa in Murmansk Re-

A gorge on the Ivanovsky Peninsula in the Barents Sea. Nature monument Ivanovskaya Bay, Murmansk Region. Photo: Gennady Aleksandrov.

Rocky wall of Mt. Kuyvchorr in the Lovozero Tundras mountain massif, a habitat for many rare plant species. Zakaznik Seydyaur, Murmansk Region. Photo: Konstantin Kobyakov.

gion. Planned national park Ladoga Skerries and planned protected areas in Zaonezhye Peninsula will be established to preserve the natural complex of the northern archipelagoes in lakes Ladoga and Onega.

Arkhangelsk Region: Pinega Strict Nature Reserve and its buffer zone.

Leningrad and **Vologda Regions:** although there are several places with gorges, rocky walls, deeply incised river valleys, ravines and cliffs, including those selected and mapped in this study, there are unfortunately no large protected areas, either existing or planned, where large parts of these objects would have protection.

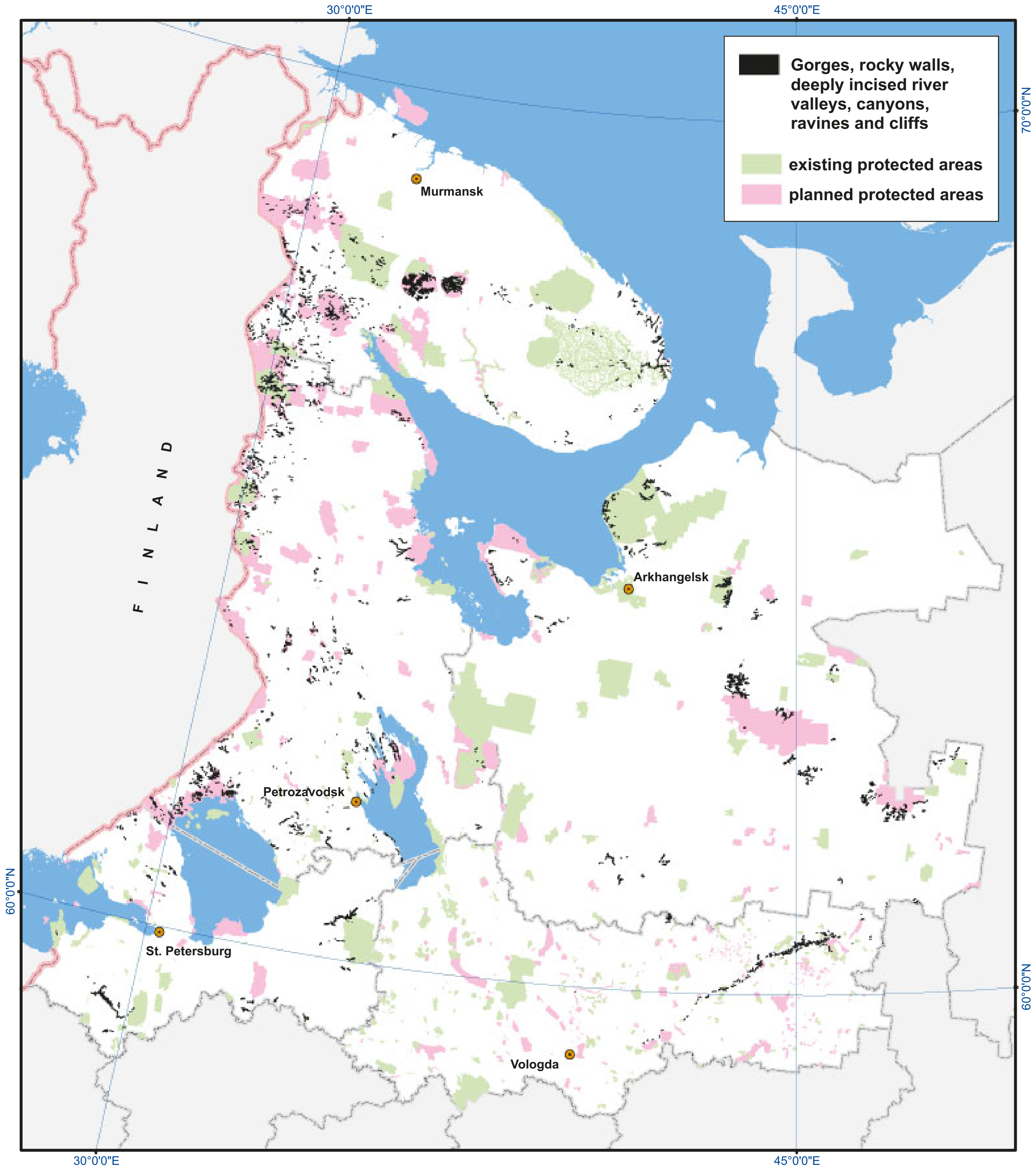


Fig. 3.38. Gorges, rocky walls, deeply incised river valleys, canyons, ravines, and cliffs selected in this study.

3.3.10. Intact riversides, flood plain complexes, valleys of minor rivers, seasonal streams and other natural biotopes at the mouths of rivers

These kinds of HCV area often occur in the same territories and are quite similar in their ecological role in terms of maintaining high species diversity. The methods used in this study do not allow distinguishing them from each other, so in this section they are considered together.

The total area of the valleys of small rivers and streams, flood plain complexes, temporary streams and other natural biotopes at the mouths of rivers selected and mapped in this study is 54,600 km2, or 6.4% of the entire study area.

The largest acreage of these objects (36,500 km^2, or 11.8% of the area of the region) was selected in Arkhangelsk Region (Fig. 3.40). Vologda Region is in second place (9,200 km^2 or 6.3% of its area). More western parts of the study area are characterized by smaller values, with the smallest ones (2,600 km^2 or 1.5%) in the Republic of Karelia, due to peculiarities of its relief and geological structure. For the territory of St. Petersburg, which is crossed by the large Neva River and its numerous tributaries, only 898 ha of river valleys were selected. This relatively small value is associated with high anthropogenic transformation of the valley and delta of the Neva. Sites which can be considered intact are preserved here as very small patches.

Fig. 3.39 indicates the shares of the protected areas of these objects by region. The best situation is in Murmansk Region where 22.2% of all areas of river valleys, etc. are included in existing protected areas, and the creation of planned protected areas will bring this share to 36%. The lowest rates are in

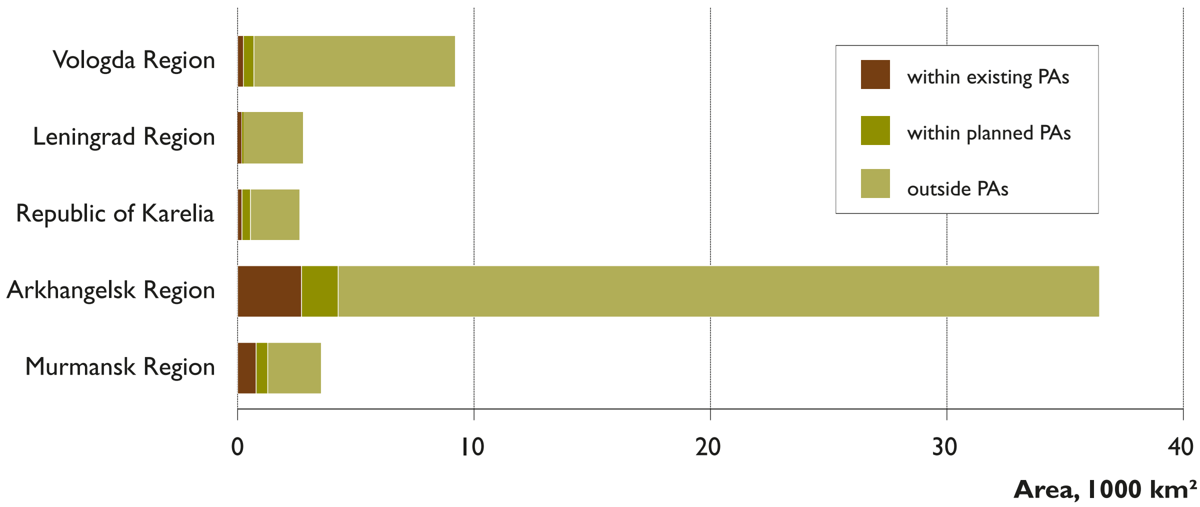


Fig. 3.39. Intact riversides, flood plain complexes and other natural biotopes at the mouths of rivers, in existing protected areas (PAs), planned protected areas and outside protected areas. (St. Petersburg excluded).

Floodplain meadows in the valley of the Northern Dvina River. Arkhangelsk Region. Photo: Elena Churakova.

Valley of the Chapoma River. Murmansk Region. Photo: Gennady Aleksandrov.

Vologda (2.7%) and Leningrad (5.8%) Regions. The establishment of all planned protected areas would raise the percentages to 7.5% in both regions. The rather extensive protected areas of these objects are explained by the fact that protected areas are often designed and created along river valleys and include all associated biotopes as parts of the natural complex.

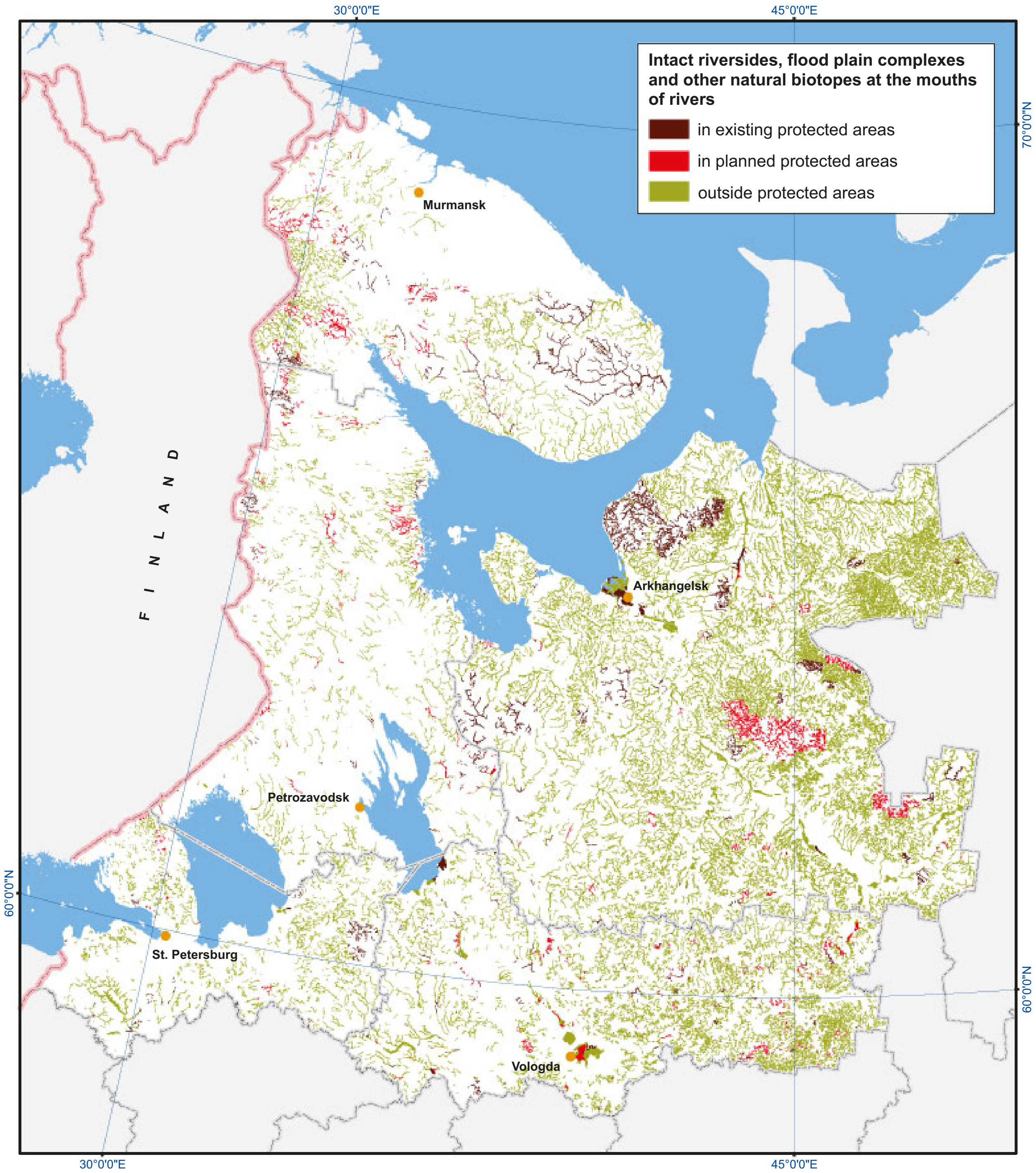


Fig. 3.40. Intact riversides, flood plain complexes, valleys of minor rivers, seasonal streams and other natural biotopes at the mouths of rivers, in existing protected areas, planned protected areas and outside protected areas, by region.

3.3.11. Estuaries and river deltas

The estuaries of the rivers Kuloi and Mezen in Arkhangelsk Region are the largest in the study area (Fig. 3.41). They are still in a natural state. However, currently they have no conservation status, and it is not intended to include them in the planned protected areas, either. Among protected estuaries, the largest is that of the Ponoi River in Murmansk Region, which is included in the Ponoi fishery zakaznik. The delta of the Northern Dvina in Arkhangelsk Region is the largest in the study area. Most of its natural parts are situated within the borders of the regional zakaznik Belomorsky. The delta of the Neva, which is the second largest, has not been selected and mapped because it is situated in a built-up area of the City of St. Petersburg and can not be considered natural territory.

Fig. 3.41. Estuaries and river deltas in existing protected areas, planned protected areas and outside protected areas.

3.3.12. Stratified lakes

We have mapped Lake Mogilnoye, the only stratified lake in Murmansk Region which has the chemical type of water stratification consisting of layers containing different concentrations of dissolved salts. The total area of this relatively small lake is 9.6 ha. It has conservation status as a nature monument of federal level. This nature monument, however, has no clear protection regime, so there is urgent need either to develop its protection regime or to incorporate Lake Mogilnoye in another protected area with an adequate regime.

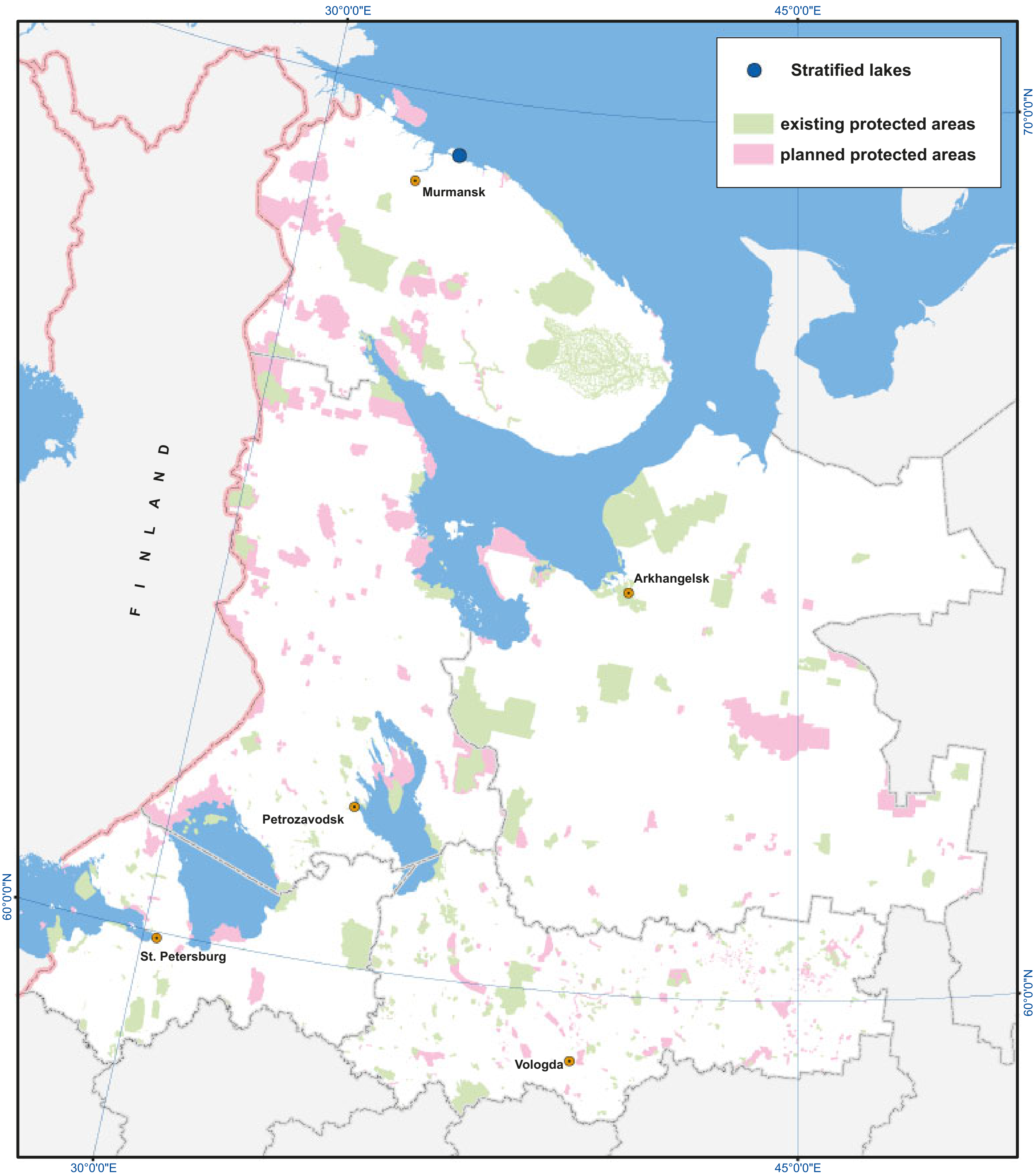


Fig. 3.42. Stratified lakes in existing and planned protected areas.

3.3.13. Salmon spawning sites

As mentioned in 2.3.22, the information on which the spawning rivers were selected was substantially eclectic and not comparable between administrative regions. In Murmansk, Vologda and Leningrad Regions we used the results of field work and all literature data of which we were aware. In Arkhangelsk Region and the Republic of Karelia, field research has not been carried out so we were restricted to the data given in the list of salmon spawning rivers (Section 74.2 of the Rules of fishing for northern fishery basin, approved by Order of the Ministry of Agriculture of the Russian Federation № 245 of April 28, 2007).

Since this list is not given in a scientific article, it can not be used as a reliable source of information, especially about the Atlantic salmon spawning grounds. The objectives of this study were restricted to the mapping of spawning salmon rivers as one of the types of HCV area and clarification of their protection status; thus questions regarding the state of salmon populations are not considered here. In Arkhangelsk Region the list may include not only rivers which really contain spawning sites of various forms of the Atlantic salmon and brown trout, but also rivers known as habitats of other species of the salmon fishes, e.g. pink salmon (*Oncorhynchus gorbuscha*), Arctic charr (*Salvelinus alpinus)*, and brook trout (*S. fontinalis)*. In the Republic of Karelia several rivers, known to be spawning sites of the Atlantic salmon and brown trout, are missing from the list. In this regard, the information on salmon spawning sites indicated in the maps of Arkhangelsk Region and the Republic of Karelia show only approximal data. Below we describe the results of mapping of the spawning sites of the threatened species of salmonid fishes only for Murmansk, Leningrad and Vologda Regions, for which we possess more reliable data.

Generally, Murmansk Region has the largest number and length of spawning salmon rivers and is characterized with the best situation in their protection in the studied area (Fig. 3.43). Here we observed the highest number of spawning stocks of the Atlantic salmon and the highest numbers of spawning individuals (Martynov 2007). Two major spawning rivers – the Varzuga and the Ponoi with their major tributaries – are fully protected in the regional fishery zakazniks Varzuga and Ponoi. Much of the River Yokanga and its tributaries are also included in the federal zakaznik Murmansk Tundra. In total, 39.1% of the total length of the spawning areas of the rivers in Murmansk Region is protected. The creation of the planned protected areas will increase this figure to 42.3%.

It should be said that the establishment of protected areas focused on the spawning rivers is not the only method to protect salmon fishes. There are many other ways to stop direct removal of fish from their habitats provided by the legislation on protection of animals. An example of this can be found in several rivers, where all fishing is prohibited within particular spawning sites. However, salmonids are extremely sensitive to the state of their environment and particularly of their spawning grounds. Therefore, to ensure the maintenance of viable populations, habitats need protection in addition to species. In other words, not only the spawning sites in the rivers but whole rivers, including growing areas and also significant parts of their basins, must be protected from human impact. From this point of view, in Murmansk Region the highest priority should be given to the establishment of the Nature Park Kano-Umba, as well as to the continuation of work on the conservation status of the lower reaches of the River Umba.

In Vologda Region we selected three salmon spawning rivers: the Andoma, Meghra and Samyna. The lower reaches of the Andoma and Samyna are situated within the protected Krestetskoe mire. None of the planned protected areas will include any part of these rivers.

In Leningrad Region, the overall percentage of protected salmon spawning rivers (9.2% of their total length) is also small. The largest protected areas are situated in the Veps Forest Nature Park and in several zakazniks within it. The creation of the planned protected areas will improve this situation only very little.

A spawning salmon. Sosnovka River, Murmansk Region. Photo: Konstantin Kobyakov.

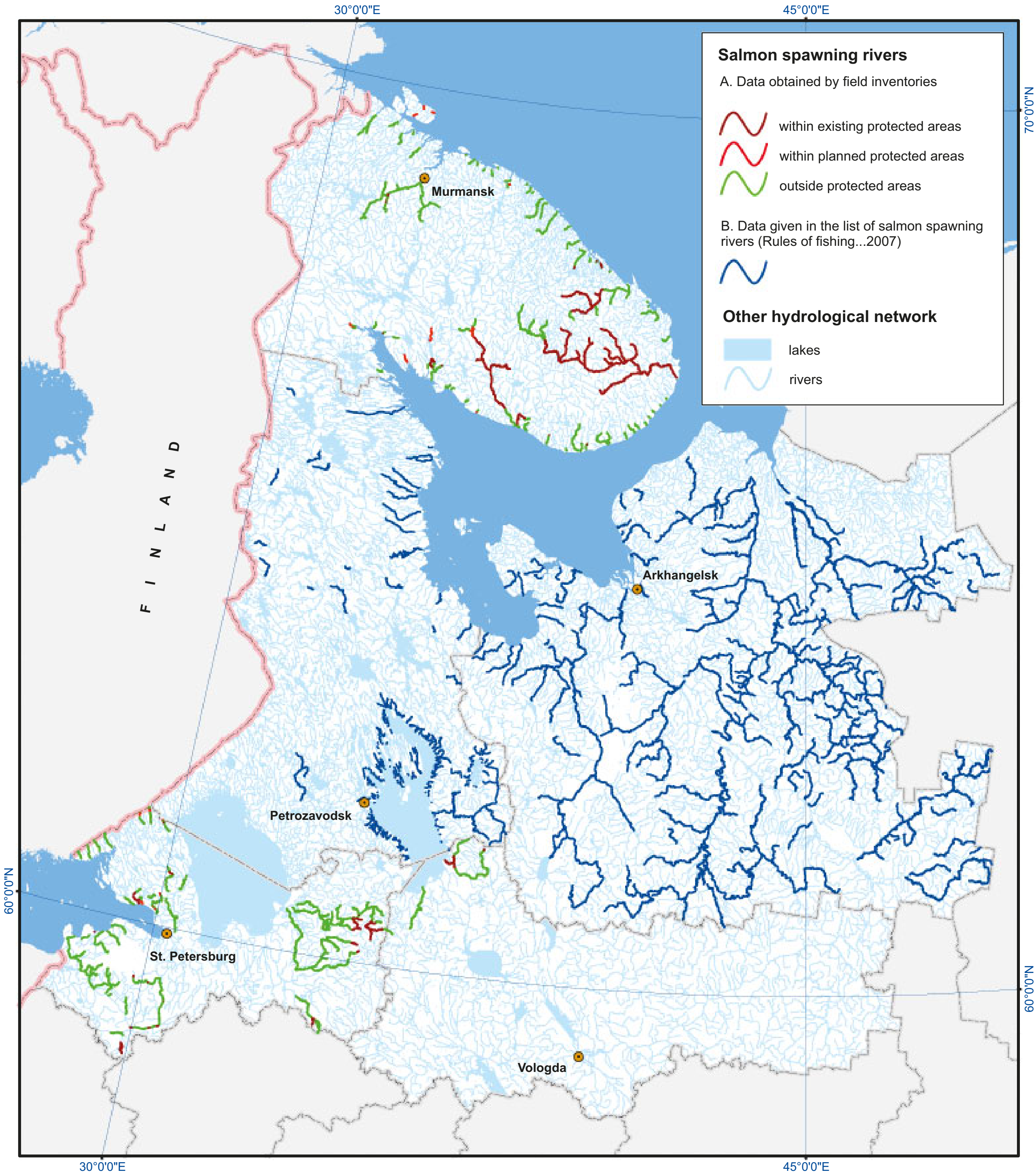


Fig. 3.43. Salmon spawning rivers in existing protected areas, planned protected areas and outside protected areas (confirmed data only).

3.3.14. Bird colonies on sea coasts

Bird colonies have been selected and mapped only in Murmansk Region (Fig. 3.44). A total of 18 bird colonies are located primarily along the coast of the Barents Sea. Of course, immediate measures should be taken to protect such unique and valuable but very vulnerable natural objects. Optimally, all of them should have the protection status that can be achieved by including them in protected areas.

Currently, only 12 of these colonies are protected,10 in the Kandalaksha Strict Nature Reserve and 2 others in the nature monuments Ivanovskaya Bay and Sea Bird Colonies in Dvorovaya Bay. The establishment of the planned nature park Rybachy Peninsula will include 2 bird colonies more, including the famous Gorodets sea bird colony, which is considered the largest in Murmansk Region. The four remaining colonies should be the targets of further efforts to plan and create new protected areas.

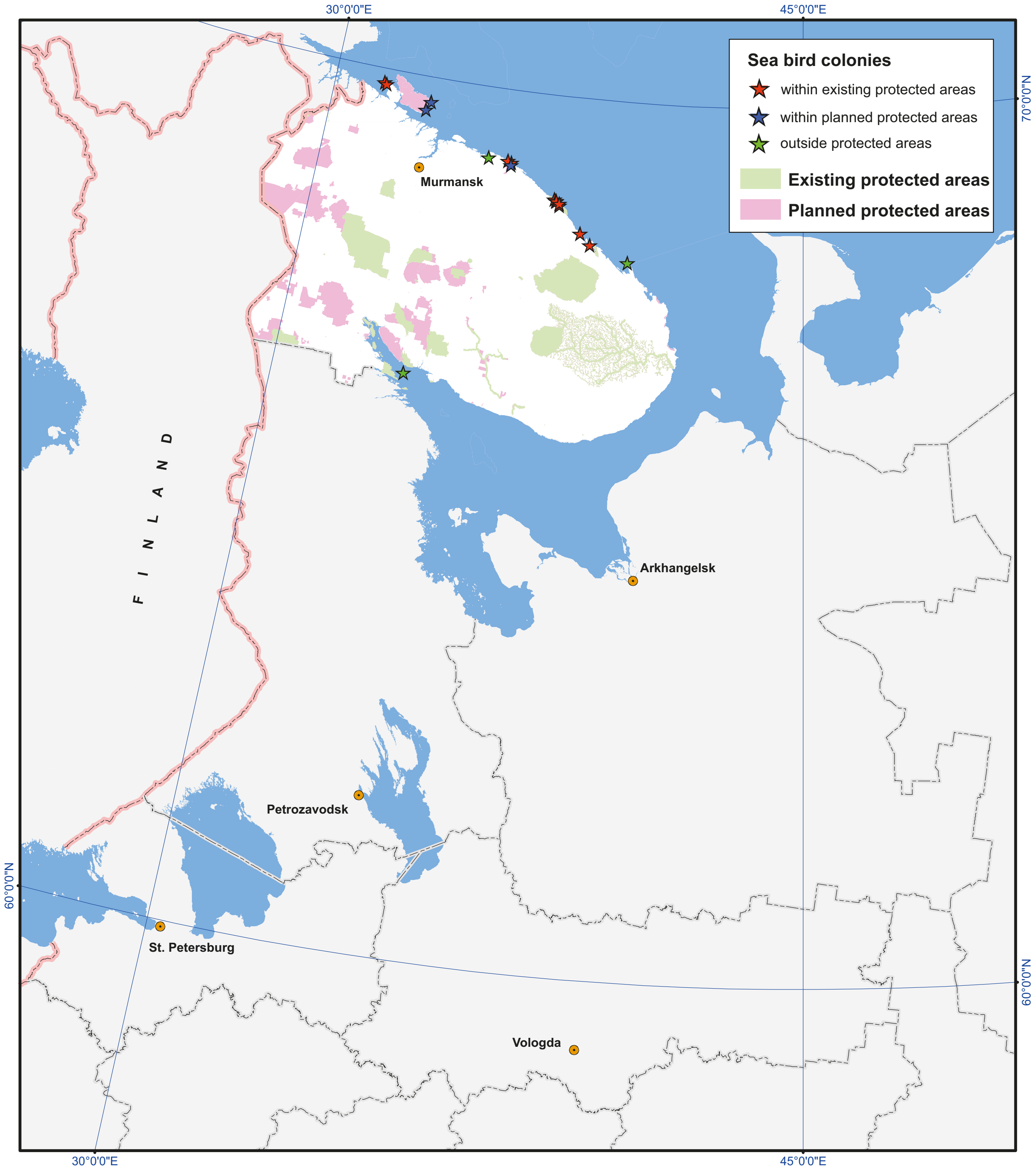


Fig. 3.44. Bird colonies on sea coasts.


Sea bird colonies in Murmansk Region. Photo: Ryurik Chemyakin (left) and Sergey Dylyuk (right).

3.3.15. Important Bird Areas

The total area of important bird areas of Russia (IBARs) in the study area is 54,000 km². Of this total, 43,400 km² is land, comprising 5.1% of the entire territory of the study area, and 10,600 km² is sea. Distribution of the selected IBARs and their areas as percentages of the entire area of administrative region are shown in Fig. 3.44 and 3.45.

Evidently, the acreage of IBARs within and without existing and planned protected areas may not reflect the reality of their security. For some of the IBARs, deterioration of even a small part of their territories could lead to the complete loss of the significance of the entire IBAR. For instance, the building of industrial infrastructures or a large road even near an IBAR could make the birds leave this place due to disturbance factors. However, to follow the rule to indicate a protected share for every type of HCV, we will use some values of the area sizes below.

In Murmansk Region the share of the area of the IBARs which are included in existing protected areas is 43.4%, the largest proportion of protected IBARs in the whole study area. This is mainly due to the extensive area of Lapland Strict Nature Reserve being considered as an IBAR. A large part of IBAR Ponoi Kotlovina is protected in the zoological zakaznik Ponoi. The most valuable parts of the IBAR Kandalaksha Gulf, as well as three other IBARs (Ainy archipelago, Seven Islands archipelago and Gavrilov archipelago), are included in the Kandalaksha Strict Nature Reserve.

Almost no increment in the area of protected IBARs is expected after the establishment of planned

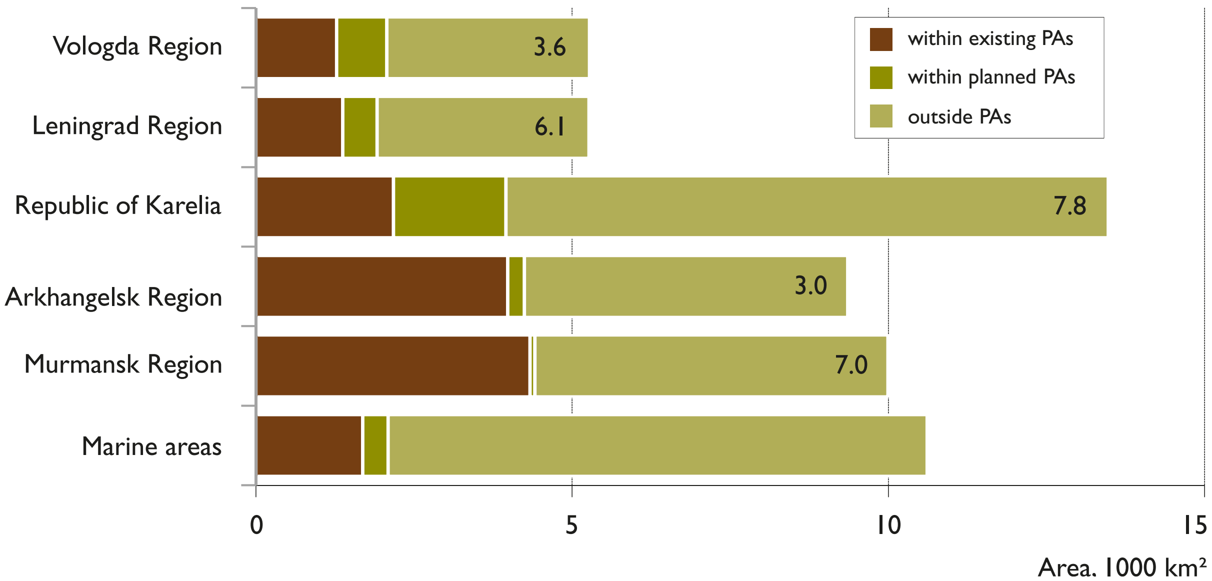


Fig. 3.45. Important Bird Areas in existing protected areas (PAs), planned protected areas and outside protected areas, and their share (%) of the total area of the region (St. Petersburg excluded).

protected areas. This is due to the fact that IBARs situated along the Barents and White Sea shores in the eastern part of Murmansk Region, namely the IBAR between the mouths of the rivers Strelna and Varzuga, the IBAR on the Tersky coast, and the IBAR on the east coast of Murman, are at the moment not under threat due to their remote location, and therefore are not in need of urgent measures for their protection. The only non-protected IBAR in the surroundings of Lake Kieshyaur is situated in the more populated and developed western part of Murmansk Region; the establishment of the regional nature monument, Mires near Lake Alla Akkajärvi, is planned for its protection.

In Arkhangelsk Region, similarly, there are two IBARs which are fully or for the most part included in the well-protected Strict Nature Reserve Pinega and the National Parks Vodlozero and Kenozero. For the currently unprotected part of the IBAR which is partly included in Kenozero National Park, the establishment of the regional nature monument Leksh-moss is planned. The latter will bring the proportion of IBARs included in protected areas to 87%. Protection of the other IBARs in the territory of Arkhangelsk Region and adjacent marine areas is insufficient. Although all of them have protected parts in adjacent existing protected areas, the areas of these protected parts

Table 3.1. Names of selected and mapped IBARs and their codes indicated in Fig. 3.46.

Arkhangelsk Region		**Leningrad Region**	
AR-001	Kargopol Dry Land – a land of cranes	LE-001	Lebyazhye
AR-003	Solovets Islands and Zhizhginsky Island	LE-002	Kurgalsky Peninsula
AR-004	Northern Dvina delta	LE-003	Berezovye Islands
AR-006	Lacha Lake	LE-004	Lower reaches of the Swir River
AR-007	Kenozerye	LE-005	Upper Luga River
AR-008	Pinega Strict Nature Reserve	LE-006	Rakovye Lakes
AR-010	Unskaya Bay	LE-007	Koporskaya Bay
AR-011	The Kuloi and its floodplain	LE-008	Southern Ladoga Shore
AR-013	Pinega navolok	LE-009	Seskar Island
Vologda Region		LE-010	Narva Reservoir
VO-001	Sondugsky landscape reserve and its environs	LE-012	Iwinsky razliv (the upper Swir reservoir)
VO-003	Sheksna Reservoir	LE-013	Vyalye Lake and adjacent mires
VO-004	Druzhinnoye Lake and its environs	LE-015	Archipelagos Dolgyi Reef and Bolshoi Fiskar
VO-006	Vozha Lake and Charondsk mires	LE-016	Petrokrepost Bay
VO-007	West coast of Beloye Lake	LE-017	Mouth of the Burnaya
VO-008	IBAR on the shores of the Rybinsk Reservoir	LE-018	Zelentsy Islands
Republic of Karelia		LE-019	Vyborg Bay
KA-001	Valaam archipelago	LE-020	Great Snipe Lekking on Korodynk Creek
KA-002	Kivach Strict Nature Reserve	**Murmansk Region**	
KA-003	Onega Bay of the White Sea	MU-001	Seven Islands archipelago
KA-004	Zaonezhye	MU-002	Lapland biosphere Strict Nature Reserve
KA-005	Olonets plain	MU-003	Ponoi Kotlovina
KA-006	Coast and islands of Lake Ladoga to the south of the River Olonka	MU-004	Ainy Islands archipelago
KA-007	Vodlozero	MU-005	Gavrilov archipelago
KA-009	Lakes of North Karelia	MU-006	Kieshyaur Lake
KA-010	Kilpola Island and adjacent waters	MU-007	Kandalaksha Gulf
St. Petersburg		MU-008	IBAR on the east coast of Murman
SPb-001	IBAR on the southern coast of Neva Bay in the Baltic Sea	MU-009	IBAR between the mouths of the rivers Strelna and Varzuga
SPb-002	Northwestern Suburbs of St. Petersburg	MU-012	IBAR on the Tersky coast
SPb-003	Sestroretsky razliv		

are too small to provide sufficient protection for the entire IBAR. Among them there are six important IBARs: Unskaya Bay, the Northern Dvina delta, the Kuloi and its floodplain, Kargopol Dry Land – a land of cranes, and Lake Lacha. On average from 9.0% to 37.6% of their area is currently protected and the establishment of planned protected areas will not increase these figures. Two IBARs, the Solovets Islands and Zhizhginsky Island, are not protected at present, and the establishment of new protected areas is not planned there.

The relatively low overall proportion of protected IBARs in the Republic of Karelia is due to the fact that the largest IBAR, Lakes of North Karelia, is situated outside any existing protected area. The establishment of the planned regional zakaznik Old Lakes, which is intended to include 3.3% of the area of this large IBAR, will definitely not solve the problem. There are only three fully protected IBARs in the Republic of Karelia: Kivach Strict Nature Reserve, Vodlozero National Park and the Nature Park Valaam archipelago. If plans for the creation of the zakaznik Yangozero and buffer zone of the Vodlozero National Park are carried out, the IBAR on the shores of Lake Vodlozero will be protected almost completely. Another major IBAR, Zaonezhye, is partly protected in the federal zakaznik Kizhi (13.5% of the whole Zaonezhye IBAR area). In addition, in the territory of the Zaonezhye IBAR there are 12 more regional zakazniks and nature monuments, but they occupy altogether only 0.7% of its area. Establishment of the planned nature park Zaonezhye will bring the protected share of this IBAR to 47.2%, which is still insufficient for its complete protection. Two smaller IBARs, the Olonets Plain, and the Coast and Islands of Lake Ladoga to the south of the mouth of the River Olonka, are practically unprotected because only minor parts are included in the adjacent Nizhneswirsky Strict Nature Reserve, nor will any new parts be incorporated in the planned protected areas there. IBAR Kilpola Island with adjoining water areas, which is located partly in Leningrad Region, is not protected at present, but is included in the planned national park Ladoga Skerries.

In Leningrad Region, 5 IBARs on the shores of the Baltic Sea and adjacent archipelagoes are fully protected. The IBARs Berezovye Islands, Rakovye Lakes, Kurgalsky Peninsula, and Lebyazhy are entirely included in the complex regional zakazniks Berezovye Islands, Rakovye Lakes, Kurgalsky, and Lebyazhy, respectively. The IBAR Vyalye Lake is included in the federal zakaznik Mshinskoye mire and regional zakaznik North Mshinskoye mire.

Peregrine falcon (Falco peregrinus) chicks in their nest on the rock ledge. IBAR Ponoi Kotlovina. Zoological zakaznik Ponoi, Murmansk Region. Photo: Ryurik Chemyakin.

Puffin (*Fratercula arctica*) colony. IBAR Ainy Islands, Barents Sea archipelago. Kandalaksha Strict Nature Reserve, Murmansk Region. Photo: Ryurik Chemyakin.

IBAR Northern Dvina Delta. Regional zakaznik Belomorsky, Arkhangelsk Region. Photo: Aleksey Fedorov.

A significant part (64%) of the total area of the IBARs in the lower reaches of the Swir River is included in the Nizhneswirsky Strict Nature Reserve. The IBARs Narva Reservoir, Iwinsky razliv, Mouth of the River Burnaya, Petrokrepost Bay, Great Snipe Lekking on Korodynk Creek, and Upper Luga River (most of the latter being located in the adjacent Novgorod Region) are not protected at all, and are not intended to be protected in the planned protected areas. Nor are the IBARs Koporskaya Bay and Vyborg Bay, of which only minor parts are currently protected, intended to be included in the planned protected areas. Finally, 43% of IBAR Southern Ladoga Shore will be protected in the case of the establishment of the zakaznik Southern Ladoga Shore, and 60.6% of the area of IBAR Seskar Island in the Baltic's Gulf of Finland will be protected in planned Ingermanlandsky Strict Nature Reserve.

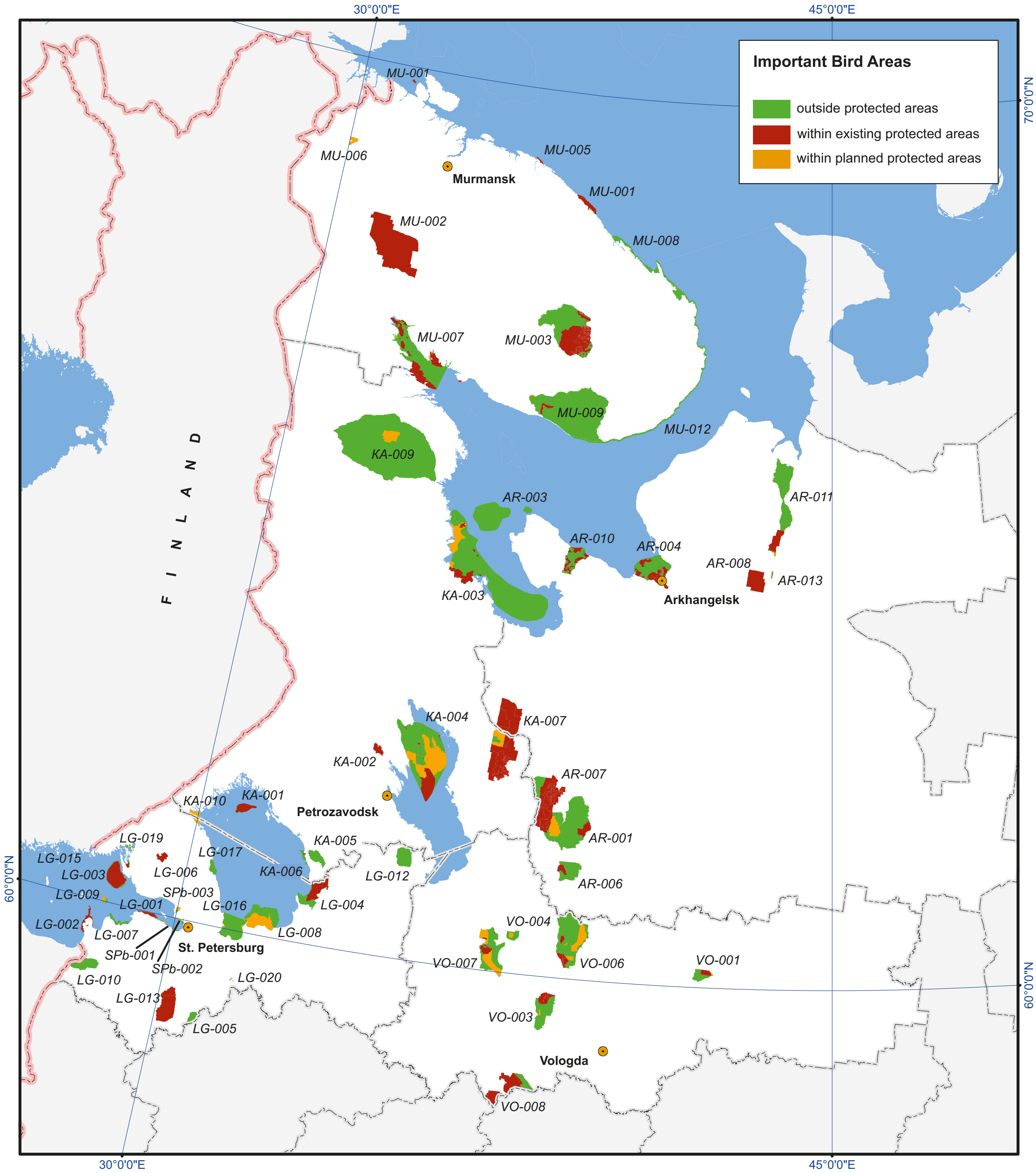


Fig. 3.46. Important Bird Areas (IBARs) in existing protected areas, planned protected areas and outside protected areas. Codes of IBARs are given in Table 3.1.

In St. Petersburg and the adjacent area of the Gulf of Finland only one IBAR, called Northwestern Suburbs of St. Petersburg, is partially protected, with parts of it included in two regional zakazniks, Yuntolovsky and North Coast of Neva Bay. However, the proportion of these protected parts (altogether, 17.1% of the whole area of the sea bird colony) is clearly insufficient. The planned expansion of the zakaznik North Coast of Neva Bay will bring the share of this IBAR included in protected areas up to 31%. Another important IBAR situated on the southern coast of Neva Bay is still unprotected but, if plans for the regional zakaznik South Coast of Neva Bay are fully implemented, 17.9% of this IBAR will be given protection. A third IBAR, Sestroretsky razliv, is also currently unprotected. However, it is intended to include a significant part of its area in the planned regional zakaznik Sestroretsky.

In Vologda Region, the biggest IBAR is situated on the shores of the Rybinsk Reservoir, with 29.1% of its area included in the Darwin Strict Nature Reserve and its buffer zone. However, the bulk of this IBAR is located in the adjacent Yaroslavl Region, where it is not protected. The areas of other large IBARs - West Coast of Beloye Lake, Vozha Lake and Charondsk mires, Sheksna Reservoir, Sondugsky landscape reserve and its environs, currently have protection varying from 9.3% - 29.8% of their areas. One large IBAR, Druzhinnoye Lake and its environs, is not protected at all. For all listed IBARs, some increase of their protected area is expected after the establishment of the planned protected areas. In this case, the most significant increase (up to 43.7%) is expected for the IBAR West Coast of Beloye Lake.

3.3.16. Habitats of species included in Red Data Book of Russian Federation

The basis for protection of rare species in the Russian Federation is established by the Federal Law on Environmental Protection on 10.01.2002 (Federal Law…2002). According to the Regulation of the order of the Red Book of the Russian Federation (№ 419, 03.10.1997), and regional legislation concerning Red Books, the Red Data Book of the Russian Federation and regional Red Data Books are the main tools for ensuring the protection of rare species, in accordance with the law.

However, the regulation for the federal Red Book, as well as those for regional Red Data books, does not provide a real mechanism for the protection of species, because habitats and habitat types for red-listed species are not exactly identified. The lack of clear definitions of habitats seems to be a consequence of the qualifications of the officers responsible for the conservation of rare and threatened species. As a result, the Red Data Books themselves, both federal and regional, do not provide exact information on the measures needed for conservation of each species.

There are, however, some exceptions. For instance, in Murmansk Region, regional regulations of the order of the Red Data Book provide legal protection measures for any identified habitat of red-listed species (e.g. prohibit logging, mining, construction, hunting, fishing, etc.) without the need to establish any kind of protected area there. Some tools for conservation of habitats of rare and threatened species could be found in forestry legislation and in various regional documents of spatial planning. However, in most regions of northwest Russia the practice of preserving habitats of rare species outside protected areas is not adopted.

Consequently, the establishment of new protected areas or expansion of existing protected areas in areas of high conservational value, which usually incorporate habitats of rare and threatened species, is the main tool in the conservation of these species. Therefore, in this study we analyze the protection status of the selected habitats of the species included in the Red Data Book of the Russian Federation only with regard to their inclusion in existing protected areas, and their expected inclusion in planned protected areas. Other tools of protecting rate and threatened species are not discussed.

The reader must take into account that the analysis below is based on limited data obtained during the Gap analysis project and therefore does not include all known records of the species listed in the Red Book of the Russian Federation. The list of records presented below is incomplete and different regions have been studied unevenly. We just try to show how the habitats of these species of which the authors are aware are provided protection at present, and are there any expected measures for their future protection. According to current Russian legislation, every habitat of a species which is included in the federal Red Data Book must be excluded from economic use, regardless of the study level of the territory.

In total, we selected and mapped 3,437 locations of red-listed species, i.e. species that are included in the lists of species of flora (vascular plants, mosses, lichens and fungi) and fauna (animals: vertebrates

Table 3.2. Numbers of selected records of fungus, lichen, plant, and animal species included in the Red Data Book of the Russian Federation, by study area.

Taxonomic groups		**Number of species**					
		St. Petersburg	Leningrad Region	Vologda Region	Arkhangelsk Region	Murmansk Region	Republic of Karelia
Fungi		3	6	4	-	1	-
Lichens		1	77	30	17	77	105
Plants	Bryophytes	1	15	-	-	3	-
	Vascular plants	31	704	209	107	579	344
Animals	Mammals	1	34	1	-	10	-
	Birds	44	332	270	82	135	20
	Fishes	14	62	76	-	1	-
	Cyclostomata	2	2	-	-	-	-
	Molluscs	1	4	2	4	-	-
	Insects	11	54	38	7	-	-
TOTAL		25	1290	630	217	806	469

and invertebrates) approved by the Russian Ministry of Natural Resources (see 2.3.28 and 2.3.29). The numbers of red-listed species of different taxonomic groups selected are presented in Table 3.2. The most complete information on all groups was collected for Leningrad Region. Arkhangelsk Region, in comparison with all other parts of the study area, is poorly studied. The Republic of Karelia where leading specialists in plants, fungi and animals were not included in the research team, is insufficiently covered due to problems with collecting data (see 2.3.28 and 2.3.29), so the information obtained is considered not sufficiently representative for inclusion in the analysis.

In total, 911 habitats of species included in the Red Book of the Russian Federation on animals (Regulation…1997) and plants (Regulation…2005) were selected in 104 protected areas. Below we present their distribution only in the 18 protected areas in

Calypso orchid (*Calypso bulbosa*). Murmansk Region. Category 3 in Red Data Book of Russian Federation. Photo: Gennady Aleksandrov.

Ghost orchid *(Epipogium aphyllum)*. Murmansk Region. Category 2 in Red Data Book of Russian Federation. Photo: Gennady Aleksandrov.

Arkhangelsk, Leningrad, Murmansk and Vologda Regions (Fig. 3.48), in each of which not less than 15 habitats were found, and whose importance for the conservation of habitat of rare and threatened species in the study area is, in the light of the data available for us, very high.

These 18 protected areas incorporate 609 selected records of red-listed species or 66.9% of their entire number found in the existing protected areas. Among them, the biggest numbers of the locations of red-listed species of vascular plants were found in the complex zakazniks Berezovye Islands and Kotelsky, nature monument Dontso in Leningrad Region and in Kandalaksha Strict Nature Reserve in Murmansk Region. The biggest numbers of the locations of red-listed species of birds are selected in Darwin and Nizhneswirsky Strict Nature Reserves, National Parks Vodlozero and Russky Sever, and zakazniks Kurgalsky, Ponoi and Rakovye Lakes. Complex Nature Park Veps Forest in Leningrad Region maintains the greatest number of habitats of red-listed species of lichens among all existing protected areas in northwest Russia.

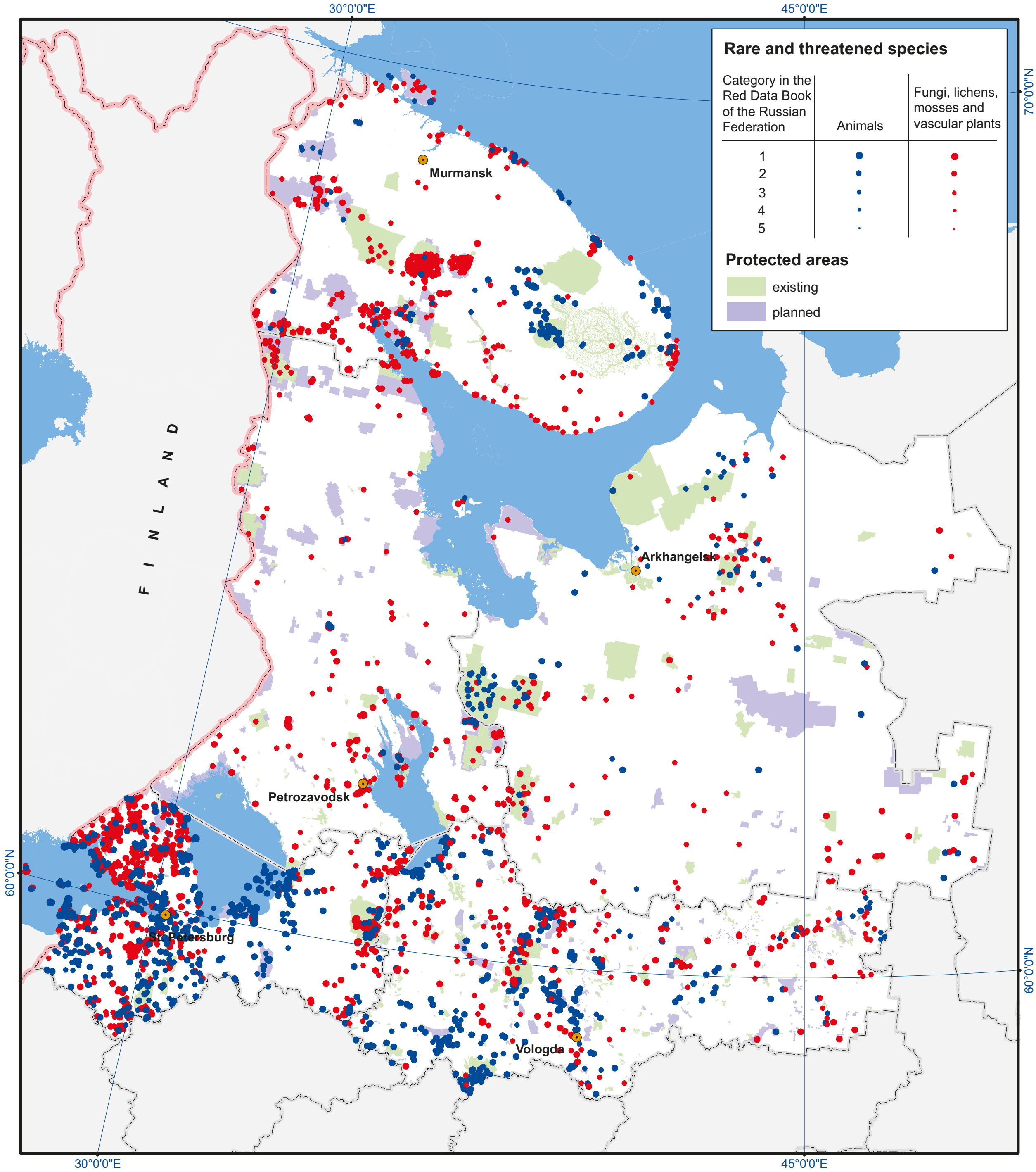


Fig. 3.47. Locations of red-listed species of plants, lichens, fungi and animals collected during this study.

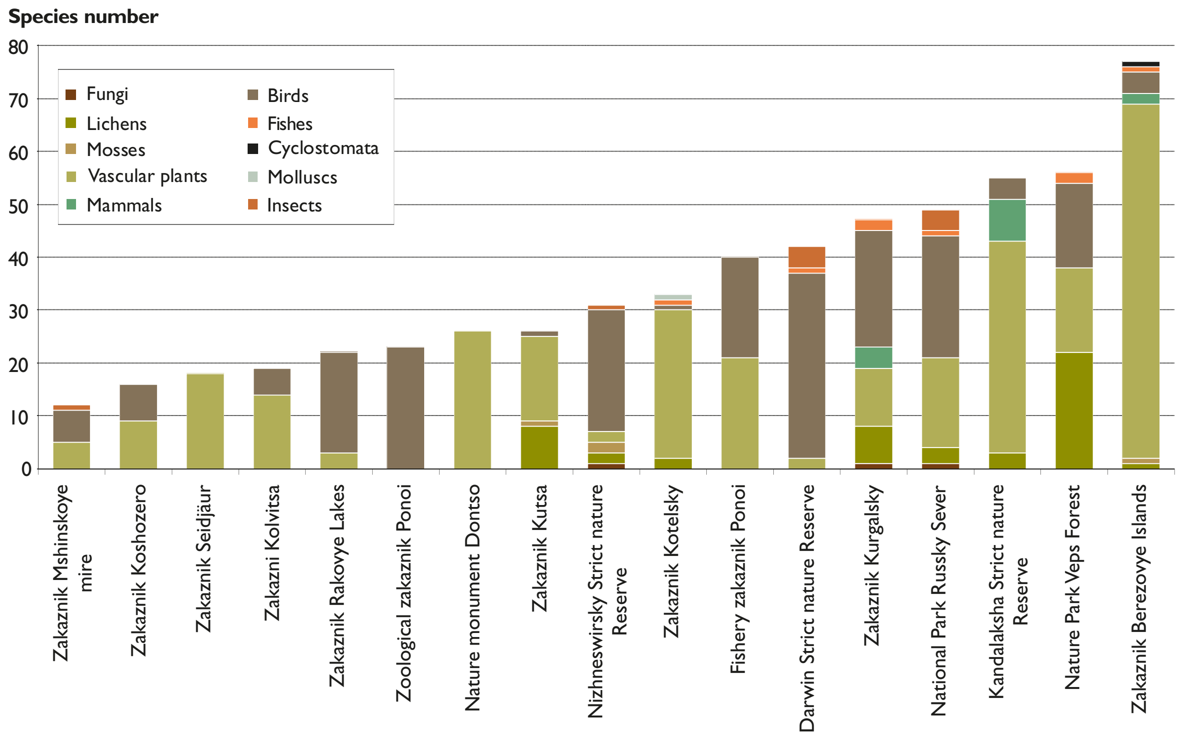


Fig. 3.48. Existing protected areas incorporating highest numbers of findings of red-listed species.

Besides existing protected areas, we selected locations of red-listed species also in the territories of planned protected areas. These territories are relatively poorly studied in comparison with existing protected areas, especially such famous ones as Veps Forest or strict nature reserves which have been the targets of biological research for decades. Therefore, the total numbers of red-listed species found in the planned protected areas are usually smaller. The only exception is the territory of the planned National Park Khibiny in Murmansk Region, which attracts researchers from Kola Research Center and other branches of the Russian Academy of Sciences owing to its exceptionally rich flora, including unique plant species.

To represent the most relevant areas for the conservation of habitat types of red-listed species, we selected 10 planned protected areas in Arkhangelsk, Leningrad, Murmansk and Vologda Regions which include at least 8 locations where red-listed species have been recorded during this study (Fig. 3.49). Together, they incorporate 323 of all 577 locations (56%) of red-listed species selected in the whole area of the planned protected areas. As expected, the highest numbers of locations of red-listed plant species were found in the planned National Park Khibiny. Two other planned protected areas in Murmansk Region, nature park Kutsa and zakaznik Lapland Forest, could also be important for the conservation of red-listed plants. The establishment of the zakaznik Southern Ladoga Shore in Leningrad Region seems very important for the protection of red-listed species of birds.

In total, 1488 locations of selected habitats of red-listed species are situated either in the territories of existing protected areas or planned protected areas. This constitutes only 43.3% of their total number selected and mapped in the study area. Definitely, protection of less than half of the known habitats even of the species listed in the Red Data Book of the Russian Federation, which have the highest protection status in the whole country, is not enough, and additional efforts are needed to ensure both their protection and that of the species included in regional Red Data Books.

In this publication, we are not able to list habitats selected for all species listed in the Red Data Book of the Russian Federation due to limitations of the volume of publication. However, we can list those species which have the highest category 1 (Endangered), i.e. taxa which have decreased to critical levels, with possible extinction in the near future. In the study area there are only a few taxa in this category: one species or subspecies each of mammals, cyclostomats and birds, two subspecies of fishes and nine species of vascular plants.

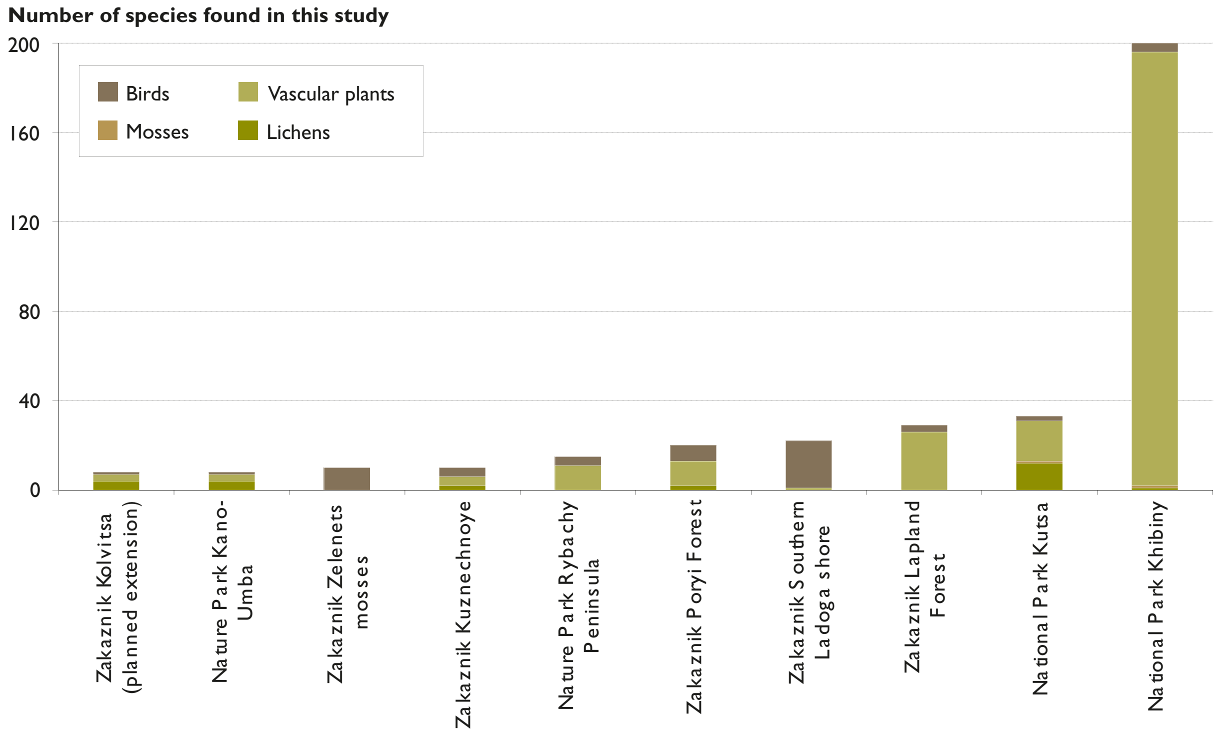


Fig. 3.49. Planned protected areas incorporating highest numbers of findings of red-listed species.

Mammals. The Baltic subspecies of the grey seal (*Halichoerus grypus* ssp. *macrorhynchus*). In total, 6 habitats of this subspecies were selected in the Gulf of Finland. One of them is included in the regional zakaznik Kurgalsky, and there is an intention to include two more locations in the planned Ingermanladsky Strict Nature Reserve. There are no plans to extend protection to the three other mapped locations in the immediate future.

Cyclostomata. The sea lamprey (*Petromyzon marinus*) is the only species in this category. Two habitat locations are known, both in the Gulf of Finland, one of them in the waters belonging to the regional zakaznik Berezovye Islands.

Birds. One taxon, the Baltic subspecies of dunlin (*Calidris alpina* ssp. *schinzi*), is in the endangered category. Four nesting locations are known in Leningrad Region, three of them protected in two regional zakazniks, Kurgalsky and Berezovye Islands.

Fishes. Habitats of two subspecies, the nelma (*Stenodus leucichthys nelma*) and the Kildin cod (*Gadus morhua kildinensis*), are selected. All known habitats of the Kildin cod are protected in the federal nature monument Lake Mogilnoye, Murmansk Region. For the nelma, seven habitats are selected, all in Vologda Region, in Lake Kubenskoye and adjacent rivers. None of them is protected, or intended to be protected in the near future.

Vascular plants. In Murmansk Region, all known habitats of two species, *Taraxacum leucoglossum* and *Helianthemum arcticum,* are situated on Turyi Cape, which is included in the Kandalaksha Strict Nature Reserve. In Vologda Region, the only known location of *Swertia perennis* is not protected nor is it intended to be included in planned protected areas. In the Republic of Karelia three known habitats of *Liparis loeselii* are also not included in the existing protected areas, nor will they be protected in planned protected areas. In Leningrad Region, we have selected and mapped locations of five endangered species. Of these, for *Liparis loeselii* three localities are known all situated in the very south of the region. Two of them are protected in the regional zakazniks Syabersky and Mshinskoye mire, while the third known location is included in the planned protected area Omchino Lake (Red Data Book… Leningrad Region 2000). For two aquatic species, *Alisma wahlenbergii* and *Caulinia tenuissima,* which inhabit shallow water and littorals of the Gulf of Finland and related water bodies, we selected about 40 locations. None of them is included in existing protected areas. Only one location of *Alisma wahlenbergii* found during this study will be

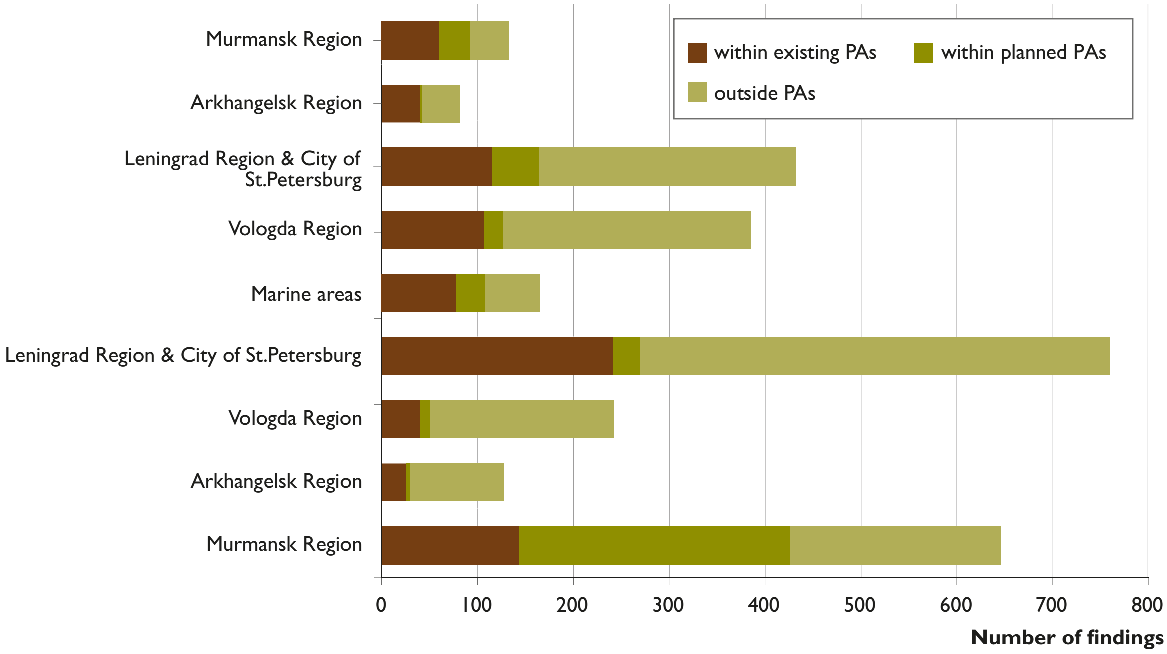


Fig. 3.50. Findings of red-listed species of animals (four upper bars) and plants (four lower bars) in existing protected areas (PAs), planned protected areas and outside protected areas, by region (Republic of Karelia excluded).

included in the planned regional zakaznik North Coast of Neva Bay. For *Swertia perennis* 5 locations are known, only one protected in the nature monument Dontso. Four known locations of *Pulsatilla vulgaris* are unprotected and not intended to be protected in the near future.

The following list shows the urgent need for protection of the species and subspecies which are in the greatest danger. Work on the establishment of new protected areas is not always enough to protect them. It is necessary to continue studies focused on discovering their habitats in every region, in order to make the network of planned protected areas more effective.

Grey seals on the Barents Sea coast. Murmansk Region. Photo: Ryurik Chemyakin.

3.4. Complex cartographic analysis of the representativeness of the protected area network and selection of sites for establishment of new nature reserves

3.4.1. Methodology of the analysis

One of the objectives of the Gap analysis project was to identify natural areas of high conservational value (HCV areas, HCVs) which are not already covered by the existing protected area network. In this section we try to summarize general and, we hope, clear results of this study in tables and charts. This generalization will inevitably make the results of the analysis too schematic, but at the same time, it makes the results more illustrative than a plain text. Our achievements may also have some methodological importance as a typical algorithm for studies of a similar kind (Korosov & Korosov 2006; Dobrynin & Stolpovsky 2008).

The project has produced extensive factual material which is, of course, not exhaustive, and many HCV areas in the studied territory have quite probably been omitted. The research coverage of all six administrative regions of the study area was uneven; some types of HCV areas were not selected in all the regions studied. For this reason, much important data could not be included in the overall analysis, since the data collection methods were not identical in different regions so consequently the results are not quite comparable. The information on the distribution of HCV areas in the City of St. Petersburg is not considered in this section at all because of the small size of the city area, which is not comparable with the areas of all other regions studied. Analysis at the regional level, where distribution of HCV areas and their protection in the existing and planned protected areas are calculated in each region separately, is more detailed, containing all the data obtained during the project.

The overall analysis presented in this section is intended to express the ratio of the areas of different types of HCVs, areas of protected areas, and areas of HCVs which are included in protected areas, as percentages of total areas of the studied regions. The following main characteristics were calculated by regions and then compared with each other:

1. Total area of protected areas as percentage of total area studied, by region (distribution of protected areas). The main results of this analysis have already been presented in section 3.1.1, and therefore these calculations are discussed here only briefly.
2. Total area of HCVs as percentage of total area studied, by region (distribution of HCVs).
3. Area of HCVs in protected areas as percentage of total area of HCVs by region (degree of conservation of HCVs in the region).
4. The share of the areas of protected areas which are occupied by HCVs (representativeness of protected areas).
5. The share of the areas of HCVs which are not included in protected areas (protected areas promising extensions).

For the analysis we used map layers (format ESRI ArcGis) of the HCVs, protected areas and administrative units, discussed in previous sections.

The processing of the cartographic materials and part of the calculations were carried out in a GIS ESRI ArcMap 9.3. environment. Some of the calculations were performed in Excel. Initially, all the maps have had a vector format. To perform the calculations, initial data were converted to raster format (GRID), which is a regular network of cells that cover the studied area, and provided with a base of the attributive data. We used a grid cell size of 100 m x 100 m (1 ha). This size provides sufficient accuracy of computations for regional analysis at a reasonable processing speed.

Below we list the types of HCV areas which were included in the analysis (Table 3.3). As already mentioned, we could not collect comparable data for all types of HCVs selected and mapped in this study and therefore exclude seven HCV types. Of these, five – i.e. sloping fens, coastal meadows, sea bird colonies, shallow water, littorals and inter-tidal sandy shoals, and stratified lakes – were not included in the analysis due to their absence in some of the regions, or to the lack of data (see Table 2.1). The other two, salmon spawning sites and habitats of red-listed species, were not included due to differences in the methods of their selection in different regions.

For all the types of HCV listed in Table 3.3., we include in the analysis only terrestrial areas, not water surfaces. HCVs situated in the territory of St. Petersburg were also excluded.

Table 3.3. List of HCV areas involved in the analysis, with abbreviations.

Types of HCV areas	Abbreviations
Intact forest landscapes	IFL
Intact forest tracts	IFT
Intact mire massifs	IMM
Aapa mires outside the aapa-province	AAPA
Spring fens	SPF
Forest tracts with high restoration potential	FHRP
Dry pine-dominated forests confined to sandy dunes, rocks, river valleys and shores of large lakes	DPF
Old-growth, minimally transformed coniferous forests dominated by spruce and fir, with nemoral plant species in ground vegetation	OSFN
Broadleaved forests and mixed coniferous-broadleaved forests	BLF
Old-growth larch-dominated forests	OLF
Alpine tundra areas in the forest zone	AlpT
Gorges, ravines, rocky canyons of rivers, cliffs and slopes	GORG
Natural floodplain ecosystems (valley complexes), valleys of small rivers and streams, temporary streams	VAL
Estuaries and deltas	ESDEL
Important bird areas of the Russian Federation	IBAR

Distribution of HCV areas in region/republic
Calculating the percentages of the areas occupied by HCVs in each administrative unit (i.e. region or republic) was carried out in several stages, using the Spatial Analyst module of ArcGis:

1. Creation of the raster level (grid) which contains the vector polygons of the distribution of different types of HCV areas in the administrative unit;

2. The grid of each type of HCV area was multiplied by the grid of administrative division (using a raster calculator);

3. The number of non-zero cells in the grid and the calculated results were entered into the grid database. This number is equal to the area (in hectares) of intersection of the HCVs and administrative units (i.e. the area of each type of HCV area in each region/republic);

4. The data on the areas occupied by HCVs were transferred from the database ArcGIS grid to the Excel spreadsheet for further calculations of the shares of the areas of each type of HCV area in each region/republic.

Degree of conservation of HCV areas in each region/republic
This value was calculated as a share of the area of HCVs included in existing protected areas of the total area of HCVs. Calculations were performed using the following algorithm. For each type of HCV area we built an individual layer which indicates the overlapping of territory of this type of HCV area and the territory of protected areas. Then we calculated the proportion of the overlapped area, firstly, of the total area of this type of HCV in the region/republic, and secondly, of the entire area of the region/republic.

The resulting percentages for each type of HCV area can not be averaged or summed, because many of them also overlap each other. For the evaluations of the summed area of all types of HCV, we made separate calculations using the mutual layer in which all HCV types were merged. Then we carried out the same calculations as for each type of HCV area.

Representativeness of the existing protected area network
We borrowed the term "representativeness" from mathematical statistics. Our intention was to ex-

press the congruence of the properties of the sample to the properties of the general data set. According to the Great Soviet Encyclopedy (1969-1978) the term representativeness means proximity of sample characteristics (composition, averages, etc.) to the corresponding characteristics of the whole population.

We considered the representativeness of the network of existing protected areas as a measure of the shares of HCV areas included in it. For the calculations, we used the above-mentioned values of the HCV area in the region/republic, and their shares included in existing protected areas. The resulting series of values of the proportion of protected parts of each type of HCV area by region/republic and in the entire study area allow estimation of the shares of every type of HCV area and comparison of how large their protected parts are in each region/republic. For this comparison we used the index of representativeness as a quotient of their protected and unprotected areas.

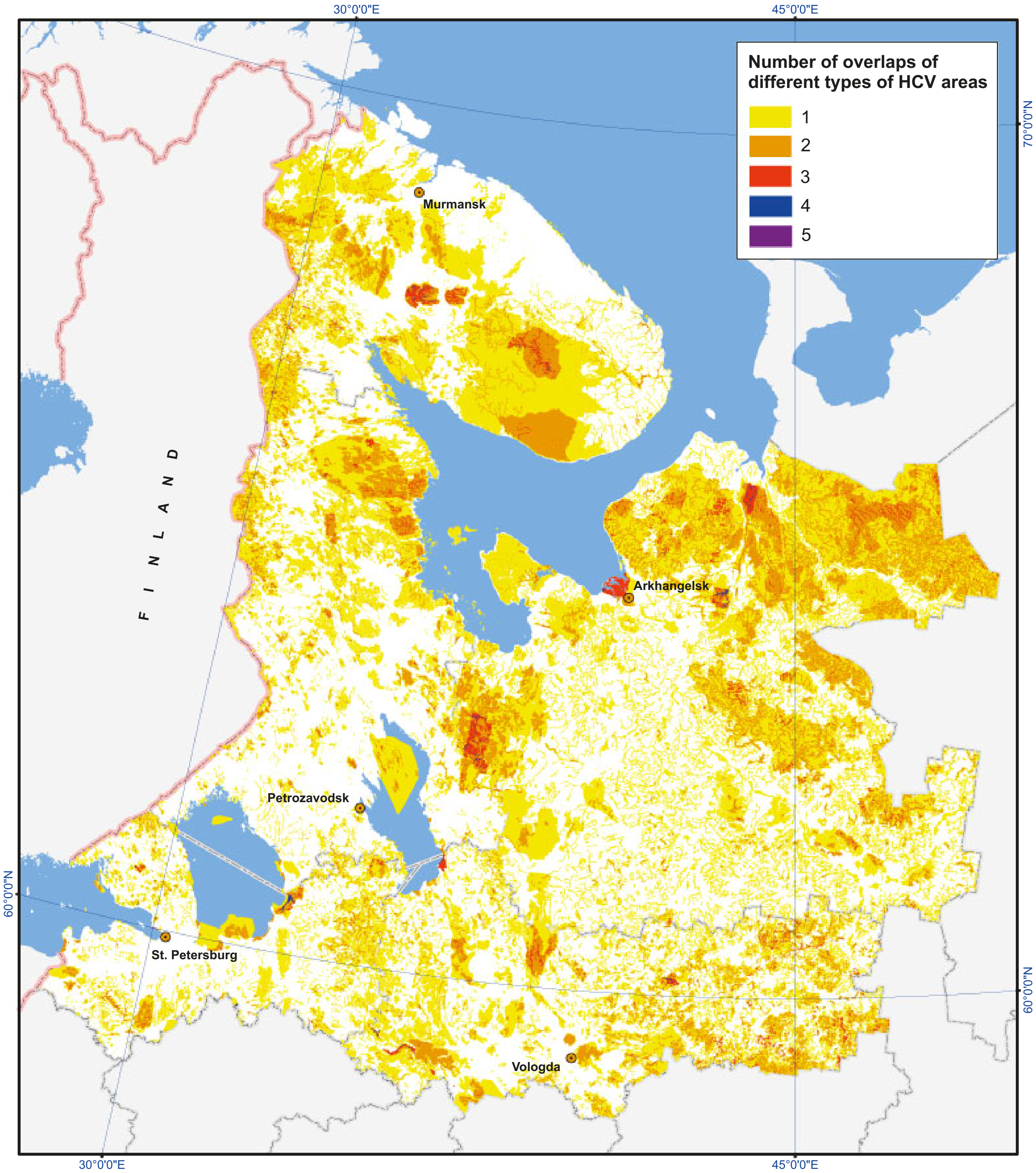


Fig. 3.51. Number of overlapping types of HCV categories on the same site.

An index of representativeness of 1 (i.e. the shares of HCV areas in the protected areas and in the entire area of the region/republic are approximately equal) usually means that HCV areas of this type have been accidentally included in the existing protected areas. A value of this index exceeding 1 allows the assumption of some special efforts to protect this particular type of HCV area. And the higher the index of representativeness, the more effective protective efforts are characteristic for the region.

Identifying the most promising areas for establishment of new protected areas

Obviously, comprehensive feasibility studies taking into account a large number of characteristic situations are needed for the planning and establishment of new protected areas. Besides the natural value of an area, one must evaluate the threat of its destruction or degradation, the socio-economic situation in the region, the availability of public or private interest, development of environmental infrastructure, and other aspects. In this study, we include in the analysis only one of these characteristics, the conservational value of the area, and our analysis does not cover all possible natural biotopes, but only 15 types.

When starting to prepare recommendations on developing the protected area network, we must first delineate all HCV areas on the map. Then we should decide whether all of them have equal importance for nature conservation, or are some of them more valuable than others.

The former point of view, i.e. all HCV areas have the same conservational importance, means that all types of HCV areas should be equally represented in protected areas. If so, we have to assume the coefficient of relative importance of each type of HCV area equals 1. If some of the protected areas include more than one type of HCV area we can simply sum all of them, and the more types of HCV area overlap in the territory occupied by a protected area, the more valuable this protected area is.

The results of this analysis, which are obtained by this type of simply counting the numbers of overlaps between different types of HCV areas, are shown in the map on Fig. 3.51. The maximum number of overlaps between different types of HCV area (5 overlaps) was found in the Pinega Strict Nature Reserve in Arkhangelsk Region. This relatively small territory (3 ha) is an intact forest landscape (IFL) with gorges (GORG) and the valley of the River Pinega (VAL) in which we have selected old-growth forest dominated by larch (OLF) and where an important bird area in Russia (IBAR) has been registered.

The acreage of protected areas with 4 overlapping types of HCV area is 11,800 ha which comprises 0.04% of the total area of HCVs in the studied territory. The share of the protected areas with 3 overlapping types of HCV area is 1.5% of the total area of HCVs in the studied territory. These values show that protected areas having three and more HCV areas constitute only a minor fraction of the total area occupied by protected areas in northwest Russia.

It seems obvious that using only the number of overlaps between different types of HCV areas is not the best method to determine priorities for protection of natural areas by the establishment of new protected areas. It seems more correct to assume that every type of HCV area has different importance in terms of conservation value, and therefore, more valuable HCV areas should have priority in the planning of new protected areas. To do this, we tried to calculate a kind of a quantitative coefficient of relative importance of HCV areas.

Coefficients of relative importance of 15 types of HCV area are presented in Table 3.4. They were worked out by a group of experts from Murmansk Region and the Republic of Karelia, and then approved by experts from all the other study areas. Thus, all the experts who have participated in the Gap analysis project have also participated in the

Table 3.4. Coefficients of relative importance (0 to 1) for 15 types of mapped HCV area, as estimated by experts.

HCV area	Coefficient of relative importance
IFL	0.5
IFT	0.35
IMM	0.19
AAPA	0.25
SPF	0.49
FHRP	0.14
DPF	0.29
OSFN	0.58
BLF	1
OLF	0.21
AlpT	0.5
GORG	0.83
VAL	0.38
ESDEL	0.4
IBAR	0.23

evaluation of the HCV areas. This inter-regional co-operation is needed to avoid contradictions between regional experts in their further work on developing the network of regional protected areas.

The experts considered every criterion of conservation value listed in 2.3.1, paying most attention to current or potential threats, or to other factors related to the distribution of the particular type of HCV area and its qualitative or quantitative changes in every region. As a result, each type of HCV area has been assessed for its relative conservation value (from 0 to 1). The highest values (0.5 and higher) are given to those types of HCV areas that have restricted distributional area, e.g. mostly or exclusively situated in hemiboreal zone and southern boreal sub-zone (broadleaved and coniferous-broadleaved forests, old-growth forests dominated by spruce and fir with nemoral elements in vegetation), or in the northern boreal forest sub-zone (e.g., alpine tundras in forest zone). Naturally rare HCV areas with especially diverse species pools, like spring fens, gorges and related biotopes, river valleys, estuaries and river deltas, also have high scores. Intact forest landscapes (0.5) and tracts (0.35), although probably the most important type of HCV area in northwest Russia due to their huge areas, have lower coefficients (for the very same reason). Lower coefficients are given to intact mire massifs and southern aapa-complexes, dry pine forests and larch-dominated forests. This can be explained by their wide distribution throughout the studied area, particularly in its northern and eastern parts, where they are only slightly threatened by economic activity. The lowest estimations of conservational value are given to forest tracts with high restoration potential, which are usually of secondary origin.

The analysis was performed by region/republic and then the results were summarized for the entire study area. We used raster grids (cell size 100m x 100 m) in which all types of HCV areas were combined by summing the values of the coefficients of their relative importance for each cell.

Identification of the most promising areas for the establishment of new protected areas was based on the presence of HCV areas with different coefficients of their relative importance. We summed the coefficients and delineated the most promising areas on the maps used a threshold of 12% of the share of protected areas of the total area of region/republic (see 3.4.4).

Relative importance of existing and planned protected areas by region

For this we summed the coefficients of relative importance for grid cells belonging to existing protected areas in the particular region, and then divided the sum by the total sum of the coefficients of relative importance for all grid cells in the map of this region or republic. The quotient shows a value of the relative importance of the existing protected area network. Similarly, we estimate the same values for the planned protected areas in such cases where their boundaries are already exactly defined and mapped.

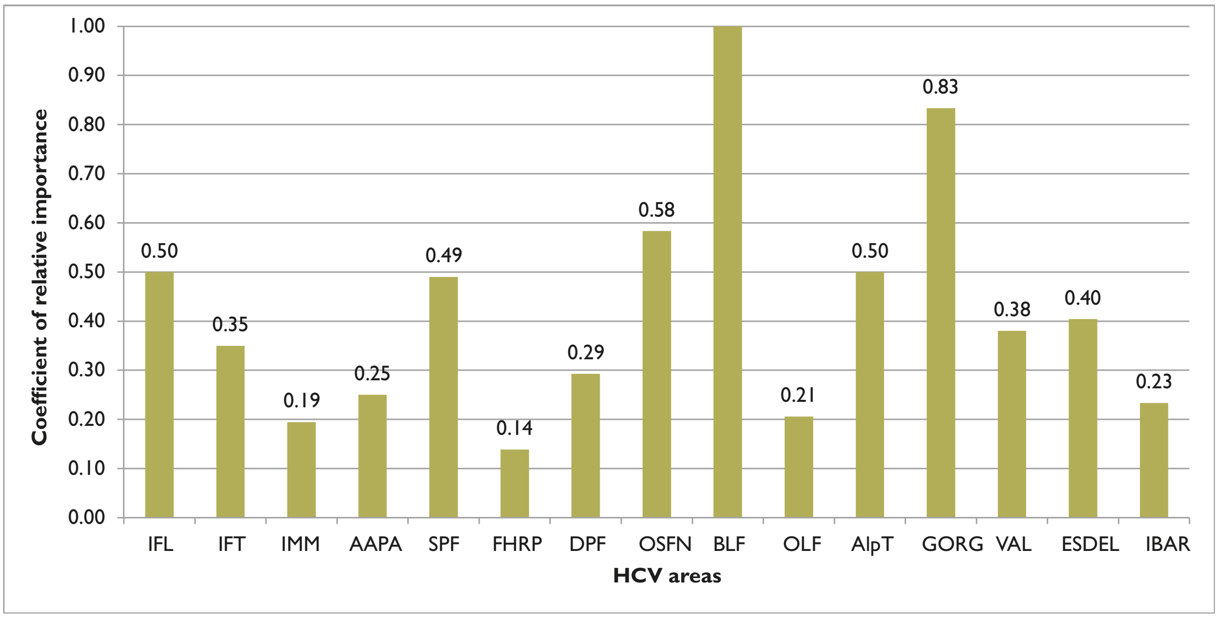


Fig. 3.52. Relative importance of mapped HCV areas (see explanations in 3.4.1).

3.4.2. Distribution of selected HCV areas in the studied territory

The purpose of this analysis was to evaluate areas occupied by different types of HCV by region/ republic (Table 3.5). These data allow the drawing of general conclusions on the occurrence of preserved natural sites and on the extent of anthropogenic transformation of the landscape.

The results show that the proportion of the area covered with the 15 types of HCV included in the analysis is quite high – 36% of the entire study area. This allows some wishful thinking about the existing network of protected areas in northwest Russia and their further development.

3.4.3. Representativeness of HCV areas in the network of existing protected areas

Proportion of HCV areas included in protected areas

For the analysis we used 15 separate layers for each type of HCV area, and a generalized layer where data for all these types were combined. The values characterizing shares of HCV areas which are included in existing protected areas to entire areas of protected areas in each region / republic are shown in Table 3.6.

The overall proportion of HCV areas included in protected areas is relatively high (66.9%), and more or less uniform in different regions/republic. The highest proportion of protected HCV areas is found in Arkhangelsk Region (73%), the lowest (55.6%) in Murmansk Region. The relatively low percentage of protected HCV areas in Murmansk Region leads from the fact that the Gap analysis project focused primarily on intact forest landscapes and we did not select intact tundra areas in the tundra zone. For this reason, vast areas of undisturbed tundra included in existing protected areas (e.g. in the Murmansk Tundra federal zakaznik) were not included in the analysis. In addition, 3 hunting zakazniks – Kanozero, Tulomsky and Simbozero situated in relatively low-value areas from all points of view except hunting – also affect the percentage of HCV areas in protected areas of Murmansk Region.

Intact forest landscapes (IFL, 37.4%), intact mire massifs (IMM, 11.7%) and important bird areas in Russia (IBAR, 18%) have the highest proportions of protected parts (Table 3.6 and Fig. 3.53). All these types of HCV are widely distributed and dominant by area in the studied territory, excluding very southern parts chiefly covered with secondary forests and dried mires.

Table 3.5. Areas of HCVs as percentages (%) of the entire areas of the administrative regions.

Note. Here and in tables 3.6 and 3.8, generalized values in the column and row “Total” were calculated separately and are not the arithmetic sums or values by region because the areas of different HCVs may overlap.

HCV areas	Arkhangelsk Region	Vologda Region	Republic of Karelia	Leningrad Region	Murmansk Region	Total
IFL	29.88	0.66	3.99	-	30.84	16.85
IFT	2.14	3.14	6.29	4.84	9.96	4.73
IMM	4.38	11.54	10.82	4.6	0.6	6.29
AAPA	3.13	0.74	0.56	-	-	1.37
SPF	0.0003	0.0009	0.0003	0.01	0.07	0.01
FHRP	0.55	10.5	0.23	4.47	-	2.48
DPF	0.05	0.12	0.03	0.37	-	0.08
OSFN	0.003	0.65	-	-	-	0.11
BLF	-	0.13	-	0.05	-	0.03
OLF	0.22	0.002	-	-	-	0.08
AlpT	-	-	0.01	-	3.25	0.55
GORG	0.13	0.05	0.24	0.18	0.46	0.2
VAL	11.81	7	1.52	3.15	2.47	6.48
ESDEL	0.18	-	-	-	-	0.07
IBAR	3.03	3.63	7.8	5.27	6.98	4.98
Total	44.63	32.06	26.53	19.94	42.74	36.05

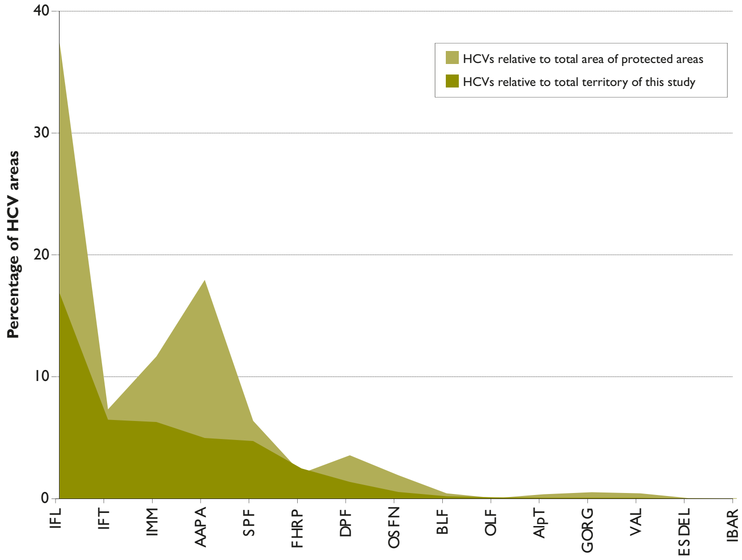


Fig. 3.53. Total area of HCVs relative to total area of protected areas (light-green) and to total territory of this study (dark-green).

The diagram presented in Fig. 3.53 shows what types of HCV area have had priority when the existing protected areas were planned and established. It seems evident that intact forest landscapes (IFL) were targeted for the establishment of protected areas, i.e. protected areas were established primarily in the preserved intact forest landscapes. Very often these areas contain also intact mire massifs (IMM) and harbor habitats of several vulnerable bird species, which allows them to be considered important bird areas in Russia as well. The shares of these types of HCV areas in protected areas is two and more times higher than their average shares in the studied area. Two other HCV types, Aapa mires outside the aapa-province (AAPA) and Alpine tundra areas in the forest zone (AlpT) also have relatively large shares of protected parts. For all the other types of HCV area, their protected parts are either almost equal to or lower than their average shares in the studied area.

Table 3.6. Shares of different types of HCV areas in protected areas (% of total area of protected areas in administrative regions).

HCV AREAS	Arkhangelsk Region	Vologda Region	Republic of Karelia	Leningrad Region	Murmansk Region	Total
IFL	55.28	0.8	35.89	-	42.9	37.42
IFT	0.77	7.1	12.53	14.6	8.72	6.39
IMM	4.11	49.15	10.18	16.69	2.2	11.67
AAPA	7.63	3.36	0.72	-	-	3.56
SPF	0.0014	-	-	0.02	0.15	0.04
FHRP	0.04	3.44	0.02	18.63	-	2.08
DPF	0.25	0.38	0.05	2.42	-	0.36
OSFN	-	0.28	-	-	-	0.04
BLF	-	0.17	-	0.35	-	0.05
OLF	1.35	0.01	-	-	-	0.53
AlpT	-	-	0.14	-	7.61	1.93
GORG	0.35	0.02	0.65	0.38	0.72	0.44
VAL	11.94	4.94	2.42	3.17	5.45	7.33
ESDEL	1.12	-	-	-	-	0.44
IBAR	17.57	16.17	28.06	27.98	10.69	17.95
Total	72.99	69.12	70.81	61.81	55.57	66.85

Representativeness of protected areas

The goal of the regional protected area networks is to preserve all nature areas still in their natural state and capable of contributing to the maintenance of the natural biodiversity of the region. Thus, protected areas should be established in such a way as to include primarily these natural areas, and their shares of the entire area of protected areas (on average 66.9%, see Table 3.6) must be much higher than those of unprotected territories (on average, 36.1%, see Table 3.5).

Thus, on average, all 15 selected types of HCV area have about double (1.9 times) the share of their areas in protected areas compared with the entire studied area. These proportions, however, are not equal for each HCV type. Only ten of them, viz. Old-growth larch-dominated forests (OLF), estuaries and deltas (ESDEL), dry pine-dominated forests (DPF), spring fens (SPF), important bird areas of the Russian Federation (IBAR), alpine tundra areas in the forest zone (AlpT), aapa mires outside the aapa-province (AAPA), intact forest landscapes (IFL), intact mire massifs (IMM) and gorges, ravines, etc. (GORG), have the quotient of share in the protected areas / share in the entire studied area, equal to or more than 1.9 (i.e. equal to or more than the average). All of them but the intact forest landscapes and intact mire massifs are quite rare biotopes in the study area and therefore received special attention when the existing protected areas were planned. The intact forest landscapes, as already mentioned, were the target areas for preservation, often together with intact mire massifs within them. In contrast, three other types of minimally disturbed natural forests – intact forest tracts (IFT), old-growth forests dominated with spruce and fir (OSFN), and broadleaved and conifer-broadleaved forests (BLF) – which are situated in the southern parts of the studied area, have values lower than the average. This has resulted from the fact that to establish a new protected area in a highly populated area with a developed economy is much more difficult than in remote areas. The lower values obtained for the valleys of small rivers and floodplains (VAL), as well as for forests with high restoration potential (FHRP), are also explained by the fact that they are mostly situated in relatively densely populated areas and have importance in agriculture and the timber industry.

In Table 3.7 we grouped all 15 types of HCV area selected in this study by the quotient of their protected and unprotected areas. The results show that nine of these HCV areas, namely larch-dominated old-growth forests (OLF), estuaries and deltas (ESDEL), dry pine forests (DPF), spring fens (SPF), important bird areas in Russia (IBAR), alpine tundras in forest zone (AlpT), aapa mires south of their main distributional area (AAPA), intact forest landscapes (IFL), and gorges, ravines, etc. (GORG) are well represented in the existing network of protected areas (the value of the quotient protected/ unprotected is more than 2).

Table 3.7. Percentages (%) of different types of HCV area in the entire area of protected areas (1); in the entire study area (2); and the quotient of (1)/(2).

HCV AREAS	Share of HCV area in existing protected areas, % (1)	Share of HCV area in the entire studied area, % (2)	quotient (1) / (2)
OLF	0.53	0.08	6.63
ESDEL	0.44	0.07	6.29
DPF	0.36	0.08	4.5
SPF	0.04	0.01	4
IBAR	17.95	4.98	3.6
AlpT	1.93	0.55	3.51
AAPA	3.56	1.37	2.6
IFL	37.42	16.85	2.22
GORG	0.44	0.2	2.2
IMM	11.67	6.29	1.86
BLF	0.05	0.03	1.67
IFT	6.39	4.73	1.35
VAL	7.33	6.48	1.13
FHRP	2.08	2.48	0.84
OSFN	0.038	0.11	0.35
Total	66.85	36.05	1.85

Two types of HCV area, namely old-growth, minimally transformed coniferous forests dominated by spruce and fir, with nemoral plant species in ground vegetation (OSFN, 0.35) and forest tracts with high restoration potential (FHRP, 0.84), are characterized by extremely weak protection levels because the value of the quotient protected/unprotected is less than 1. For the other four types of HCV area this value is close to the average level, i.e. between 1 and 2.

The high fluctuations of these values, from 6.63 for larch-dominated old-growth forests to 0.35 for spruce- and fir-dominated old-growth forests (i.e. nearly twenty times greater) for different types of HCV areas, reflect two obvious facts: (1) that representation of certain types of HCV areas within the network of existing protected areas is substantially uneven, and (2) that the overall representativeness of the existing protected area network is not satisfactory for the protection of all types of HCV area in the studied territory.

These results, among other things, emphasize a need to include the coefficients of relative importance of HCV areas in the process of estimation of representativeness of the existing protected area network. These coefficients must reflect not only the natural rarity of the type of HCV area in each region/ republic, but also the share of its area included in protected areas. The higher the share of the HCV type that remains unprotected, the higher the priority this HCV type deserves.

Percentages of different types of HCV area in protected areas by region/republic

The aim of this analysis was a quantitative comparison of the types of HCV area represented in existing protected areas in Arkhangelsk, Vologda, Leningrad, and Murmansk Regions and the Republic of Karelia (Table 3.8 and 3.9).

The simplest calculations presented in Table 3.9 show that HCV areas which were selected and mapped in this study occupy, in total, 36.1% of the entire studied area. Of these, 12.5% (or 4.5% of the entire studied area) are included in existing protected areas. Leningrad Region is characterized with the highest degree of protection of HCV areas (17.7%). All the regions and the Republic of Karelia have a significant potential for increasing the proportion of protected HCV areas, taking into account the fact that at present the existing protected area network covers only 6.73% of the study area.

Fig. 3.54. shows the total area of HCVs as percentages of total area studied; total area of protected areas as percentages of total area studied; total area of HCVs in protected areas as percentages of total area studied; and total area of HCVs in protected areas as percentages of total area of protected areas (line). According to these calculations, Arkhangelsk Region possesses the largest areas of HCVs and the highest values for their protection in existing protected areas. The reason is that large protected areas in Arkhangelsk Region are almost completely

Table 3.8. Protected parts (i.e. located in existing protected areas) of 15 types of HCV area as percentages (%) of their entire areas by administrative region, and on average for the entire study area.

HCV areas	Arkhangelsk Region	Vologda Region	Republic of Karelia	Leningrad Region	Murmansk region	Total
IFL	13.59	6.58	40.32	-	14.01	14.95
IFT	2.66	12.23	8.94	17.23	8.81	9.09
IMM	6.9	23.06	4.22	20.7	36.81	12.5
AAPA	17.93	24.56	5.7	-	-	17.52
SPF	37.07	-	-	16.92	20.72	20.32
FHRP	0.6	1.77	0.36	23.8	-	5.65
DPF	36.98	17.37	8.41	36.84	-	30.2
OSFN	-	2.35	-	-	-	2.32
BLF	-	7.03	-	43.91	-	13.17
OLF	45.81	26.44	-	-	-	45.73
AlpT	-	-	69.04	-	23.59	23.75
GORG	19.52	1.85	12.31	11.97	15.6	14.83
VAL	7.43	3.83	7.14	5.75	22.21	7.62
ESDEL	45.13	-	-	-	-	45.13
IBAR	42.56	24.15	16.14	30.29	15.44	24.26
Total	12.01	11.68	11.97	17.7	13.1	12.49

Table 3.9. Overall results of the analysis.

Share, %	Administrative regions					Total
	Arkhangelsk Region	Vologda Region	Republic of Karelia	Leningrad Region	Murmansk Region	
HCV areas (of the total area of the administrative region	44.6	32.1	26.5	19.9	42.7	36.1
Areas of existing protected areas (of the total area of the administrative region)	7.3	5.4	4.5	5.8	10.1	6.7
HCV areas included in existing protected areas (of the total area of the administrative region)	5.4	3.8	3.2	3.5	5.6	4.5
HCV areas included in existing protected areas (of the total area of protected areas)	73.0	69.1	70.8	61.8	55.6	66.9
HCV areas included in existing protected areas (of the total area of HCV areas)	12.0	11.7	12.0	17.7	13.1	12.5

situated in intact forest landscapes. Murmansk Region possesses about the same high share of HCVs (chiefly intact forest landscapes) in its territory, and the highest share of protected areas of the entire area, but the total area of HCVs in protected areas as percentages of the total area of protected areas is the lowest here. This is explained by the presence of huge areas of minimally transformed forests which are not included in existing protected areas, due to the low threat of their being cut in the nearest

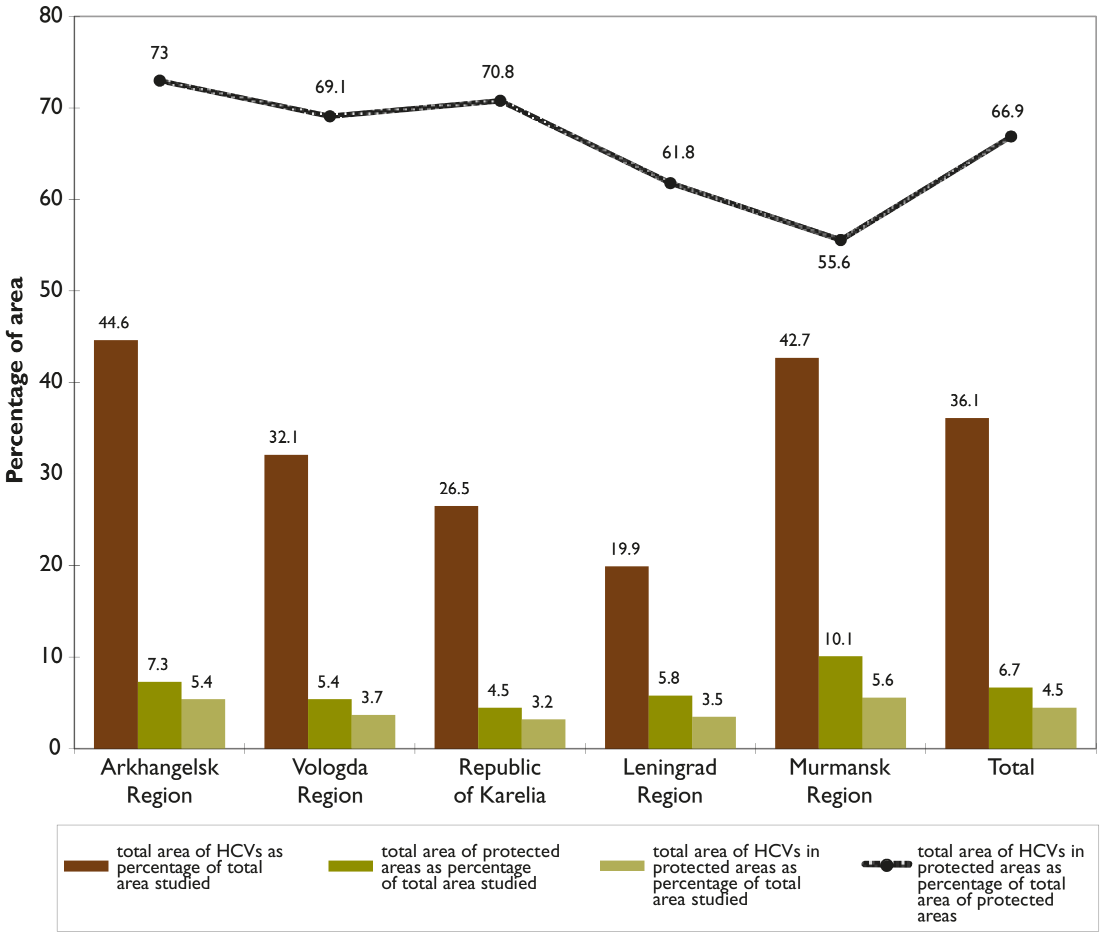


Fig 3.54. General results of the analysis.

of their being cut in the nearest future. The other regions have more modest values of proportions of both HCVs and protected areas of their entire areas, and the degree of protection of the HCVs is also lower (3.2 – 3.8) than in Arkhangelsk and Murmansk Regions.

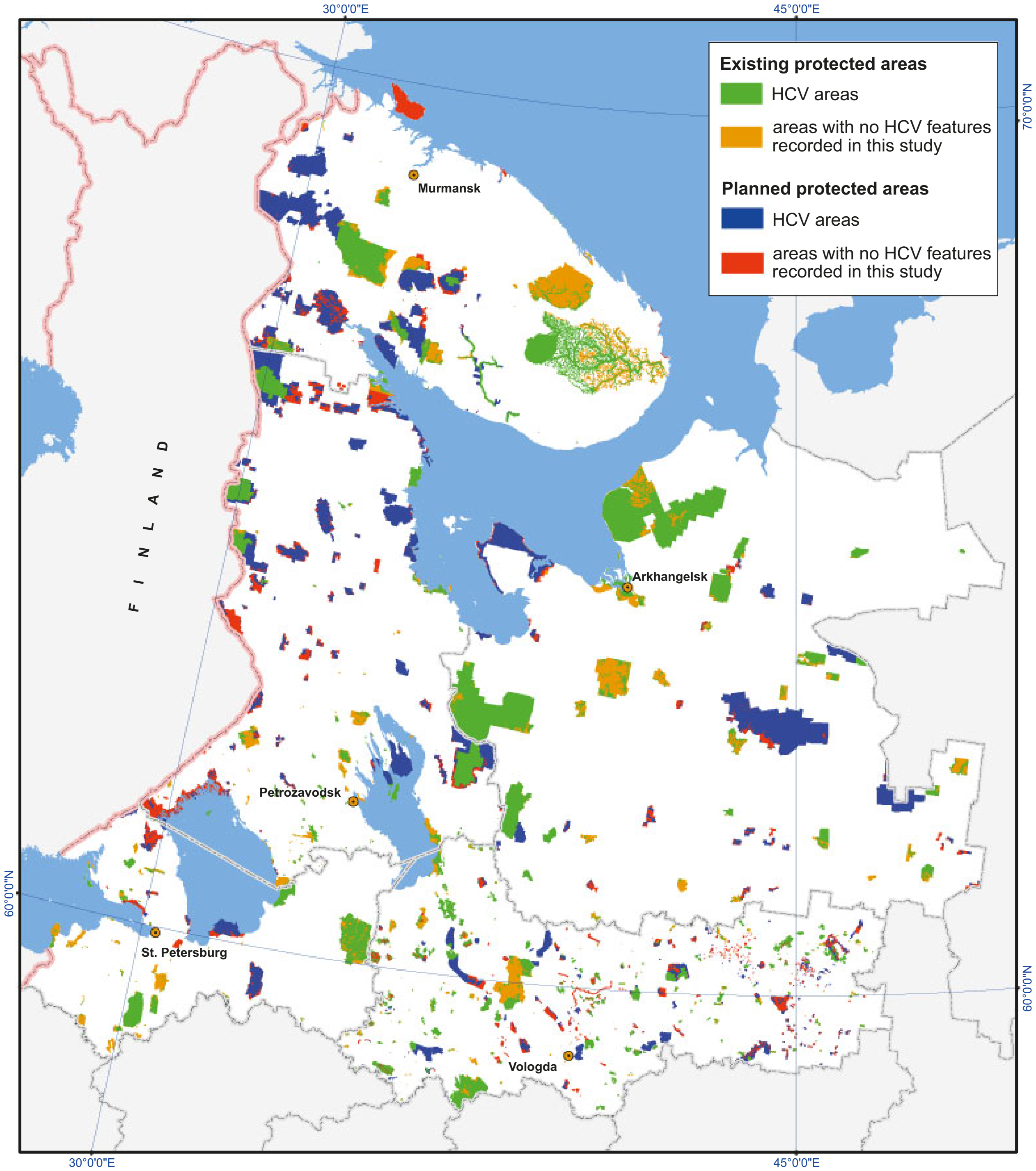


Fig. 3.55. Locations of HCV areas and areas with no HCV features recorded in this study (other HCV values may exist) in existing protected areas and planned protected areas.

3.4.4. Integral assessment of the distribution of HCV areas and representativeness of the protected area network

In previous sections we presented results obtained by evaluation of the distribution of HCV areas in each of the studied regions and the Republic of Karelia, and their shares included in regional protected area networks. Below we will try to use these results for selecting those unprotected areas which seem most important for regional nature conservation. For this we need data on the spatial distribution of HCV areas and their sizes in combination with other characteristics discussed above: their relative importance and situation with their inclusion in existing protected areas. These values, combined in the same database, allow rapid calculations for each local area throughout the entire studied territory.

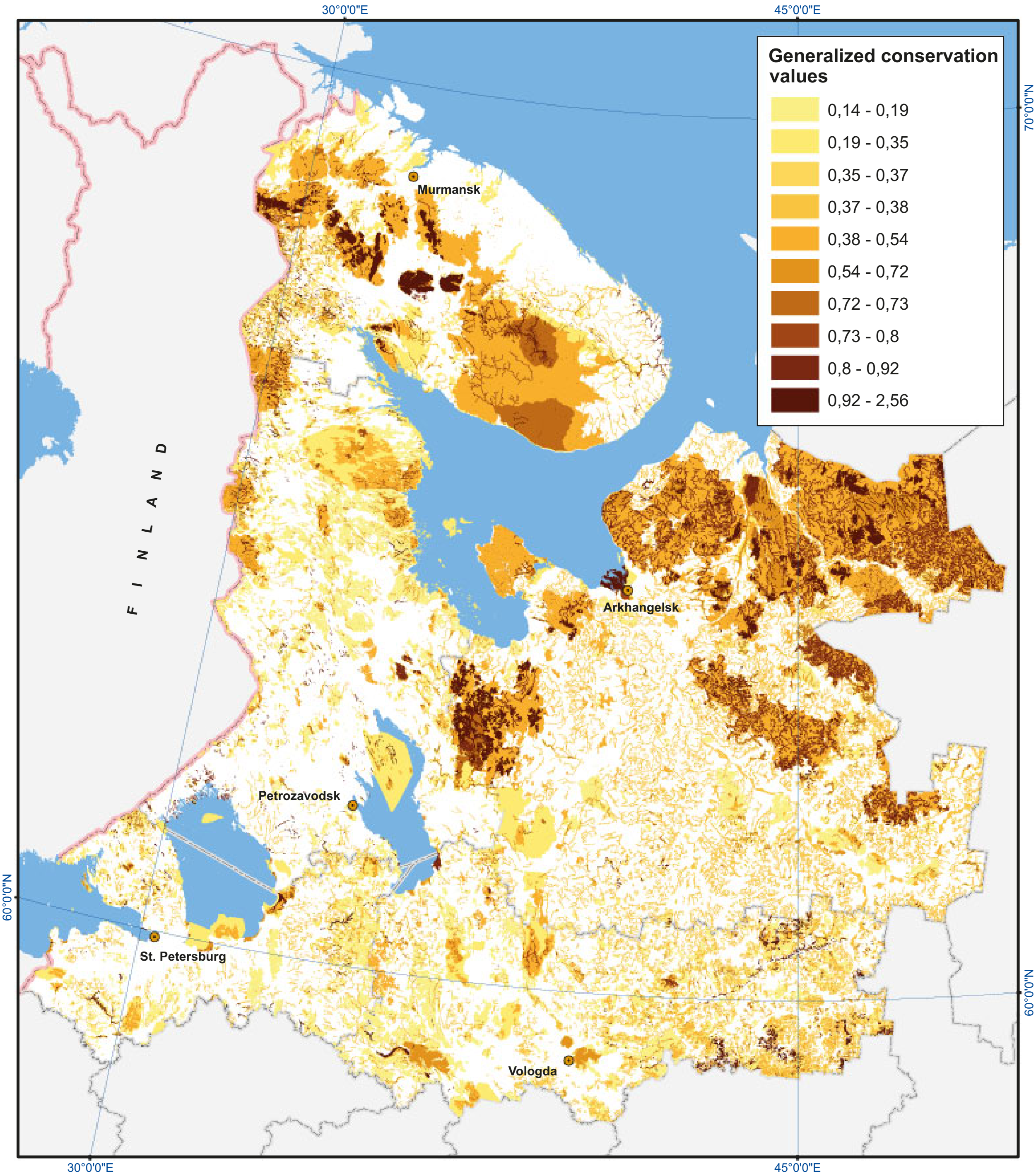


Fig. 3.56. Generalized conservation values of the studied area, calculated using inter-regional coefficients of relative conservational importance of HCV areas.

Spatial distribution of the generalized values of relative conservational importance of HCV areas

Generalized conservation values of the studied area are presented in the map (Fig. 3.56) where selected HCV areas are differently colored according to their coefficients of relative conservational importance (see Table 3.4). The more significant the summarized conservational values of the HCVs, the darker the highlighted area.

The most extensive dark-brown areas with high estimates of total conservational value are situated in the northern and eastern parts of the studied territory, which still include vast intact forest areas. Their conservation values are always increased by overlapping ofintact forest landscapes with other types of HCVs in the same territory. However, the highest values of total conservational importance were obtained in relatively small areas situated in southern parts of the studied territory. The maximum score of 2.56 was calculated for an area situated on the border of Leningrad Region with the City of St. Petersburg, in the lower reaches of the River Roschinka. This site has rare types of old-growth forests in combination with other types of HCV area selected in this study. It is protected in the zakazniks Gladyshevsky and Lindulovskaya Grove. Similar high estimates of conservational value were obtained for quite large territories situated along the mountain ridges of the Khibiny Tundras and Lovozero Tundras, which are intended to be included in the planned Khibiny National Park.

Significance of existing and planned protected areas for the conservation of HCV areas

Maps showing the spatial distribution of HCV areas with different coefficients of relative importance allow estimations of generalized values of conservational importance of protected areas, both existing and planned. To calculate these values, we used (1) inter-regional coefficients of relative importance of the HCV area (or the sum of the coefficients of relative importance of HCV areas, in cases where HCV areas overlap in the same territory) multiplied by (2) the square of the HCV area(s) in any territory (e.g. protected area) and divided by (3) the entire area of the studied territory. The formula is as follows:

$$Z = \frac{\sum K_{HCVarea} \times S_{HCVarea}}{S_{studyarea}}$$

where Z = generalized value of conservational importance of protected area (this may be not only the territory of protected area, but also any other area);

$K_{HCV\ area}$ = coefficient of relative importance of HCV area (Table 3.4);

$S_{HCV\ area}$ = the square of the HCV area which is included in the protected area or other studied territory (in hectares);

$S_{study\ area}$ = the entire area of protected area or other studied territory (in hectares).

Using this formula, we calculated the values of the conservational importance of each region and republic, and for each protected area (both existing and planned) situated in the study area. The results are presented in Fig. 3.57.

According to our calculations for the entire region/republic (brown columns), Leningrad Region has the minimal (0.06), and Arkhangelsk Region the maximal (0.24) values of conservational importance in the study area. The reason is that the summed areas of HCVs as percentage of the whole area of the region in Arkhangelsk Region is much higher than in densely populated Leningrad Region. The fact that several types of HCV area in Leningrad Region have the highest coefficients of relative importance does not influence the overall significance, because their areas are incomparably small in comparison with the huge intact forest landscapes existing in Arkhangelsk Region.

Calculations for the existing and planned protected areas are generally similar to those presented in Fig. 3.54. Slight differences appeared after including inter-regional coefficients of HCV areas in the calculations. For instance, in Leningrad and Vologda Regions and the Republic of Karelia, generalized values of conservational importance of protected areas, both existing and planned, are much higher than these values of the entire region or republic. This indicates the high efficiency of the network of protected areas there. Arkhangelsk and Murmansk Regions have the highest absolute values of conservational importance of the existing protected areas. Establishment of the planned protected areas in Arkhangelsk and Murmansk Regions will significantly increase the conservational value of their territories. In Leningrad and Vologda Regions and Karelia, this increase will not be so big because the most valuable natural areas are already included in the existing protected areas. Some of the planned protected areas there will not include

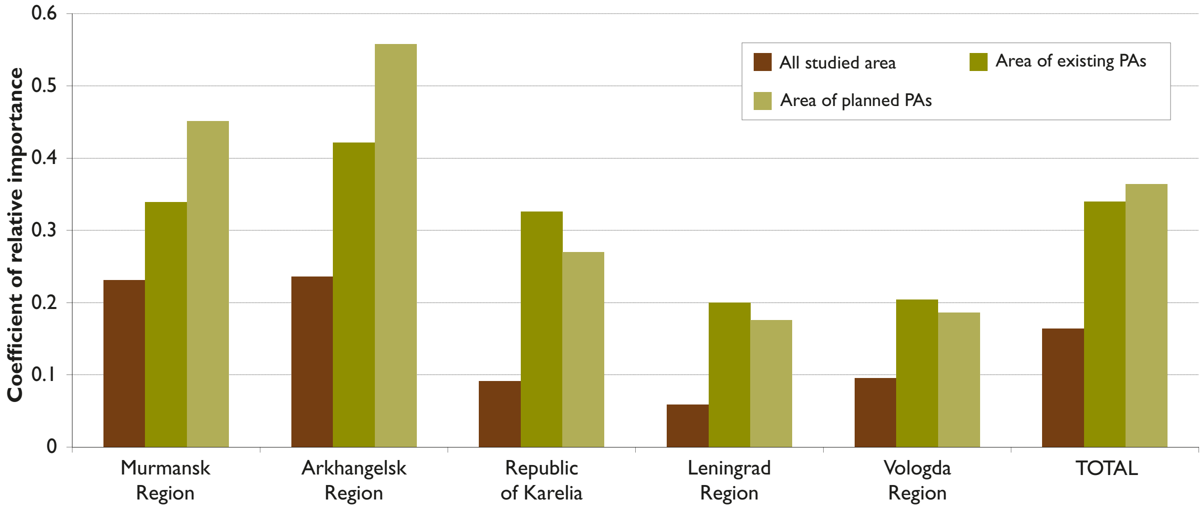


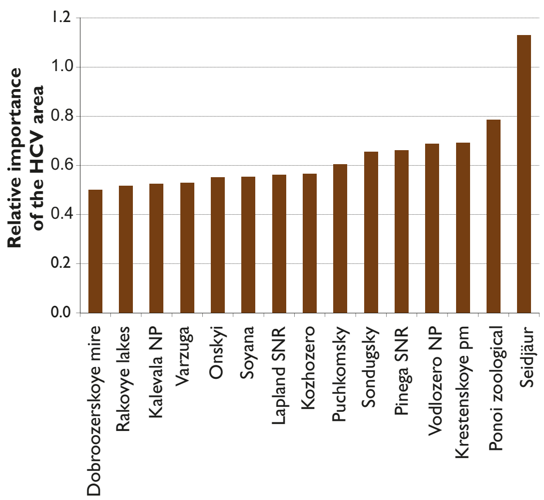
Fig 3.57. Relative importance of protected areas (PAs) by administrative region.

those 15 types of HCV area which are considered in our analysis and calculations.

To identify existing and planned protected areas which have the highest values of conservational importance, we selected 15 existing and 15 planned protected areas with areas not less than 10,000 hectares (Fig. 3.58). As expected, the existing zakaznik Seidjäur and the planned National Park Khibiny, both located in the Khibiny Tundras and Lovozero Tundras mountain ridges in Murmansk Region, have the highest values. Once again, this confirms the uniqueness of these nature areas.

Identification of promising areas for the establishment of new protected areas

The calculations show that none of the existing and planned protected areas analyzed in this study has the maximal score for the values of conservational importance which, as already mentioned, could reach 2.56 (maximal score of relative conservational value of the area for a given set of layers). Among the existing protected areas the highest score (1.83) was calculated for a one hectare area of the regional nature monument Arnicas and Poppies in Indichyok Gorge (Murmansk Region); the score for the planned National Park Khibiny was 1.54.



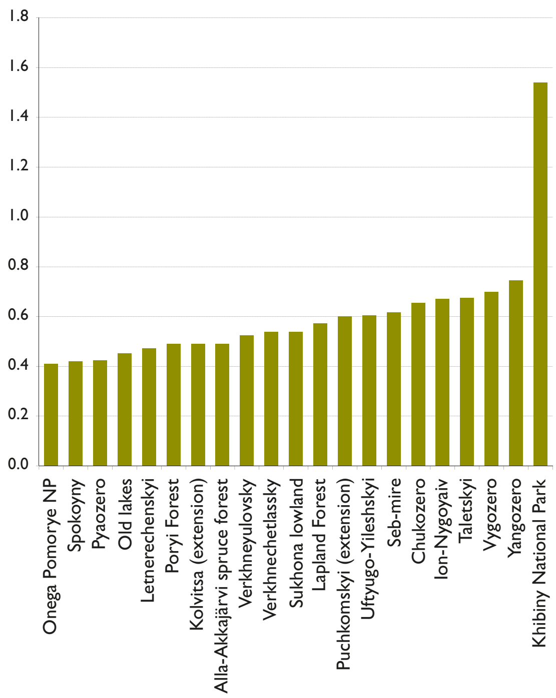


Fig 3.58. Existing (left chart) and planned (right chart) protected areas (> 10,000 ha) ranked by importance.

Thus, theoretically, some changes in the borders of planned protected areas towards increasing their values of conservational importance seem possible. It should be remembered that in this study we are using only a restricted set of information (only 15 types of HCV area, lack of distributional data of red-listed species for some areas, etc.), so the following recommendations are in need of further clarification.

Using the previously calculated values of conservational importance for the territories where HCV areas were selected and mapped, we have attempted to delineate the most valuable territories, which will occupy the same area as the planned system of protected areas, i.e. 12% of the entire study area. The threshold of 12% equals the percentage of the area of all existing and planned protected areas of the entire study area at the moment of writing (spring 2011). Our task was to select territories representing altogether 12% of the entire area of every region studied whose total conservational importance would be the greatest. We could not use the threshold of 17% recommended by the 10th Conference of the Parties to the Convention on Biodiversity (Report of the tenth meeting ... 2010) in this analysis because in Leningrad Region the summed area of all selected HCVs is less than 17% of the entire area of the region.

Thus, the procedure was to select maximum 12% of grid cells whose importance exceeds a certain threshold value. These threshold values appeared to be different in each administrative region. Due to relatively high homogeneity of the generalized values of conservational importance of HCV areas, even small changes in the threshold value lead to a sharp increase in the number of selected cells, and, accordingly, increase of selected areas.

For example, in Arkhangelsk Region, which possesses large intact forest landscapes, using a threshold value of 0.5 means selection of 10.1% of grid cells (i.e. areas considered as HCVs cover 10.1% of the entire area of the region). This is realistic in terms of including these areas in a regional protected area network. However, if we use a threshold value of 0.49, the percentage of selected grid cells becomes 31%, i.e. three times higher, exceeding all reasonable limits of protected areas in the region. A similar situation is observed in Murmansk Region. In Leningrad and Vologda Regions and the Republic of Karelia, these differences are much smaller (Table 3.10). To unify data obtained from administrative units differing in size and degree of anthropogenic transformation, we constructed a map of the areas of high conservational importance using two threshold values. In Fig. 3.59 they are shown in different colors. One of them, colored dark green, is calculated using threshold values which do not allow exceeding the limit of 12% of the entire study area (the threshold value is high, the selected territory has a slightly smaller area than 12%). Light green areas are selected at a lower threshold value and their total area exceeds 12 % of the entire area studied.

Some of the dark green areas with high conservational importance are partly or entirely covered by existing protected areas (e.g. Kostomuksha Strict Nature Reserve, Kalevala and Paanajärvi National Parks situated along the Finnish-Russian state frontier, zoological zakaznik Ponoi in Murmansk Region, etc.), but much of these areas are not included in either existing or planned protected areas. This means that there are extensive valuable natural areas requiring protection, and that vast areas with high conservational value can be easily omitted during planning of protected areas in the regions. Many important factors are not taken into consideration in the process of planning of protected areas. Detailed feasibility studies aimed at selecting the most valuable nature areas must be constantly carried out in every region and the complex maps indicating areas with high conservational value based on exact calculations should guide the planning for the development of regional protected areas.

Table 3.10. Percentages (%) of areas with high conservation values of the entire areas of administrative region (separately for the calculations using thresholds < 12% and > 12% of the entire area of administrative region) which are mapped in Fig. 3.59.

Threshold value used in the calculations	Regions				
	Arkhangelsk Region	Vologda Region	Republic of Karelia	Leningrad Region	Murmansk Region
< 12% of total area studied	10.1	10.7	8.9	9	9.1
> 12% of total area studied	32	12.4	13.1	12.6	32

New eco-geographical data can significantly change our understanding of the conservational importance of certain areas. Some areas considered as natural due to the absence of traces of clear logging, drainage, etc., may have severely deteriorated due to pollution, proximity to mega-cities, local infrastructure, intensive use of surrounding agricultural lands, etc. Such information, reducing the value of natural areas, could be obtained during field studies. However, we believe that methods of estimating conservational value developed in this study could be used as the starting point and help in more detailed analyses of the current situation and development of the protected area network in every region.

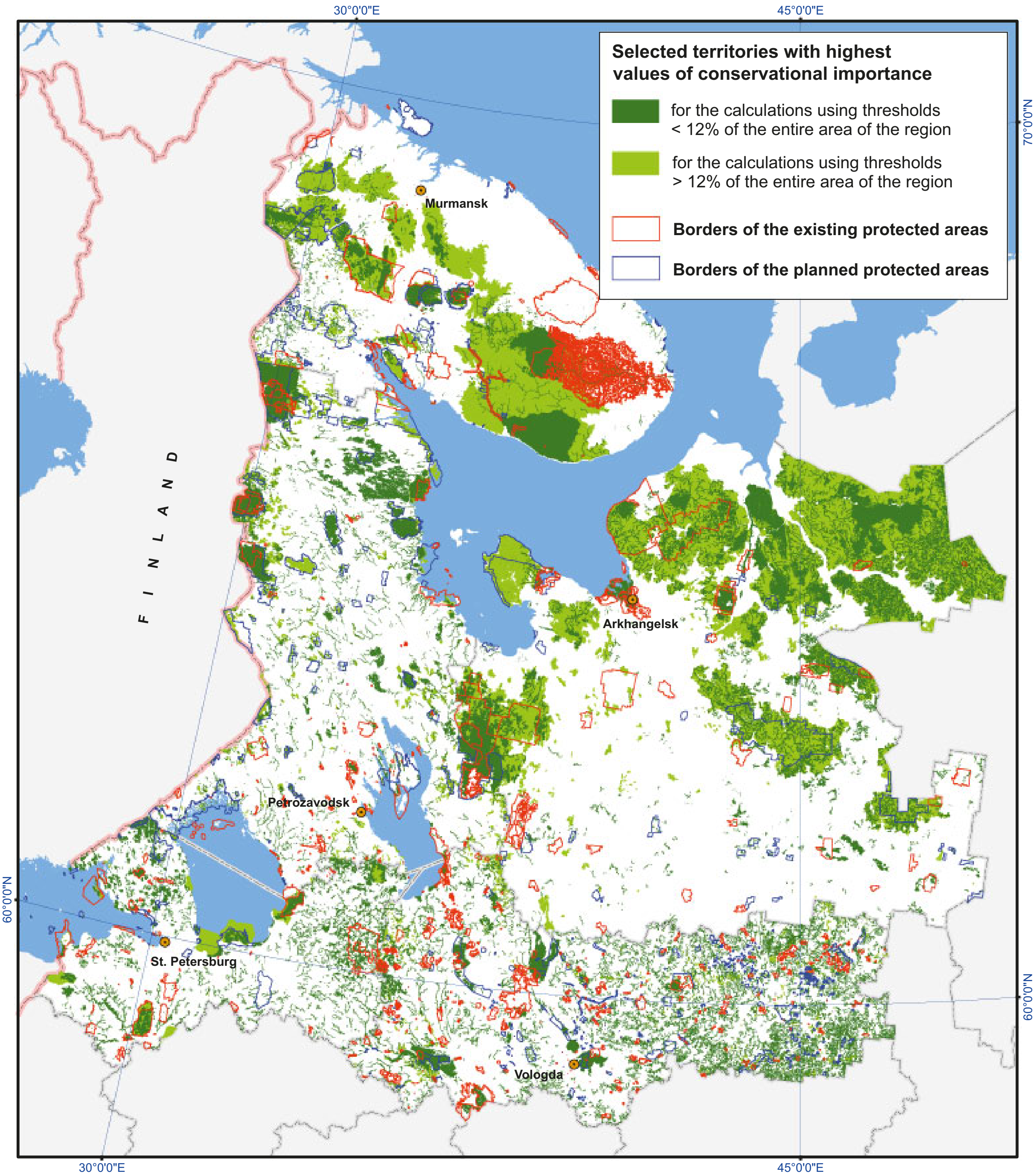


Fig 3.59. Territories with high values of conservational importance in existing protected areas, planned protected areas, and outside protected areas.

4. ON INTERNATIONALLY IMPORTANT NATURE-VALUES IN NORTHWEST RUSSIA

Olli-PekkaTurunen, Jyri Mikkola, Tapio Lindholm & Rauno Ruuhijärvi

When analysing nature values on national or regional level, the most valuable areas from the international perspective are quite often not getting the attention they would deserve. Typical of nature-conservation tradition in many countries, some regionally rare biotopes and habitats of rare species, which in the study area may occur on the margin of their natural distribution, are getting most of the attention. However, these biotopes or species may at the same time be rather common in a neighbouring country or region, and thus in the study area have specific value only on a national or regional level.

In northwest Russia there are plenty of valuable natural features that can be considered valuable also on the international level. In this chapter some examples of such features and individual objects are given. The conclusions presented are based on the cartographic material produced by the Gap-project, analysis of publicly available satellite images (www.maps.google.com, www.kosmosnimki.ru, glovis.usgs.gov) and the reference material listed at the end of this book. For evaluating the significance of some nature values on the international level, the unified system of bio-climatic vegetation zones by Ahti et al. (1968) and Hämet-Ahti (1981) has been used as support.

4.1 General

Northwest Russia holds the honor of having Europe's two largest freshwater lakes, Lake Ladoga and Lake Onega on its territory. The vast tidal flats and shoals of the White Sea, of which those located in the *Mezenskaya Guba (Mezen Bay)* area have remarkably high tidal water-level fluctuation The Baltic Sea Portal, are significant at least on the European scale (Larsen et al. 2004). The northern part of the internationally important White Sea – Baltic Sea migratory bird flyway, with its terrestrial and water-area stop-over sites, leads across the territory of northwest Russia (Noskov & Gaginskaya 2010). Northwest Russia also hosts huge, almost intact mire-landscapes that have, when it comes to their size, no match in Europe outside Russia. Representative examples are, for instance, the eccentric raised-bog systems surrounding the White Sea on its southern and southwestern margins, the mire systems of northeastern Arkhangelsk and the vast raised bog-systems in western Vologda Regions. The vast Fennoscandic aapa mire systems of northwestern Karelia and the Kola Peninsula have great international value as well. Also, northwest Russia has several large (> 50,000 ha) intact forest landscapes, of which the vastest can find their match in size in Europe only amongst the intact forest landscapes of the Republic of Komi, Russia. Together the forests and wetlands of northwest Russia act as an internationally significant carbon store age which helps to slow down climatic change also on the global level.

4.2. Examples of individual internationally valuable objects

4.2.1. Mountain tundras

The Khibiny and Lovozero mountain complexes in Murmansk Region form two vast alpine tundra areas surrounded by northern taiga. They were already recognized in the 19th century as especially rich areas of tundra flora, and in later studies (like in Gap-analysis) their uniqueness has become even more obvious. It is largely based on the peculiar bedrock of these mountain complexes (Semenov 1997) and their isolated location away from the Scandic Mountains in western Fennoscandia. In the study area this is one of the rare areas which host endemic taxa, and the amount of red-listed species and their habitats in these mountain com-

Khibiny. Photo: Valentin Zhiganov.

plexes is exceptionally high. At least in eastern Fennoscandia no other areas with such a representative concentration of rare tundra species (Red Data Book of East Fennoscandia 1998) are known, and in the western part of Fennoscandia there are only few such localities (Norwegian and Swedish databases on nature reserves).

4.2.2. Forests

In the Gap analysis the forests of northwest Russia were not mapped or analysed in such detail scale that sound conclusions on the international significance of their individual forest biotopes could be drawn. Thus the evaluation of forests here is limited to the landscape-level.

A special feature of world-scale importance in the study area is so called Greenbelts. In northern Europe there are several Greenbelts (Proceedings of the World Heritage… 2003, Feasibility study… 2009, Hubert-Hansen et al. 2009, Titov et al. 2009), south-north directed mega-corridors or more accurately long "chains" of valuable natural objects, consisting of both natural-state forests and other habitats that are only slightly fragmented or otherwise damaged. In the Gap analysis study area, three chains of this kind of rather connected natural objects can be recognised: the border area between Finland and Russia (in the far north the border area between Norway and Russia); the eastern part of Karelia, from Vodlozero National Park along the White Sea coast to the north; and the cluster of large intact forest territories in the eastern part of the Arkhangelsk Region. Among ecologists it is generally agreed that nature protection efforts should focus on saving as much of these existing mega-corridors as possible.

In previous studies the large intact forest landscapes of Russia have been identified (Yaroshenko et al. 2001, Aksenov et al. 2002) and their high conservation value as the backbone of a global network of areas in need of protection has been stressed by different international forums (e.g. Convertion on Biological Diversity, Message from Malahide 2004), most recently at the United Nations Biodiversity meeting in 2010 in Nagoya (Report of the tenth meeting… 2010). When evaluating where the most urgent protection effort is needed, the most unique cases under immediate threat become priority. From northwest Russia the following provide an example:

A huge intact forest landscape ***Laplandsky Les,*** consists of Lapland Strict Nature Reserve (278,436 ha) plus two planned protected areas, forest zakazniks Lapland Forest and Ion-Niyugoive (together 310,000 ha), with slightly more than 70 % of their total area being covered by forests. This wilderness is located near the Finnish state border and continues on Finnish territory and also on Norwegian territory as an enormous complex of already protected wilderness areas. Altogether these areas form the largest pine-dominated, practically intact "near tundra" forest at least in Europe. The total area of this wilderness is more than 1 million hectares, almost all of it already protected or included in protection plans.

Pyaozero forest wilderness consists of spruce-dominated natural forests in Paanajärvi National Park and in the surrounding planned landscape

Lapland Forest (or Laplandsky Les) – spruce-dominated forest of dwarf-herbaceous type preserved in a fire refugee in the mountain gorge "Hanhikuru" on the northern slope of the Saariselkä mountain-range, Murmansk Region. Photo: Konstantin Kobyakov.

zakaznik Pyaozero (202,200 ha). On the Finnish side it occupies the territory of Oulanka National Park. The uniqueness of this territory is due to the very high natural state of the forests. In some areas there is no sign of felling or fires for at least 600 years (Smirnova & Korotkov 2001). Another unique value for the area is that within its borders there is the largest concentration of high-productive natural-state spruce forests anywhere in Fennoscandia (Anonymous 2004). Here the high productivity can be seen not from the qualities of the timber-stand only, but also as a dominance of herbs on some thousands of hectares scattered throughout this wilderness. In the Nordic countries these kinds of high-productive areas have normally been transformed by human activity long ago, and it is really exceptional to find them anywhere on a large scale. The best examples of almost natural high-productive forests in the area are situated in the northeastern part of Paanajärvi National Park and to the east of the park border (Ovaskainen 1998).

Muyezerka forest is located on the administrative border of Kostomuksha and Muyezerka municipalities of the Republic of Karelia. Over 100,000 hectares in extent, it consists of Kostomuksha Strict Nature Reserve and surrounding wilderness areas to the west, east and southeast of the nature reserve. It is the largest surviving territory of natural state, pine-dominated, high productive dense forests with middle boreal character in the whole of Europe. The forests are practically totally untouched east of the Kostomuksha Strict Nature Reserve, in an area that is part of the planned landscape zakaznik Spokoyny (71,600 ha). This is an area far from any major waterways, so it was spared from traditional logging activities in the past. There is no other wilderness area of just this type anywhere in Europe, and even at the global level it is really difficult to find other examples of a similar kind. Also Finnish species-studies (Lindgren 2001, Hottola 2009) show the area to be exceptionally rich in rare boreal forest species. Some small margins of the area spread onto Finnish territory and are already under protection.

Brook with rich mire-vegetation on its margins. Intact boreal forest of Maksimjärvi. Planned landscape zakaznik Spokoyny, Republic of Karelia. Photo: Jyri Mikkola.

The Ileksa River catchment area, located mostly on the lowlands of Vodlozero National Park in eastern Karelia and western Arkhangelsk Region and partly inside the planned landscape zakazniks Yangozero (37,400 ha) and Chukozero (58,300 ha) on the Karelian side of the administrative border, covers over 400,000 ha, mostly an intact mosaic of old-growth forests, mires and waterways. In Europe's forested vegetation zones, intact lowland catchment areas even approaching this size are practically non-existent. Even among little damaged catchment areas it is impossible to name any other of the size of the Ileksa's catchment area. Therefore it is really important to ensure that the planned protection areas will be established to protect the greater part of the whole hydrological entity. Despite its large size, the Ileksa's catchment area is only a part of a much larger intact forest landscape which spreads over the watershed between the White Sea and the Baltic Sea, and hosts the headwaters of many other rivers, too. On the territory of the Arkhangelsk Region, east of the Vodlozero National Park, stricter protection measures than at present are needed to secure the natural values of this intact forest landscape.

Onega Pomorye (or Onezhskoye Pomorye) wilderness area is located on a large peninsula jutting into the White Sea from the southeast. Originally there was a plan to establish a national park of almost 500,000 ha on the peninsula, but at present the size of the planned Onega Pomorye National Park is less than half of the original plan. Despite the fact that the originally planned protected area is at present being logged from the south, the wilderness area left is still the vastest high-productive wilderness forest area bordering the sea in Europe. Practically anywhere else than in northern Europe, the marine shoreline areas of Europe have been so populated for so long that almost all high-productive coastal and lowland forests have been under intensive use.

Verhneyulovsky (also known as "***Dvina Forest***"), the huge, spruce-dominated wilderness area on the plateau east of the River Northern Dvina in the Arkhangelsk Region is probably the only single object studied in the Gap analysis project that "could be easily seen even from the Moon". It is one of the largest intact forest landscapes on high-productive lowland areas in the whole of Europe. Only the central part of this wilderness is now under a protection plan (495,000 ha), so there is a high risk that without extra protection efforts this unique wilderness area will lose its most extraordinary value, i.e. its magnificent size (cf. Fig. 5.1.).

4.2.3. Wetlands

The study area of the Gap analysis is extremely rich in different types of wetlands and, except the southern part of the study area, they are mainly in a natural condition. In Europe, wetlands in general have been studied to a degree that allows the evaluation of the significance of the mires of northwest Russia in an international context. The data on the wetlands of northwest Russia, however, are not detailed enough to evaluate for instance single mire-types in the international context, thus the focus here is on the mire-massif level.

The Gap analysis, for instance, produced new information on the distribution of aapa mires outside the aapa-predominant mire provinces of Kola and Northwestern Karelia. The amount of aapa mires outside these two mire provinces turned out to be significantly greater than earlier studies have suggested which can be considered an internationally significant result of research.

Thinking beyond the concept of vast mire-landscapes (already pointed out as a value of international importance earlier in this chapter), those among the great diversity of mires that most deserve to be highlighted may be those with more or less unique structure, or those that represent wetland types that have vanished from most parts of Europe:

Ypäyzhsuo in northwest Karelia is an aapa mire system formed around several river-corridors. It exceeds 50,000 hectares, and the treeless fen areas in the middle of the mire are exceptionally vast. The vast marginal areas are bogs. Aapa mire systems this big with similar structure cannot be found anywhere else in northwest Russia (Komi included) or Fennoscandia, which together form the distribution of aapa mires in Europe. Ypäyzhsuo is the biggest Fennoscandian type aapa massif. The large aapa mires situated in the Arkhangelsk Region are so far little studied, but they are on sediment soil and their hydrology is probably different. They are valuable in their own category. Ypäyzhsuo is listed among the important peatlands of Russia (Botch 1999).

The Ponoi depression mires in the interior of the Kola Peninsula form a truly unique system of very wet aapa mires that surround the middle course of the River Ponoi and the courses of some of its tributaries. The size of this mire system is measured in terms of some hundreds of thousands of hectares (due to the nature of the surrounding terrain, determining the exact borders for the mire-system is very difficult in places). This mire-system has no

Gap analysis project gave much new information on aapa mires in northwest Russia, especially in Arkhangelsk Region. Sinichye mire is one of the splendid aapa mires with rich flora due to the hydrologic factors. Photo: Tapio Lindholm.

match in northwestern Europe. Part of the mire-system (Chalmny Varre mire) is also listed among the important peatlands of Russia (Botch 1999).

The Pomorsky Bereg *(Pomor Shore area).* Raised bog-systems represent here an exceptionally well developed and preserved raised bog succession series, formed on the coastal terraces of the southern part of the White Sea and representing various mire succession stages, from the coastal land-rise marshes to very old raised bogs of the uppermost coastal terrace. The Karelian part of the area (Nyukhcha) is listed among the important peatlands of Russia (Botch 1999).

Due to strong anthropogenic impact, alluvial swamps, mires and forests have become a rarity in most parts of the southern boreal and hemiboreal bio-climatic zones in Europe, as well as in more southern zones. Northwest Russia still offers very representative examples of combinations of these habitats, like the wetland system surrounding ***the confluence of rivers Vologda, Lesha and Suhona,*** just northeast of the city of Vologda.

The Ponoi depression mires harbour a great diversity of vegetation that is clearly visible in the satellite picture.

4.2.4. Archipelagoes

In the Gap analysis, no special survey or detailed analysis of archipelagoes was commited. However, vast inland-water archipelagoes in Europe are relatively rare, so evaluation of the international significance of at least one inland-water archipelago in northwest Russia can be given:

Lake Ladoga hosts in its northwestern part the vastest well-preserved inland-water archipelago in the whole of Europe. This is due to some historical reasons. In other areas of Europe, such as Finland, most archipelagoes are more or less populated or at least a significant part of their forests has been subject to logging relatively recently. Those inland archipelagoes that have remained truly intact, like the Lake Inari archipelago in northern Finland, are smaller in size than the Ladoga archipelago. On Ladoga the archipelago forests have avoided loggings for the last 60 years in an area where a great variety of rare habitats can be found, for example: broadleaf forests of nemoral character, calcareous rocks, steep cliffs and many communities of endangered species. These are in addition to various shoreline habitats like rocky beaches and sandy beaches with their special vegetation. Ladoga is also home for the endemic Ladoga ringed seal (*Pusa hispida ladogensis*) (Plan for the establishment… 2001). When the Ladoga Skerries National Park will be created, it will provide a good basis for the protection of the whole area. Establishing the planned protected area Kuznechnoye on the southern margin of the archipelago would complete the protection.

Most of the islands along northwestern shore of the Lake Ladoga are included in the planned Ladoga Skerries National Park. Republic of Karelia. Photo: Anna Kuhmonen.

5. FORMS OF TERRITORIAL PROTECTION OF BIODIVERSITY IN RUSSIA AND RECOMMENDATIONS ON CONSERVATION OF IDENTIFIED PRIORITY SITES

5.1. Biodiversity conservation through the development of a network of protected areas

Viktor Petrov

The main way to preserve natural values in the Russian Federation is the establishment of specially protected areas. According to the Russian Federation law "On Specially Protected Nature Areas", from March 14, 1995 № 33-FZ (Federal Law ... 1995), a protected area includes "...land, water surface and the air space above them, where natural complexes and objects that have special environmental, scientific, cultural, aesthetic and recreation value are situated. These areas are removed in whole or in part from economic use and a special protection regime is established by the decisions of the state authorities". As can be seen from this definition, protected areas serve as a legal tool banning or restricting economic activities in a particular area, and they are not always created in order to preserve exclusively natural values. Quite often, the objective of the creation of a protected area is also conservation of cultural values, in particular historical and memorial sites. The concepts of scientific and recreational values of protected areas are rather blurred and could allow using protected areas for non-core tasks, such as the establishment of buffer zones around sites for geophysical research, or to restrict the industrial use of land which is intended for future recreational building. In such cases protected areas fail to achieve the objectives for which they ought to be established. However, the fact that the Federal law provides for the establishment of protected areas in territories harboring natural complexes and areas of special conservation value (HCV areas) allows considering protected areas as a basic tool to improve the situation regarding gaps in the protection of HCV areas identified during the Gap analysis project. The Russian Federal law on protected areas directly provides for the following categories:

- Strict state nature reserves (zapovedniks)
- National parks
- Nature parks
- Zakazniks (state nature reserves with flexible protection regimes)
- Nature monuments
- Dendrological parks and botanical gardens;
- Health resorts and healing landscapes
- Areas conserving and maintaining traditional (rural) nature use.

In addition, the Russian Federation law on protected areas provides possibility that the Federal Government, regional governments and local authorities may establish other categories of protected areas in addition to those listed in the law. However, there is a tendency towards strict ordering of types of protected areas, which could lead to the removal of such a possibility from federal law. Therefore, the establishment of protected areas which belong to the categories directly listed in federal legislation seems more reliable for the protection of HCV areas and other types of valuable natural complexes.

It should also be noted that the territories of traditional nature use have uncertain legal status, complicating their creation. Dendrological parks, botanical gardens, therapeutic areas and resorts are primarily oriented to specific aims, allowing transformation of natural biotopes towards optimization of their recreational use. Thus, to preserve the intact or minimally transformed natural areas which have been selected and mapped in the Gap analysis project, the most effective way is planning for the following categories of protected areas: strict nature reserves, national parks, nature parks, zakazniks and nature monuments.

The establishment of strict nature reserves is the most preferred form of conservation of undisturbed natural communities. They usually cover large areas and all natural complexes within strict nature reserves are completely withdrawn from economic activities. However, in the study area, there are almost no territories outside the existing protected areas which can be completely removed from economic use without significant effect on the interests of the local population. In addition, strict nature reserves are owned by the Russian Federation and can only be established at the federal level. In recent times, federal protected areas have been created only in accordance with special programs approved by the Russian government. Therefore, planning the establishment of federal protected areas to ensure protection of HCV areas identified in this study is reasonable only in such cases when such action is already intended under the programs approved by the government of the Russian Federation, or projects within such programs. National parks are created in the same manner as strict nature reserves, i.e., they must be included in the federal programs for the development of the national protected area network.

National parks, nature parks, zakazniks and nature monuments differ slightly (Ayupov et al. 1999). Zoning of territory intended for different types of nature use, from strict protection to allowing some economic activities, is done in both national parks and nature parks. In Leningrad Region, the possibility of zoning territory is included also in the regulations of zakazniks. This means that regional zakazniks do not significantly differ from nature parks in the form of their organization. In all other regions of the study area, zoning in zakazniks and nature monuments can not be done directly (simply by indicating areas with different modes of protection and economic use), but only by indication of the type of protection regime for particular areas within a zakaznik or nature monument. The use of such indirect zoning may be difficult to understand, both for visitors and for the application of the protection regime, so this version of zoning should be used with caution.

Nature monuments differ from national parks, nature parks and zakazniks in that they are usually established not for the preservation of a particular territory which includes natural biotopes and their complexes, but for the protection of certain natural biotopes and their complexes. The distinction is quite nominal because complexes of natural biotopes may include, for example, an array of hills or mire massif that are large enough in size and virtually indistinguishable from territories which are included in a nature park or zakaznik. From a managerial viewpoint, nature monuments differ from national parks, nature parks and zakazniks in that the creation of a nature monument does not require, under the legislation, the creation of management institutions or administration to provide any type of protection regime for the territory of the nature monument.

The Federal law on specially protected nature areas (Federal Law... 1995) provides a possibility for the reservation of land plots for subsequent creation of protected areas. The protection regime in the reserved plot may already include the main constraints applicable to the planned protected area. Negotiation procedures for reserving land plots are easier than those directly aimed at establishing a protected area because they do not require the same level of ecological documentation. Thus, the reservation of land plots is a good means of immediate conservation of endangered natural biotopes preliminary to the creation of protected areas. However, the following should be considered. First, the reservation of land can be done only in accordance with the accepted schemes for the development of a regional protected area network. In other words, one can use the tool of land reservation only for those biotopes whose nature conservation value has previously been accepted by decisions of federal, regional or local administrations, and which are expected to be included in the planned protected areas in the future. Second, Russian Federation legislation sets a 7-year time limit: if a planned protected area has not been established during this period – due to lack of funding, for example – the reserved area loses its temporary protected status and is again threatened.

The regulations concerning conservation of biodiversity through the development of a network of protected areas in the Russian Federation do not meet modern needs. In fact, current legislation does not include clear regulations concerning (1) the basis for the creation of protected areas, (2) selection procedures for various categories of protected areas and their protection regimes, (3) the required number of protected areas of different forms as shares of the area of the entire administrative unit depending on the level of economic development of this unit, or (4) rules for ecological restoration in protected areas. Significant loopholes also exist in the management regulations and protection of existing protected areas, especially of those at the regional level. A project aimed to identify, analyze and find ways to optimize the management of regional protected areas was

Mire near Lake Ala-Akkajärvi (6,566 ha), planned nature monument. Murmansk Region. Photo: Gennady Aleksandrov.

carried out also in the framework of the Finnish–Russian Development Program on Sustainable Forest Management and Conservation of Biodiversity in Northwest Russia. The results of this project have been published recently in "Assessment of the management and needs of regional protected areas in Northwest Russia" (Milovidova et al. 2011).

It seems that one cause of weakness in the development and management of regional protected areas in northwest Russia is the lack of their integration in the economy. Until an effective way for such integration is found, regulations concerning the establishment and management of protected areas will remain vague because state administrations at every level seem less than eager to take on unfunded liabilities. Unfortunately, we can predict the continuation of this situation in the coming years too. The uncertainty in legal regulations concerning protected area network development and management will continue, or we will be faced with an even worse scenario with regulations changing towards reducing opportunities for effective conservation of biodiversity in intact natural biotopes.

Currently, the Russian authorities tend to integrate protected areas into the economy through the development of recreation. This is quite reasonable; however, if the development of the protected area network is aimed only towards gaining economic benefits from protected areas for local communities (e.g., creating visitor facilities and services, contacts with tourist companies and entrepreneurs, etc.), many of the HCV areas revealed in the Gap analysis project will not be taken under protection in the immediate future.

Based on the results of the Gap analysis project we offer the following recommendations for the development of the existing protected area network in order to fill gaps in the protection of HCV areas. We believe that these recommendations could be implemented during coming years despite the absence of clear regulations concerning optimization of the existing protected areas' management and the reluctance of local administrations to establish new protected areas:

1. Take maximal efforts to include in planned **national parks** in the federal programs on the development of protected areas all those sites that have high recreational appeal and for which the development of recreation does not lead to decrease of their conservation value (i.e. ecotourism can be managed in ways compatible with the protection of species and their habitats). National parks provide better employment of local people than nature parks and are therefore the most attractive type of protected area for regional and municipal authorities. At the same time, we can assume that the development of national parks will be provided with the greatest managerial effort from the state authorities because their emphasis on recreation allows them to be integrated in the economy.

2. There are a number of other conservation measures that do not have the same status as the national parks but are also important for nature conservation. For instance, in current conditions, the protected area category of nature monument seems very useful and should be used more extensively. We recommend establishing nature monuments in all cases where it is possible to overcome the difficulties of small size, and when the characteristics of the natural object allow the creation of a nature monument. This type of protected area entails little or no financial costs for management, and there is no time limit to its existence. In fact, the establishment of nature monuments (usually intended for further transformation into a more effective type of protected area) is a more reliable form of conservation of HCV areas than the simple reservation of land plots which is also permitted by Russian law (see above).

3. There are still many sites whose high conservation value has been preserved in spite of their natural resources being used in some way. In these areas we recommend the creation of "soft mode" protected areas, prohibiting only the main disturbance ac-

tivities (e.g. logging, mining and associated activities, construction, etc.) and conserving traditional modes of use of natural resources. In such cases we recommend the creation of zakazniks, managed by collegial administrations including representatives of companies and institutions interested in long-term sustainable use of the site, and therefore in preventing destruction of the natural environment. These zakazniks will have the support of local communities and do not require substantial funds for their management from local authorities.

4. The establishment of so-called "compensational" protected areas when, for public image reasons, companies whose economic activity threatens valuable natural objects need to support the creation of protected areas, preserving them at least partly.

These guidelines do not completely avoid current problems in the development of a network of protected areas. Therefore, besides the establishment of new protected areas, we must also take into account all suitable methods promoting conservation of HCV areas outside protected areas. The next section is devoted to the consideration of methods which could be applied mainly to forest areas, because the Gap analysis project was focused on areas dominated by forest vegetation.

5.2. Conservation of biodiversity outside protected areas

Alexander Markovsky & Andrey Rodionov

5.2.1. Levels of biodiversity

Conservation of wildlife, or conservation of biodiversity in conditions of increasing human impact, can preserve the natural environment, ensure its stability under negative influences and contribute to the stabilization of conditions for the existence of human civilization.

In practice, conservation of biodiversity is very difficult, requiring the combined efforts of experts on different aspects. Currently available theoretical analyses (e.g. Andersson et al. 2001, Biotic diversity... 2003, Wennberg et al. 2005, Groom et al. 2006, Asunta et al. 2007) provide the basis for a rough classification of natural objects in need of protection as follows:

- Intact forest landscapes: large forest areas (more than 50,000 ha) that are important at the global and national levels
- Rare and unique ecosystems: smaller areas (100 ha to 50,000 ha) occupied by biotopes with high conservational value, significant at the regional and local levels
- Key biotopes (key habitats): relatively small areas of special biological value (less than 100 ha), significant at the local level.

Level 1. Intact Forest Landscapes

These are large natural areas untouched or minimally disturbed by human activities that are important at the global and national levels. Within the forest zone, an intact forest landscape must have an area not less than 50,000 ha with no permanent settlements or transport infrastructure (other than directly related to operation of the state border) and unaffected by modern intensive economic activities. These territories, due to their large areas, are able to tolerate periodic natural catastrophes (e.g. extended fires, outbreaks of forest pests) and increasing human impact. From the point of view of forestry, intact forest landscapes should include forests which are defined as "climax" or "virgin" according to the current forestry industrial standard (OST 56-108-98. Forestry. Terms and Definitions, 1998).

The great value of intact forest landscapes is their function in the global perspective, like regulating global ecological balance, maintaining the stability of the biosphere, and preventing environmental crises. Intact forest landscapes support water and air resources, regulate the content of carbon dioxide in the atmosphere, and maintain natural biological diversity. Intact forest landscapes maintain

Intact forest landscape in planned zakaznik Poryi Forest. Murmansk Region. Photo: Gennady Aleksandrov.

the functional self-sufficiency of natural biotopes within them. Unaltered ecosystems which exist within intact forest landscapes could serve as standards of biological diversity and natural dynamics.

In the study area, intact forest landscapes are mostly represented by old-growth forests, either untouched or minimally transformed, and also non-forest ecosystems, like intact mires of various types, water bodies, forest-tundra sites, etc. The extensive area of protected forest in Kalevala National Park (Republic of Karelia), and the unprotected forest area on the watershed between the rivers Northern Dvina and Pinega (Arkhangelsk Region) and other intact forest landscape examples are described in Yaroshenko et al. (2001), Gromtsev (2001), Aksenov et al. (2003), Biotic diversity ... (2003).

Level 2. Rare and unique ecosystems
This category includes valuable natural areas measuring from 100 to 50,000 ha. They are often the remnants of former intact forest landscapes (in conjunction with intact non-forest ecosystems), fragmented due to recent human impact (Gromtsev 2001, Jennings et al. 2005, Bublichenko et al. 2006). These areas are characterized by the absence of modern intensive human activities and have preserved the natural structure and dynamics of forest communities. Unique landscapes and habitats of rare and protected plant and animal species, including those listed in the federal and regional Red Data Books, are often present. Territories that have been transformed by human activities but have retained non-forest natural values, e.g. geological, aquatic, or wetland objects, also belong to this category.

As examples we can indicate here fragmented old-growth forests in the planned Zaonezhye Nature Park, situated on the Zaonezhye Peninsula in the northern part of Lake Onega (Republic of Karelia), and fragments of old-growth forests dominated by spruce and fir in Vologda Region and in the south of Arkhangelsk Region.

Level 3. Key biotopes
This category includes small HCV areas of less than 100 ha and individual objects of special conservational value. Key biotopes, due to such factors as the presence of unique substrates, moisture conditions or light, for example, are in fact key habitats of species which are rare or vulnerable to human impacts. They may serve as refuges and dispersal centers for these species and are repositories of local biodiversity (Axelsson & Norén 2003, Svedlund & Löfgren 2003, Jennings et al. 2005, Groom et al. 2006; Asunta et al. 2007).

Key biotopes or key habitats may include rock fractures, edges of mires, shores of lakes and rivers, and other features, usually different from those typical in the surrounding areas. Even relatively small objects, like a rock outcrop, a single log or snag of a huge old tree (e.g. aspen), can be called key habitats if they harbour populations of species which are confined only to them.

Key biotopes usually have no value as commercial forest or agricultural land (e.g. moist forest types, narrow strips of meadows along shores, wetlands, and old trees, dead or with moribund parts, etc.). This makes recommendation of their protection easier. However, key-biotopes are usually very small, and, therefore, selection and mapping of them is not possible in the perspective of the whole administrative unit. Field inventories of the areas intended to be treated with logging seem the only way to find key biotopes and define their borders.

Intact forest tract in the planned Zaonezhye Nature Park. Republic of Karelia. Photo: Oleg Kharchenko.

New houses built within the planned Ladoga Skerries National Park. Republic of Karelia. Photo: Elena Pilipenko.

5.2.2. Threats to biodiversity

In the study area the most significant threats to biodiversity are:

- forest logging (see example in Fig. 5.1)
- mining and associated operations
- development of infrastructure (settlements, roads, power lines, etc.).

5.2.3. Biodiversity conservation outside protected areas

Of course, the best way to conserve biodiversity is to eliminate or severely limit human activities in accordance with current federal law and regional legislation concerning protected areas. However, this is not always possible due to imperfect legislation and socio-economic reasons.Under these circumstances, the conservation of biodiversity outside protected areas is of particular relevance. In each administrative unit, ways to preserve biodiversity outside protected areas should be found which take into account the presence of HCV areas and the specific nature use in the region.

To maintain levels of biodiversity outside protected areas we recommend the following measures (Markovsky et al. 2007):

- Territories of the **first level** should be excluded from human impact, either giving them the status of protective forests (i.e. forests which serve to protect some elements of the environment, like water-protective forests, protective forests in tundra zone, etc.), or declaring a voluntary moratorium on the use of these areas (if the creation of protected areas, for whatever reason, is not possible)
- Territories of the second level should be entirely or partly withdrawn from the the threat of anthropogenic transformation by giving them temporary SPS (specially protected site) status. This procedure is in accordance with current Forest legislation of Russian Federation: Forest Code of the Russian Federation on 04.12.2006 N 200-FZ, hereafter Forest Code (Forest Code…2006). The other option is to permit there only such activities as will ensure the preservation of existing natural values or reduce dam-

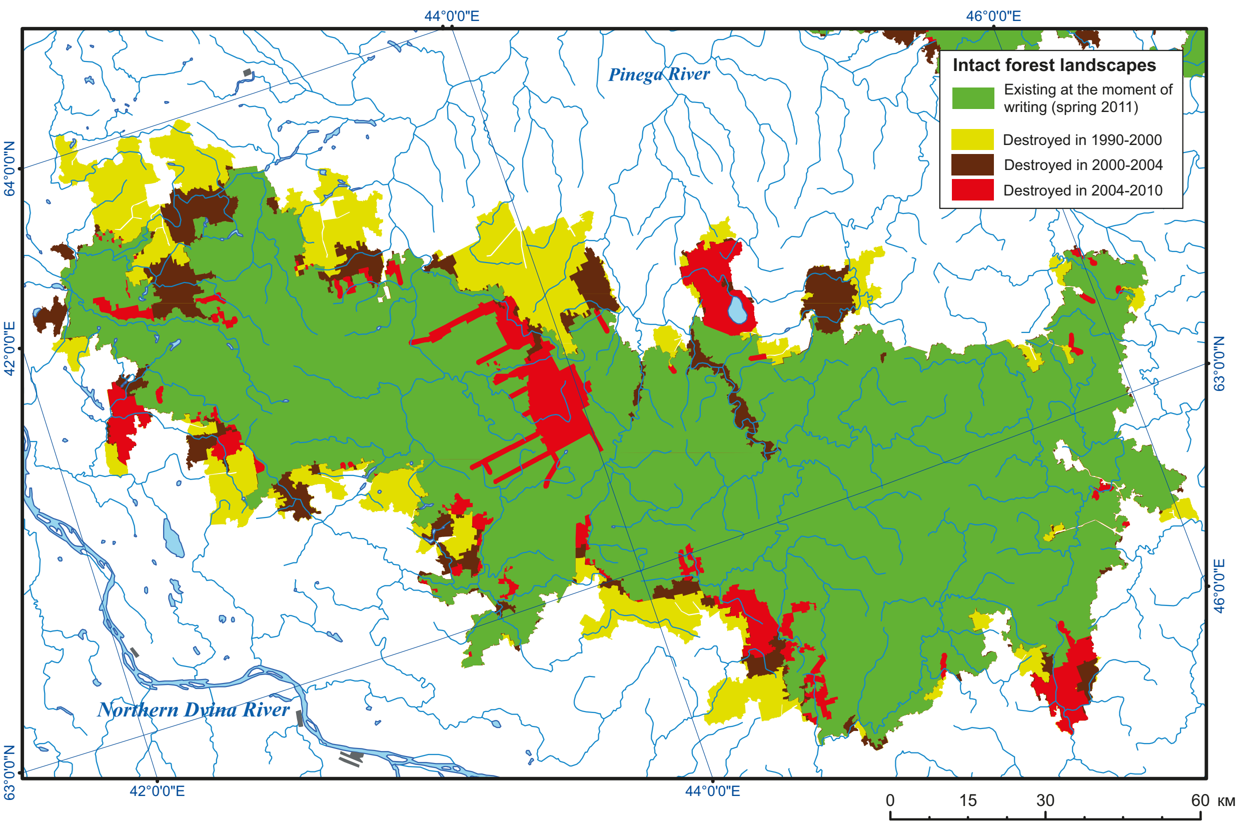


Fig. 5.1. Intact forest landscape between Northern Dvina and Pinega rivers and its reduction during 1990-2010 due to major logging. Planned zakaznik Verkhneyulovskyi, Arkhangelsk Region.

age (e.g. to allow selective logging only in winter). Voluntary forest certification (Forest Stewardship Council, FSC) could also promote preservation of these areas as high conservation value forests.

- Territories of the **third** level may be protected through precise identification in the terrain followed by exclusion from planned timber harvesting (e.g. as specially protected sites), or directly during the procedure of defining logging areas, i.e. the selection of sites to be excluded from exploitation.

5.2.4. Mechanisms of biodiversity conservation outside protected areas

Mechanisms for the conservation of biodiversity outside protected areas may be classified as follows:

Protective forests outside protected areas
In the Russian Federation, protective forests currently cover 22% of the entire forest land (19% of forest-covered land excluding clear cuts). Many of them serve as protection for water bodies. Formerly, forests situated along the shores of lakes and rivers to protect these sites of aquatic biological resources were considered as protective forest and were automatically excluded from logging. Forest Code (Forest Code…2006) has made environmental legislation in Russia more complicated. Currently, these forests bordering water bodies can be attributed to at least eight different categories of protection (a single plot may be attributed to several of them). According to the Forest Code and the 2006 Water Code of the Russian Federation, hereafter Water Code (Water Code…2006), these categories are as follows:

1. coastal protective strips, Article 65 of the Water Code (Water protective zones and near-shore protective belts)

2. water protective zones, Article 65 of the Water Code, Articles 102 (Protective Forests and Special Protective Parcels of Forests) and 104 (Legal Regime for Forests within Water-Conservation Zones) of the Forest Code

3. restricted forest belts along water bodies, Articles 102 and 106 (Legal Regime for High Value Forests) of the Forest Code

4. protective forests for spawning rivers, Articles 102 and 106 of the Forest Code

5. forests located in the first and second belts of sanitary protective zones of sources of drinking and domestic water supply, Articles 102 and 105 (Legal Regime for Forests which Perform Functions of Protecting Nature and Other Sites) of the Forest Code

6. fish-conservation areas, Article 48 of the Federal Law "On Fishery and Preservation of Aquatic Biological Resources" (Federal Law …2004)

7. categories of specially protected sites for "protective forest areas for banks and soil along water bodies and slopes", Article 104 (Legal Regime for Forests within Water-Conservation Zones) of the Forest Code)

8. categories of specially protected sites for "strips of forest along rivers or other water bodies inhabited by beavers" (*Russian* Instruction on *Forest Inventory* 1994).

By classifying intact or minimally transformed forest tracts as protective forest, we may promote conservation of biodiversity in territories of the first and second levels according to the classification discussed above (intact forest landscapes, rare and unique ecosystems outside protected areas).

Voluntary moratorium
A voluntary moratorium is a freewill decision of the economic entity to exclude some area(s) from economic use (logging, mining, etc.), drawn up in accordance with generally accepted procedure.

A voluntary moratorium may be appropriate in cases where the immediate establishment of a protected area or the assignment of territory to the category of protective forests is, for any reason, impossible.

This mechanism, as well as the establishment of protective forests, seems applicable to the same levels of biodiversity, i.e. intact forest landscapes, rare and unique biotopes. Currently there are more than ten such moratoria in the territory of northwest Russia. The following examples are from the Republic of Karelia:

- "Statement on Environmental Policy in Forest Management of the Segezha Pulp and Paper Mill" (26.10.2005). The Segezha Pulp and Paper Mill hereby declares that it will not procure through its own divisions, nor will it purchase from other suppliers, timber which originates from old-growth forest, as defined by the forest inventories and maps of intact forest landscapes of the northern areas of European Russia (2004), including all sites of old-growth forests revealed in the Republic of Karelia and in Murmansk Region during inventory work conducted by the Forest Club of Russian environmental NGOs in 1997-2005.

- "Protocol of Agreement on the protection and use of old-growth forests situated in the Yangozero area of the Pudozh central forestry unit under lease to the timber company Karellesprom, (12.07.2008)." This document states that the timber company Karellesprom, during the period of lease, will not carry out logging, road construction or other activities that may affect natural forest ecosystems in old-growth forest areas located in forestry grids (quartals) 2, 4-7, 10-14, 17-19, 21-26, 34-38, and 48-50. When the temporary leasing agreement is re-negotiated in the future, both partners will apply to the Ministry of Forestry and other executive bodies of the Republic of Karelia to deduct rental charges to Karellesprom for the abovementioned areas. At present, Karellesprom supports the efforts of the Karelian Regional Nature Conservancy (NGO SPOK) on the establishment of a new protected area, the landscape zakaznik Yangozero, with a strict protection regime. Zakaznik Yangozero is included in the list of planned protected areas approved as part of the Scheme of Spatial Planning of the Republic of Karelia, approved by directive of the government of the Republic of Karelia, № 102-P, July 6, 2007.

Selection of key biotopes and key habitats

To preserve areas which belong to the third level of the classification discussed above (key biotopes), their borders must be exactly selected and mapped. Then all kinds of human impact leading to their deterioration must be excluded. For instance, these areas should have status of specially protected sites when their surroundings are planned for harvesting, or directly during the procedure of defining logging areas, i.e. the selection of sites to be excluded from exploitation. These measures may allow the most valuable key biotopes to be retained as natural biogroups within cut areas.

Currently in the Russian Federation there are a number of methods which can be used for selection of key biotopes:

- "Recommendations for the conservation of biological diversity in the process of logging in Kirov Region" (approved and recommended for testing and further practical use by the Council of the Federal Forestry Agency)

- "Recommendations for combination of final felling with environmental conservation in areas of old-growth (virgin) forest in the Republic of Komi" (approved and recommended for practical use at the meeting of the Scientific and Technical Council of the Forestry Agency of the Republic of Komi) (Guidelines ... 2005)

Extended areas of old-growth forest situated in the Yangozero area of the Pudozh central forestry unit, leased to the timber company Karellesprom, were temporarily excluded from logging under a voluntary moratorium by the company. Photo: Oleg Kharchenko.

- “Key habitats of the Arkhangelsk Region and recommendations for their protection”, published in a series on conservation of biodiversity in forest ecosystems of Arkhangelsk Region (Ray et al. 2008)

- “Guidelines for conservation of biological diversity during logging in the Republic of Karelia”. Approved by the Ministry of Forestry of the Republic of Karelia, 16.11.2009. (Markovsky & Ilyina 2010)

Red Data Books
Despite the lack of effective legal mechanisms for giving conservation status for habitats of species listed in the Red Data Book of the Russian Federation and the regional Red Data Books (see 3.3.16), these are currently the main tools for ensuring the protection of rare species, in accordance with the Federal Law on Environmental Protection (10.01.2002). In many cases it would be possible to prevent human activity threatening the habitats of rare species by decisions of the supervisory and judicial authorities.

As an example, the Arbitration Court of the Republic of Karelia invalidated the agreement between the Ministry of Forestry of the Republic of Karelia and the timber company Komileszagotprom on the leasing of Grid No. 141 of the Ladvozero forestry unit (decision of the Arbitration Court of the Republic of Karelia from November 7, 2008, № A26-2602/2008). One of the reasons for this decision was the presence of the lichen Lobaria pulmonaria (included in the Red Books of both the Russian Federation and the Republic of Karelia) in the old-growth forest in question.

5.2.5. Conclusions and recommendations

1. There are several legal means of conserving HCV areas outside protected areas in the study area.

2. The approach based on the discrimination of three levels of biodiversity (intact forest landscapes, rare and unique ecosystems, and key biotopes), seems the most useful for biodiversity conservation in the current situation.

3. Saving HCV areas on all three levels of biodiversity outside protected areas should be considered an intermediate target on the way towards the establishment of new protected areas.

4. Using a voluntary moratorium should be recommended chiefly in those cases where the immediate establishment of protected areas or assignment of the territory to protective forests seems impossible.

5. Development of Russian federal and regional legislation is needed to ensure uniform approaches concerning preservation of rare and unique ecosystems, and key biotopes.

6. Species listed in federal and regional Red Data Books are well-protected by law but not in practice. This law should be used more widely to provide a basis for improving the protection of their habitats, with the assistance of supervisory and judicial authorities.

5.3. HCV areas requiring urgent protective measures in 2011-2013

Denis Dobrynin, Aleksander Kirillov, Nadezhda Maksutova, Aleksander Markovsky, Maria Noskova & Viktor Petrov

A large number of HCV areas needing urgent protection have been revealed during the Gap analysis project. The threats are either present or imminent, and affect the existence of these areas or their extremely high nature conservation value, which must be protected from even hypothetical threats. However, creating new protected areas for all of these HCV areas, or to protecting them outside protected areas using the methods described in 5.2, must be well-documented and therefore need time.

The Russian regional experts who are listed as the authors of this chapter have prepared a list of the HCV areas which need the most urgent protection measures during 2011-2013 (Table 5.1). In addition to the criteria of conservation value listed in 2.1.3., we also took into account some values related to factors that are not included in the analysis (for example, value for geological and paleontological studies).

In the City of St. Petersburg, the Republic of Karelia, Arkhangelsk and Leningrad Regions, the boundaries of the HCV areas listed in Table 5.1. coincide with those recommended for the establishment of new protected areas. In Vologda and Murmansk Regions the situation is different. In

Vologda, the results of the Gap analysis project show that current plans for development of the regional protected area network should be changed towards creation of ecological corridors between HCV areas. We propose to establish there three inter-connected complexes of protected areas. In Murmansk Region, a planned nature park situated on the Rybachy and Sredny Peninsulas is aimed to protect not only intact nature areas, but also adjacent territories that have some cultural and historical value. For this reason, we include in the Table not the entire territory of the planned nature park but only those HCV areas which have been revealed in this study.

Table 5.1. HCV areas recommended for urgent protection measures in 2011-2013.

Number on map (Fig.5.2)	Name and category of planned PA	Brief background of conservational value and need for urgent protection
Murmansk Region		
1	Khibiny National Park	The greatest mountain massifs in Murmansk Region and in the whole northwest Russia. This area has several unique features, like exposed bedrock areas of the ancient pre-Cambrian Baltic Shield, mineral composition of soil-forming rocks, and extremely high species diversity (currently recorded species numbers: over 400 vascular plants, 300 mosses, 150 liverworts, 400 lichens, 27 mammals, 123 birds, 2 reptiles, and one amphibian). More than half of the species listed in the Red Data Book of the Murmansk Region (2003) occur in this area, and many of them only there. These are 8 vascular plants (including the endemic *Papaver lapponicum*), 8 liverworts, 19 mosses and 5 lichens. The area has high recreational potential. At present, however, only unregulated tourism is developing there, which may have a deleterious effect on sensitive communities existing in these mountains at high altitudes.
2	Kutsa Nature Park (re-organization of the existing zakaznik Kutsa towards higher category and enlarged area).	The area is covered with minimally transformed northern boreal old-growth forest. The mosaic of various relief forms in combination with the well-developed hydrological network produces a landscape of great beauty with high recreational potential. Many kinds of natural biotopes are preserved there, harboring high species diversity. About 300 species of lichens, 100 liverworts, 300 mosses and more 370 vascular plants occur in the existing zakaznik. Terrestrial vertebrate fauna include 2 species of amphibians, 2 reptiles, 106 bird species and 29 mammals. Of these about 20 species are included in the Red Data Books of different levels. More than 100 species of vascular plants, ca. 50 lichens, and ca. 50 mosses have been recorded in the area planned for addition to the existing zakaznik.
3	Zakaznik Lapland Forest	This vast area incorporates combinations of alpine tundra areas in the forest zone with minimally transformed northern boreal old-growth forest, chiefly spruce-dominated. Several red-listed species of plants and animals are found there.
4	Zakaznik Poryi Forest	The area is covered with northern boreal old-growth forest in combination with alpine tundra areas and mires. All biotopes here seem either intact or minimally transformed and harbor many red-listed species. Intact mires, including mesotrophic spring fens, are of special value owing to their rarity and the extremely high species diversity of their vegetation.
5	Zakaznik Kolvitsa (re-organization of the existing zakaznik for improved HCV area protection and expansion).	The re-organization of the area of the existing zakaznik excludes areas which have no special conservational value. At the same time, areas of intact old-growth forest currently outside the zakaznik will be included. This will increase the area of preserved intact and minimally transformed forests and promote conservation of key habitats for many red-listed species.
6	Zakaznik Ponoi (re-organization of the existing zakazniks towards optimizing the protection of HCV areas).	The aim of re-organization of this zakaznik is to conserve three HCV areas currently only partly within the zakaznik. One HCV area is a wetland situated in the middle reaches of the Ponoi River which completely fulfils the requirements of the Ramsar Convention. The other two are situated at the mouth of the Ponoi and in the valley of the Rusinga River. They are characterized by unique floristic features and incorporate many rare and threatened species, including some listed in the federal Red Data Book.

Number on map (Fig.5.2)	Name and category of planned PA	Brief background of conservational value and need for urgent protection
7	Gorodets sea bird colonies, Skorbeev Bay, Eina Bay and rocks on the Sredny Peninsula	These are typical examples of Important Bird Areas in Russia. They are situated on two adjacent peninsulas, Rybachy and Sredny. Both areas are characterized by high species diversity and high conservational and scientific value. They are under threat because of recreational pressure and uncontrolled construction of recreational objects.
Republic of Karelia		
8	Ladoga Skerries National Park	The largest well-preserved inland archipelago in the whole Europe. The archipelago forests have avoided loggings for the last 60 years in an area where a great variety of rare habitats can be found, for example broadleaf forests of nemoral character, calcareous rocks, steep cliffs and many communities of endangered species. These are in addition to various shoreline habitats like rocky beaches and sandy beaches with their special vegetation. Ladoga is also home to the endemic Ladoga ringed seal (*Pusa hispida ladogensis*). The area is under threat from uncontrolled recreation, logging and construction of infrastructure which is not compatible with the protection of natural biotopes.
9	Zaonezhye Nature Park	The area possesses unique relief formations: long and narrow ridges of preglacial bedrock, and moraine hills, kames and eskers with deep depressions between them occupied by the bays of Lake Onega and inland lakes with large archipelagoes. Of great interest are *Shungite Cambisols*, a unique soil type which evolves on carbonaceous shale eluvium. These soils owe their high natural fertility to the carbon present in the soil-forming rock and are called “the Olonets Chernozems” because of their typical black color. High soil fertility, in combination with relatively moist climate with mild winters, produces high biodiversity of flora and fauna, which is typical for preserved sites of old-growth forest, for secondary forest formed on clear cuts without any management, and for non-forest ecosystems. The presence of scenic landscapes with unique recreational properties, as well as many historical and ethno-cultural monuments, makes the area attractive for tourists. At present, the area is under threat from logging, uncontrolled recreation, and construction.
10	Zakaznik Spokoyny	This is the largest (over 100,000 ha) surviving territory of natural state, pine-dominated, high productive dense forests south of the northern boreal sub-zone in the whole of Europe (according to the unified system of bio-climatic vegetation zones by Hämet-Ahti 1981). The forests are practically totally untouched because the area is situated far from any major waterways, so has been spared from traditional logging activities. There is no other wilderness area of just this type anywhere in Europe, and even at the global level it is really difficult to find other examples of a similar kind. Also Finnish species studies (Lindgren 2001, Hottola 2009) show the area to be exceptionally rich in rare boreal forest species. At the moment of writing (spring 2011) this area is under threat of logging by several timber companies which have leased forest plots.
11	Zakaznik Chukozero	This area incorporates 58,300 ha of intact forest landscape including a mosaic of old-growth forests, mires and waterways. This is only a part (on the Karelian side of the administrative border) of a large intact forest area covering over 400,000 ha. In Europe’s forested vegetation zones, intact lowland catchment areas even approaching this size are practically non-existent. The area harbors rare and threatened species of animals, vascular plants, fungi, lichens and mosses. Many of them are red-listed. This is due to the presence of a variety of habitats which can be found only in intact landscapes. These intact landscapes have been formed after the last glaciations, developing naturally since then, undergoing periodic natural catastrophes, like fires and windfalls. This area is a remnant of the primeval taiga forest surrounded by vast areas transformed by logging.
12	Zakaznik Yangozero	This area of 37,400 ha is another part (adjacent to Chukozero) of the same large intact lowland catchment area covering over 400,000 ha in the Republic of Karelia and Arkhangesk Region. The area is situated in the watershed between the White and Baltic Seas, including the source of the River Vyg, the largest in Karelia. Thus, one great value of unaltered forests and wetlands there is their function in the water balance of many larger lakes and rivers.

Number on map (Fig.5.2)	Name and category of planned PA	Brief background of conservational value and need for urgent protection
13	Zakaznik Ypäyzhsuo	This is an aapa mire system formed around several river-corridors. It exceeds 50,000 hectares, and the treeless fen areas in the middle are exceptionally vast. Aapa mire systems this big with similar structure cannot be found anywhere else in northwest Russia (Komi included) or Fennoscandia, which together form the distribution of aapa-mires in Europe. Ypäyzhsuo is listed among the important peatlands of Russia (Botch 1999).
Arkhangelsk Region		
14	Zakaznik Solzensky	One of the largest remnants of the Late Vendian Metazoa, situated on the White Sea shore. The crystalline rocks are fine-grained and soft, preserving the finest details of their fossils, and soft, making the dissection and study of their internal structures easier. Soil erosion and destruction of the sea shore require immediate action to preserve these important paleontological deposits.
15	Zakaznik Shilovsky	This area is a habitat for the southernmost population of the wild forest reindeer (*Rangifer tarandus tarandus*) in Arkhangelsk Region. High diversity of suitable biotopes within the area is important for maintaining the reindeer population. Expansion of the area to 50,000 ha will improve conditions for the reindeer population.
16	Zakaznik Verkhneyulovsky	This is one of the last intact forest landscapes in a catchment area of a medium-sized river in the southern boreal sub-zone of Europe. This large protected area, if established, would be very important in maintaining the ecological balance of the entire region, harboring many species included in the Red Data Books of the Russian Federation and Arkhangelsk Region. Examples include birds (*Aquila chrysaetos, Bubo bubo, Falco subbuteo*, *Glaucidium passerinum*, *Strix nebulosa*), plants (*Cypripedium calceolus*, *Dactylorhiza traunsteineri, Paeonia anomala*, etc.), lichens (*Bryoria fremontii*, *Lobaria pulmonaria*, etc.), and mosses (*Sphagnum subfulvum, etc.*). Ca 10% of all salmon spawning rivers in the Arkhangelsk Region are situated in this area. The area is also important in conserving and maintaining traditional nature use by local population, and has high recreational potential, e.g. in water, hunting, and educational tourism.
17	Zakaznik Uftyugo-Yileshsky	This is a core zone of intact landscape of southern boreal forest on a moraine fluvio-glacial plain. It incorporates several HCV areas, like old-growth forests dominated by spruce and fir, low density old-growth forests, aapa mires and spring fens. The area is important for protection of the hydrological regimes of major rivers – the Uftyuga, Ilesha, and Osa – in their upper reaches. Creating a protected area here is important for the maintenance of ecological balance of the eastern part of Arkhangelsk. Populations of wild forest reindeer survive in the area and many red-listed species have been recorded.
Leningrad Region		
18	Ingermanland (Ingermanlandsky) Strict Nature Reserve	Situated on islands in the eastern Gulf of Finland. Grounds for the establishment of a strict nature reserve here are conservation of the marine and insular ecosystems in the eastern Baltic area, the habitats of many marine plant and animal species, pre-spawning concentration areas and spawning sites for the main commercial fish. The islands also have great value as resting and breeding sites of migratory birds, and are considered a key area for the existence of the migration route from the White Sea to the Baltic Sea. Further, the establishment of this protected area will promote protection of many other rare and endangered species of animals, plants and fungi. The area possesses high potential for conducting international biological studies and development of educational tourism. At present, there are several threats due to strong human impact, primarily construction of the underwater gas-pipeline Nordstream and numerous oil and coal terminals.

Number on map (Fig.5.2)	Name and category of planned PA	Brief background of conservational value and need for urgent protection
19	Regional complex zakaznik Morye	This relatively small area on the southwest shore of Lake Ladoga has kept its natural state and could serve for studying the history of the formation of Ladoga Lake and the landscapes of the Karelian Isthmus. Besides geological value, the area is important for the conservation of large intact massifs of fens and transitional peatlands with vegetation complexes typical of aapa-mires but very rare in middle and southern taiga sub-zones. It is also valuable as a resting and breeding area for migratory birds (swans, sea diving ducks and waders) within the White Sea-Baltic corridor. There are several records of species included in the Red Data Book of the Russian Federation, for instance vascular plants such as *Dactylorhiza traunsteineri, Isoetes setacea* and *Rhynchospora fusca*, and birds such as *Lagopus lagopus* (nesting), *Aquila clanga, Haliaeetus albicilla, Pandion haliaetus* (during migration). One of the largest known resting areas of *Cygnus bewickii* is in littorals and shallow water areas of Lake Ladoga. In addition, many species included in the Red Data Book of Nature of the Leningrad Region (2000, 2002) have been recorded.
20	Regional complex zakaznik Karelsky Forest	Preservation of one of the last intact forest tracts in Leningrad Region, in the south-east of the Scandinavian Crystalline Shield. The natural landscape of the area is characterized by a combination of granite and gneiss outcrops with complexes of glacial and glaciofluvial deposits, like moraine hills, kames and eskers, with intact fens in depressions between them. These HCV areas serve as habitats of many rare and threatened animal, plant, lichen and fungi species confined to old growth coniferous forests with nemoral elements in the herb layer. Several species of fungi *(Leptoporus mollis, Pycnoporellus fulgens)*, vascular plants *(Pulsatilla vernalis, Woodsia ilvensis, Ajuga pyramidalis, Lobelia dortmanna)*, birds *(Bubo bubo, Cygnus cygnus, Haliaeetus albicilla, Pandion haliaetus, Picoides tridactylus, Strix nebulosa)* and mammals *(Lynx lynx, Gulo gulo, Mustela lutreola)* are listed in the Red Data Books of the Leningrad Region (2000, 2002); of these *Pulsatilla vernalis, Ajuga pyramidalis, Lobelia dortmanna, Bubo bubo, Haliaeetus albicilla* and *Pandion haliaetus* are also in the Red Data Book of the Russian Federation.
Vologda Region		
21	Zakaznik with wetland and plain biotopes between the two rivers Mologa and Suda	Wetland and plain biotopes of high conservational value. A few surviving fragments of intact forest in the hemiboreal forest zone of northwest Russia.
22	Zakaznik Ikhalitsky	Wetlands of high conservational value.
23	Protected nature complex Atleka	Intact forest tracts in combination with intact mire massifs. The planned zakaznik is intended to include two existing zakazniks, Atleka and Soydozerskyi, with the addition of a valley of the River Soida, two intact mires (Ilyinskoye and Tarbazboloto), two lakes (Dikoye and Laynozero), as well as ecological corridors between them.
24	Protected nature complex Rabangskaya Sukhona	Intact forest tracts, wetland and plain biotopes of high conservational value. Important Bird Areas in Russia.

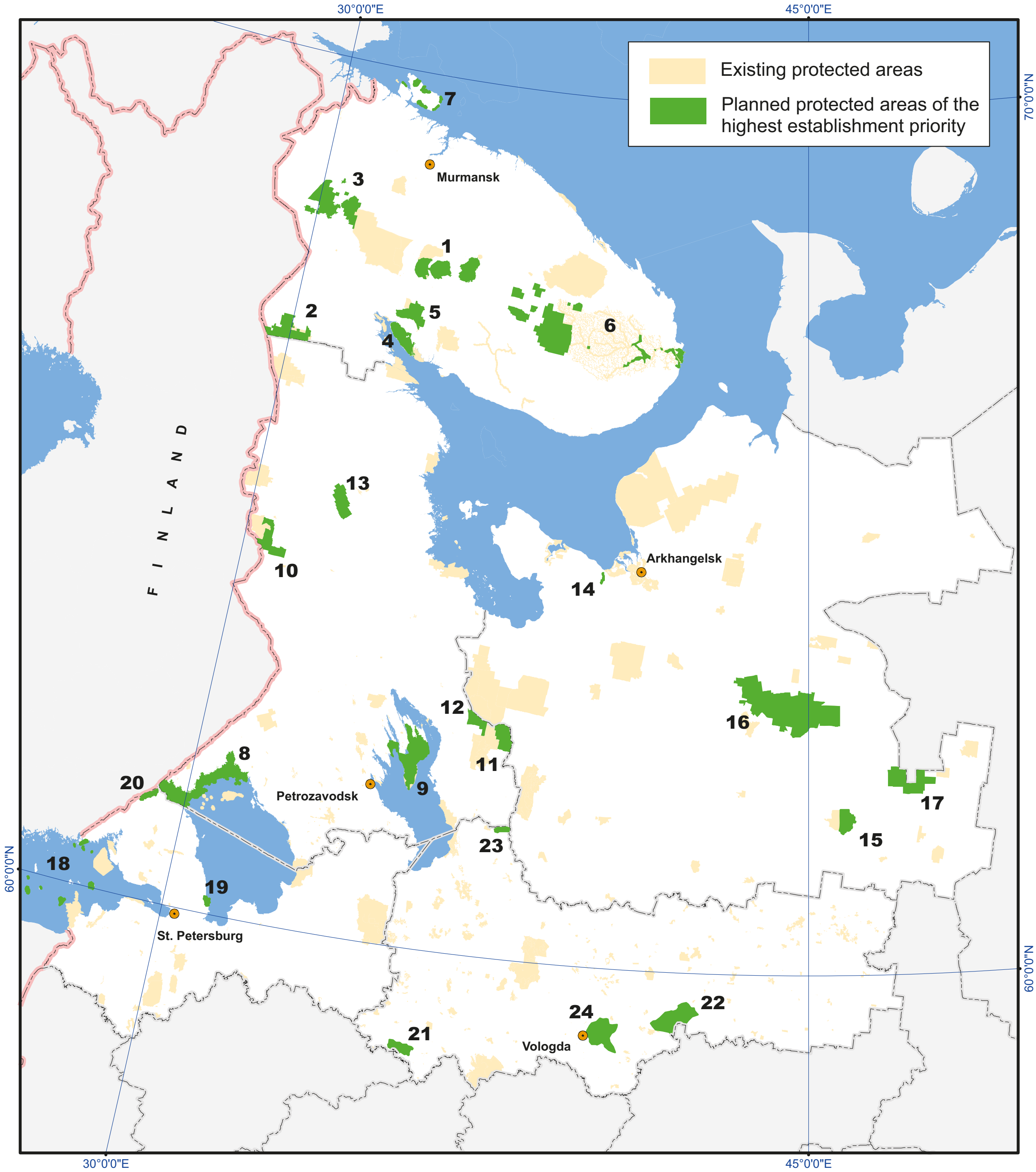


Fig. 5.2. Locations of HCV areas recommended for urgent protection measures in 2011-2013. Numbers of planned protected areas according to Table 5.1.

1. Khibiny National Park
2. Kutsa Nature Park
3. Zakaznik Lapland Forest
4. Zakaznik Poryi Forest
5. Zakaznik Kolvitsa
6. Zakaznik Ponoi
7. Gorodets sea bird colonies, Skorbeev Bay, Eina Bay and rocks on the Sredny Peninsula
8. Ladoga Skerries National Park
9. Zaonezhye Nature Park
10. Zakaznik Spokoyny
11. Zakaznik Chukozero
12. Zakaznik Yangozero
13. Zakaznik Ypäyzhsuo
14. Zakaznik Solzensky
15. Zakaznik Shilovsky
16. Zakaznik Verkhneyulovsky
17. Zakaznik Uftyugo-Yileshsky
18. Ingermanland (Ingermanlandsky) Strict Nature Reserve
19. Regional complex zakaznik Morye
20. Regional complex zakaznik Karelsky Forest
21. Zakaznik with wetland and plain biotopes between the two rivers Mologa and Suda
22. Zakaznik Ikhalitsky
23. Protected nature complex Atleka
24. Protected nature complex Rabangskaya Sukhona

CONCLUSION

The area considered within the framework of the Russian-Finnish project "Gap analysis of the Protected Area Network in Northwest Russia" comprises most of the Northwest Federal District and includes six administrative units of the Russian Federation, viz.: Leningrad Region, the City of St. Petersburg, Vologda Region, the Republic of Karelia, Arkhangelsk Region (excluding the Nenets Autonomous District and the archipelagoes of Franz Josef Land and Novaya Zemlya), and Murmansk Region. The total area (including inland waters) is 869,200 km^2. The study area is located in two biomes, Eurasian tundra and Eurasian taiga, and is divided into several belts of vegetation: Arctic vegetation (tundra), forest tundra, northern boreal, middle boreal, southern boreal and hemiboreal forests. There is also vertical zoning in vegetation. Marine areas are under federal governance, so technically cannot be considered as part of the area of the administrative units studied within this project. However, some of the hight conservation value (HCV) areas included in the study are located on the shores and islands of the seas. Therefore, we included in the analysis also those marine portions adjacent to them.

The study area includes 641 specially protected areas of the federal and regional levels, including 8 strict nature reserves (of which 5 have buffer zones), five national parks (one with buffer zone), 2 nature parks, 175 zakazniks, 316 nature monuments, one botanical garden and one spa nature resort.

The Russian Federation law "On Specially Protected Nature Areas" (Federal Law…1995) also delegates to the competent authorities the right to establish other protected area categories in addition to those listed in the law. Vologda Region is the only one in northwest Russia which has made use of this right, establishing three new protected area categories, i.e. 118 protected mires, two tourist-recreational areas and one nature complex.

The exact boundaries for several nature monuments were not defined at the time of the study so these protected areas are not included in the Gap analysis project. Similarly, we do not include protected areas of local level established by municipalities because their status may be undefined. Thus, the analysis includes 570 protected areas, occupying altogether 57,600 km^2, or 6.7% of the study area. In addition, protected areas comprise 2,100 km^2 of water surfaces of the Barents, White and Baltic Seas.

As a result of the Gap analysis project we have identified 24 types of HCV areas, analyzed their distribution and the current situation with regard to their protection in the entire study area. Some HCV areas are located in the waters of the Barents, White and Baltic Seas.

In addition, 15 types of HCV areas for which we have the most representative data were used to estimate the representativeness of the existing protected area network, i.e. we analyzed the share of the acreages of protected areas which are occupied by HCV areas in every region of the study area (excluding the City of St. Petersburg).

Modern tools of geographic information systems (GIS) and remote sensing technologies were used at all stages of the preparation and processing of empirical data collected during the project. The basis for mapping the HCV areas were published cartographic materials, including topographic maps (scale 1: 200,000); large-scale geological and other thematic maps (e.g. detailed maps of mire vegetation); forest inventory data; and data from field observations by regional experts. The main information sources for this study are digital spectro-zonal satellite images of high and medium resolution taken in recent years. The results of semi-automatic interpretation of satellite images and the subsidiary cartographic materials have been used in the creation of a large-scale vegetation map.

The aim of the project was twofold: to study the current situation with the protection of HCV areas in the existing protected area network, and to identify those HCV areas which are in most urgent need of protection. We have estimated the share of different types of the selected HCV areas included in protected areas and outside protected areas in each region. We have also estimated the distribution of the HCV areas in different vegetation zones and at various altitudes. The degree of protection of the HCV areas of each type was estimated as the proportion of their area included in the existing protected area network (separately for categories I-IV of their protection regimes). Accordingly, the gaps in the existing protected area network of northwest Russia are estimated as the proportion of the HCV areas currently outside existing and planned protected areas. Besides the evaluation of existing threats, we have listed HCV areas in need of urgent protection, preferably in 2011-2013.

It is important to note that the opinions of the regional experts may apply to restricted specific cases and be limited in the broader context. Data obtained in every region can be quickly evaluated for use in practical decision-making. Based on this data, we created generalized maps and calculated the relative value of the total area covered by the current and planned system of protected areas. The resulting map indicated 12% of the territories with maximum conservational values, which should be given priority in development to optimize the existing protected area network.

This was the first such detailed study to be carried out in northwest Russia. It included selection and mapping of different types of HCV areas and analysis of the real situation regarding their protection, not only in federal but also in the regional protected areas. In addition to distribution of HCV areas inside and outside protected areas, the adequacy of the protected area protection regimes (i.e. restrictions on the use of natural resources) was also taken into account. As a result, we have found that territorial nature conservation in northwest Russia can be described as being in crisis.

The results obtained during the Gap analysis project provided not only a general picture of the situation with nature conservation in northwest Russia, but also allowed the development of practical recommendations at different levels: from the creation of spatial schemes for the planning of nature conservation for a whole region, to plans for immediate protection of particular sites. The latter is possible both by the establishment of new protected areas and by using other ways to restrict economic activities in particular HCV areas.

Conclusions based on results of the Gap analysis project:

1. **The situation of territorial nature conservation in northwest Russia should be characterized as a crisis.** The share of protected areas is less than half the current national average figure, which is 15% of land area and inland waters. The share is now only 6.73%, when the recommended value is 17% (Report of the tenth meeting ... 2010). The first step to remedy the situation is the immediate establishment of the protected areas which are already planned.

2. Although 6.73% of the entire study area of northwest Russia is included in protected areas, only 1.23% is occupied by protection regimes belonging to groups I and II that ensure real preservation of natural systems. This is insufficient to perform the tasks of the protected area network, i.e. the conservation of natural complexes and the biological diversity of the organisms inhabiting them. Thus, further development of the protected area network should be not only in the direction of increasing the territory occupied by protected areas, but also towards the optimization of protection regimes in the existing protected areas.

3. HCV areas of different types selected and mapped in this study occupy, in total, 36.1% of the entire study area. Although this share is quite high, only 12.5% of these (or 4.5% of the entire study area) are included in existing protected areas. Thus, there is significant potential for increasing the proportion of protected HCV areas within the network of existing and planned protected areas.

4. Analysis of the values of conservational importance for the territories where HCV areas were selected and mapped has shown that the establishment of all planned protected areas and increasing of the total area of the protected area network by 72% (from 6.73 to 12% of the entire study area) will increase their total conservational value. However, increasing the territories of protected areas will not be sufficiently effective unless it is focused on including the HCV areas revealed during this study. The estimated value of the most important HCV areas (within the 12% boundary level of territory which should be protected) based on our proposals is ca. 50% above the current level (0.52 vs. 0.35), based on existing plans for the establishment of new protected areas without focusing on particular HCV areas. This allows optimization of the planning of new protected areas.

5. The analysis of the distribution of existing and planned protected areas in different vegetation zones has revealed a significant imbalance in the plans for new protected areas. It is intended to double the areas of planned protected areas in the boreal forest zone. In contrast, in the hemiboreal forest zone (which incorporates the most endangered natural biotopes), the proposed increases in the area of protected areas look disproportionately small and definitely insufficient to protect natural diversity.

6. The share of area within protected areas gradually decreases when moving from north to south in all the regions. This is because economic development of northern territories is much lower than in southern ones. However, the hemiboreal forest types are the most endangered natural communities currently under risk of extinction in northwest Russia. In this regard, we emphasize the urgent need for further work towards the establishment of new protected areas there.

7. Many of the HCV areas identified in the Gap analysis project are internationally rare or even unique, primarily owing to their large sizes, wide distribution and inter-connectedness. Intact or minimally transformed landscapes retaining their natural structure support biodiversity and can significantly affect the preservation of biodiversity of northern Europe as a whole.

Recommendations based on Gap analysis project results:

1. In Murmansk Region, the Republic of Karelia, and the middle and northern parts of Arkhangelsk Region, large intact forest landscapes are of the greatest value in terms of the protection of natural biotopes and maintaining natural biodiversity. These areas should be taken under protection as a priority.

2. All hemiboreal forests still in a natural state are under risk of regional extinction. Therefore, in Vologda Region (and possibly in Leningrad Region), all the remaining fragments of natural forest of southern taiga types should immediately be taken under protection.

3. In addition to the conservation of natural old-growth forests, areas which are suitable for "ecological restoration", e.g. secondary forests with high recovery potential should be recommended for inclusion in protected areas.

4. Due to the high extinction risk of the last fragments of natural old-growth forests in the hemiboreal and southern boreal forest sub-zones of northwest Russia, we recommend creating biological stations for field research on the ecological restoration of these forests in Leningrad and Vologda Regions and in the southern parts of Arkhangelsk Region and the Republic of Karelia.

5. The development of regional protected area networks should be based on the common methodological principles proposed in the Gap analysis project. This would provide a unified approach on the protection of HCV areas in northwest Russia coordinated between its various administrative units.

Recommendations for further research:

1. Expanding basic data by incorporating satellite imagery interpretation of infrastructure (communication network, sources of disturbance) and industrial impact on nature. Inclusion of more advanced data on distribution of fungi, plants and animals (including endangered species) in the analysis.

2. Satellite images, even those of the highest resolution, show locations of potential HCV areas and their approximate boundaries only if the HCV area is large enough (e.g. intact forest landscapes, intact forest tracts, intact mire massifs, etc). It seems necessary to increase the area covered by field investigations for the accurate identification of all HCV areas found during the Gap analysis project and to identify HCV areas which have so far been missed.

3. The developmental priorities of the analysis of representativeness of regional protected area networks should be the following:

   - more objective estimation of the relative conservational value of different types of HCV areas by the consolidation of the opinions of all experts, and taking into account economic and social needs of the studied territories
   - using overlay analysis of multivariate statistical procedures that allows:
     - assessment of the conservation value of each locality and its adjacent areas
     - transformation of the point counts in the spatial characteristics (e.g. for rare and threatened species)
     - including in the analysis the dynamics of natural variables and the performance of statistically sound zoning.

4. There is a severe lack of primary information on the occurrence of rare and threatened species of fungi, plants and animals, especially in the remote northern and eastern areas of northwest Russia. Funding for studies of their distribution is absolutely insufficient. Thus, it would be useful to develop methods for accurately assessing the probability of the occurrence of these species, not only by direct observation but also using indirect characteristics such as descriptions of habitats, estimates of the impact of different environmental factors, and the degree of human impact. Maps of the probability of occurrence of rare and threatened species can help in preliminary estimations of conservational value and could be useful for optimal organization of field inventories.

5. The Gap analysis project has resulted in the collection of a significant amount of data on existing HCV areas in northwest Russia, the most important parts being included in this publication. Using this background, more detailed studies should be conducted in each region in order to prepare further publications focused on developmental priorities for optimization of the regional protected area networks.

6. The Gap analysis project has revealed a need for international studies in conservation biology and the development of a unified international approach to the assessment of protected area networks and identification of HCV areas in northwest Russia and northern Europe as a whole.

Veratrum album grows on coastal grasslands. Barents Sea coast, Murmansk Region. Photo: Gennady Alexandrov.

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Web-links

Official Website of the Administration of St. Petersburg – http://gov.spb.ru

Official Website of the Government of Arkhangelsk Region – http://www.dvinaland.ru

Official Website of the Government of Leningrad Region – http://www.lenobl.ru

Official Website of the Government of Murmansk Region – http://www.gov-murman.ru

Official Website of the Government of the Republic of Karelia – http://gov.karelia.ru

Official Website of the Government of Vologda Region – http://vologda-oblast.ru

ConsultantPlus. Non-commercial network of information and legal services – http://base.consultant.ru/cons/cgi/online.cgi?req=home

Information system for the strict nature, reserves, national parks and federal zakaznics of the Russian Federation – http://oopt.inf

The Baltic Sea Portal – http://www.itameriportaali.fi

Finnish Environment Institute (SYKE) – http://www.syke.fi and www.syke.fi/nature/nwrussia

Barents Protected Area Network BPAN - http://www.bpan.fi

Karelian Regional Nature Conservancy (NGO SPOK) – http://spok-karelia.ru

Karelian Research Center of the Russian Academy of Sciences – http://krc.karelia.ru

Komarov Botanical Institute of the Russian Academy of Sciences, St. Petersburg – http://www.binran.ru/

Murmansk Regional public organization Kola Biodiversity Conservation Center –http://kola-nature.org

Non-commercial partnership Transparent World – http://transparentworld.ru

Polar-Alpine Botanical Garden & Institute of the Kola Research Center of the Russian Academy of Sciences – http://pabgi.ru

Vologda State Pedagogical University – http://vologda-uni.ru

World Wildlife Fund (WWF) Russia – http://wwf.ru

Zoological Institute of the Russian Academy of Sciences, St. Petersburg – http://zin.ru

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Interactive maps of the areas of high conservational value selected in this study (English version) – http://gis.transparentworld.ru/en/gapnw/

Interactive maps of the areas of high conservational value selected in this study (Russian version) – http://gis.transparentworld.ru/gapnw/

In old-growth forest large pine trees at the age 300 years or more survive frequent fires. Planned landscape zakaznik Spokoyny, Republic of Karelia. Photo: Olli Manninen.

APPENDIX

List of existing protected areas

Name, area and year of establishment of protected areas of federal level: zapovedniks (strict nature reserves), national parks and their protective buffer zones are given after the Web-site "Nature protected areas of Russian Federation": http://www.zapoved.ru.

Name, area, year of establishment and protection regimes of the protected areas of regional level are given after the report by Milovidova et al. (2011), where they are listed in accordance with their status indicated in the State document "Regulations of State protected areas". It is important to note that in some cases the size (in hectares) given for the protected areas mentioned in this document, may in fact differ from their real areas.

The list has been compiled on the basis of data actual on **01.12.2010.**

Abbreviations for the protected regimes used in the legend (Column 5):

SPR – strict protection regime. All anthropogenic activities prohibited, including visits by tourists, which are restricted to guided excursions in open zones only.
LOG (No logging) – forest logging strictly prohibited.
MIN (No mining) – geological activities, viz.: mining, extraction of coal, ore, peat, and sapropel are strictly prohibited.
BLD (No building) – all building activities outside villages, including construction of buildings, roads, pipelines, electric lines and other installations are prohibited. Construction essential to the operation of the protected areas is allowed.
"–" in Column 5 means that no protection regime is applied to this territory.

Abbreviations for the Groups of protection regimes (Column 6):

1. **Strict protection regime:** All anthropogenic activities prohibited, including visiting by tourists, which are restricted to guided excursions in open zones only.

2. **Sufficient protection:** All three main classes of disturbance activities strictly prohibited, viz.: forestry; mining and associated activities; and construction, other than directly related to operation of the protected areas. In other words, this group unites all three types of protected regimes (Log+Min+Bld), or two types (Min+Bld) for those protected areas which are situated in the tundra zone in treeless landscapes.

3. **Medium protection:** At least one of the three main disturbance activities, i.e. forest cutting (Log), mining (Min) and construction (Bld) (excepting objects belonging to the protected area), are strictly prohibited.

4. **Weak protection:** None of the three main disturbance activities (neither Log, nor Min, nor Bld) is prohibited. So-called "protected area existing only on paper". In fact, they are highly threatened.

RED FONT is used throughout the list for those protected areas neither indicated in the maps nor mentioned in the text; they are protected areas of regional level with indefinite borders.

A. Arkhangelsk Region

1	2	3	4	5	6
Number	Name and type of protected area	Area (ha)	Estab-lished	Protection regimes	Groups of protection regimes
Protected areas of the federal level					
Strict Nature Reserves (= Zapovedniks)					
1	Pinega	51 552	1974	SPR	1
2	Protected belt of the Pinega Strict Nature Reserve	30 545	1984	-	4
National Parks					
3	Kenozero	139 663	1991	Core zone: MIN, BLD; Recreational zone: MIN, BLD; Zone of re-established rural landscapes: MIN;	3
4	Vodlozero	468 340	1991	Zone of special strict protection: SPR ; Core zone: MIN, BLD; Recreational zone: MIN; Zone of re-established rural landscapes: MIN;	Zone of special strict protection: 1; Other zones: 3
Federal zakazniks					
5	Siisky		1988	BLD	3
Protected areas of the regional level					
Landscape zakazniks:					
6	Kozhozero	201 605	1992	-	4
7	Lensky	16 707	1993	-	4
8	Mudyug	2 514	1996	MIN	3
9	Primorsky	438 723	2004	-	4
10	Puchkomsky	11 870	1996	MIN	3
11	Chugsky	7 973	1996	MIN	3
12	Ust-Chetlassky	2 157	1987	-	4
13	Verkolsky	4 6521	1988	-	4
Biological zakazniks:					
14	Belomorsky	65 345	1998	-	4
15	Dvinskoi	7 200	1973	-	4
16	Filatovsky	23 600	1975	-	4
17	Klonovsky	37 100	1980	-	4
18	Konosha	9 000	1976	-	4
19	Kotlassky	13 400	2002	-	4
20	Kuloi	24 700	1994	-	4
21	Lacha	8 800	1971	-	4
22	Monastyrsky	15 900	1975	-	4
23	Onsky	20 600	1976	-	4
24	Plesetsky	20 000	1981	-	4
25	Selenginsky	6 400	1975	-	4
26	Shilovsky	23 900	1969	-	4
27	Shultussky	11 500	1975	-	4
28	Solvychegodsky	6 400	1970	-	4
29	Soyana	315 910	1983	-	4
30	Sursky	13 500	1975	-	4
31	Unsky	51 507	1996	-	4
32	Ustyansky	6 200	1988	-	4

33	Vazhsky	16 500	1976	-	4
34	Vielegodsky	26 600	1986	-	4
35	Yarengsky	38 000	1975	-	4
Geological zakazniks:					
36	Zheleznye Vorota	8 074	1991	MIN	3
Hydrological zakazniks:					
37	Permilovsky	175 000	1994	-	4
Nature monuments					
Botanical nature monuments:					
38	Pikhty (silver firs) near Arkhangelsk	1	1991		
39	Shegmas	5	1989		
Hydrological nature monuments:					
40	Urochishche Kurtyaevo	150	1989		
Landscape nature monuments:					
41	Birch near Lokhovo village	single tree	1991		
42	Experimental pine plantations, 1939	8	1991		
43	Experimental pine plantations, 1956	4	1991		
44	Experimental pine plantations, 1958	3	1991		
45	Experimental pine plantations, 1959	41	1991		
46	Experimental pine plantations, 1964	15	1991		
47	Experimental pine plantations, 1965	1	1991		
48	Experimental pine plantations, Sovyi Mountains	17	1991		
49	Experimental pine plantings established by S.V. Alekseev in 1927-1930	32	2004		
50	Experimental pine plantings established by S.V. Alekseev in 1949	14	2004		
51	Experimental pine plantings established by S.V. Alekseev in 1951	5.6	2004		
52	Forest, Lakhtinsky	25	1989		
53	Forest, Shirshinsky	455	1989		
54	Forest, Tegrinsky	287	1987	BLD	3
55	Grove, Voronovskaya	5	1987	BLD	3
56	Grove, Zelenaya	39	1991		
57	Island Chernyi	162	1991		
58	Lake Churozero	13	1991		
59	Lake Kaly	201	2004		
60	Lake Maloe Shuiskoe	700	1991		
61	Larch forest, Listvennichnaya grove	65	2004		
62	Larch forest, Lyamtsa	50	1987	BLD	3
63	Larch forest, marked "Leninu slava!" on forestry plan	5	1987	BLD	3
64	Larch forest, marked "Slava KPSS!" on forestry plan	1	1987	BLD	3
65	Linden alley in Severnaya Dvina River Valley	2	1991		
66	Mineral Spring (hydrosulfide)	2	1991		
67	Mire, Pikovo (Tykovo)	1 100	1991		
68	Mire, Vakkhannik	46	1991		
69	Natural pine stand	58	1991		
70	Natural pine stand with admixture of spruce plantings	118	1991		
71	Natural spruce forest, Churozero	72	1991		

72	Natural spruce stand with admixture of birch and alder	14	1991		
73	Padun Area	6	1987	BLD	3
74	Pine forest	30	1987	BLD	3
75	Pine forest	42	1991		3
76	Pine forest, Argunovsky	3	1987	BLD	3
77	Pine forest, Bereznikovsky	42	1987	BLD	3
78	Pine forest, Blagoveshchensky	35	1987	BLD	3
79	Pine forest, Ispolinovsky	89	1989		
80	Pine forest, Kachaevsky	22	1989		
81	Pine forest, Komsomolsky	163	1987	BLD	3
82	Pine forest, Korenevsky	166	1987	BLD	3
83	Pine forest, Kryazh	240	1989		
84	Pine forest, Myandach	23	1989		
85	Pine forest, Palkinsky	10	1989		
86	Pine forest, Rylkovsky	120	1987	BLD	3
87	Pine forest, Shunemsky	118	1987	BLD	3
88	Pine forest, Talazhsky	36	1989		
89	Pine forest, Tarasovsky	102	1989		
90	Pine forest, Timanevsky	247	1989		
91	Pine forest, Zeleny	82	1987	BLD	3
92	Pine forest,Sosnovaya grove (northern edge of Onega city)	3	1987	BLD	3
93	Pine near Churyega village	single tree	1991		
94	Pine plantation, Kedrovyi garden	0.5	1991		
95	Pine plantings near Nikiforovo village	not defined	1991		
96	Pine stand near Medvedevo village	not defined	1991		
97	River Ena with a strip of river bank	200	1991		
98	Spring “Twelve springs”	33	1991		
99	Spring Talitsky (eastern edge of Onega city)	0.3	1987	BLD	3
100	Urochishche Igumenikha	30	1991		
Geological nature monuments:					
101	Cave, Vodnaya	6.6	1987	BLD	3
102	Cave, Kulogorskaya-5	17	1987	BLD	3
103	Cave, Kulogorskaya Troya	50.8	1987	BLD	3
104	Karst massif Golubinsky	210	2005	BLD	3

Protected areas of the local level					
105	Green zone pine forest on Yagry Island	233			
108	Local nature monument, Lapazhinka				
106	Pine stand	1.73			
107	Protected nature landscape, Turovetsky Pine Forest	218		MIN, BLD	

B. Vologda Region

Number	Name and type of protected area	Area, ha	Estab-lished	Protection regimes	Groups of protection regimes
Protected areas of the federal level					
Strict nature reserves (Zapovedniks)					
1	Darwin Strict Nature Reserve (total area shown, although only 63 904 ha are situated in Vologda Region, the remainder in adjacent Yaroslavl region)	112 673	1945	SPR	1
2	Protected buffer zone of Darwin Strict Nature Reserve (total area of protected buffer zone shown, although only 39 890 ha are situated in Vologda Region)	41 623	2001	MIN	3
National parks					
3	Russky Sever (Russian North) (including Shalgo-Bodunovsky Forest, a state zakaznik of regional level, and four regional nature monuments: Mountain Maura, Mountain Sandyreva, Mountain Tsypina and Forest Sikolsky)	166 400	1992	strictly protected core zone: **SPR;** strict protected zone: **MIN, BLD;** zone dedicated to development of ecological tourism: **MIN, BLD;** recreational zone: **MIN;** zone dedicated to tourist services **MIN;** zone dedicated to household purposes: **MIN;** zone of protection of historical and cultural objects and cultural landscapes: **MIN;**	Strictly protected core zone: **1** Other functional zones **3**
Protected areas of the regional level					
Zakazniks					
4	Atleka	3 370	2000	MIN, BLD	3
5	Bobrishnyi Ugor	375	1985	-	4
6	Chadogoshchensky	4 172	1989	MIN, BLD	3
7	Chernoozersky	1 876	2009	MIN, BLD	3
8	Circular Structure, Chermzha	2 026	1985	MIN, BLD	3
9	Ezhozero	2 295	1983	MIN, BLD	3
10	Forest, Brusensky	610	1986	MIN BLD	3
11	Forest, Pochinkovsky	3 549	1997	MIN, BLD	3
12	Forest, Andogsky	830	1984	MIN	3
13	Forest, Azletsky	752	1987	MIN, BLD	3
14	Forest, Dikovsky	243	1997	MIN, BLD	3
15	Forest, Entalsky	1 032	1985	MIN, BLD	3
16	Forest, Gorodishchensky	11 286	1991	BLD	3
17	Forest, Koloshemsky	1 622	1986	MIN BLD	3
18	Forest, Ramensky	1 353	1986	MIN, BLD	3
19	Forest, Selmengsky	1 549	1986	MIN BLD	3
20	Forest, Sholsky	1 984	1985	MIN BLD	3
21	Forest, Strelkinsky	1 563	1996	MIN, BLD	3
22	Forest, Talitsky	1 608	1985	BLD	3
23	Forest, Unzhensky	1 969	1985	BLD	3
24	Forest, Verkhovsky	890	1993	MIN, BLD	3
25	Forest, Verkhovazhsky	1 785	1987	MIN BLD	3
26	Forest, Verkhvinsky	959	1985	MIN BLD	3

27	Gorsky	365	1989	MIN, BLD	3
28	Ikhalitsky	1 537	1987	MIN BLD	3
29	Ilezsky	954	1993	MIN, BLD	3
30	Izonikha	334	1987	MIN, BLD	3
31	Kharinsky	4 734	1989	BLD	3
32	Klavdinsky	754	1994	BLD	3
33	Klyuchi	650	1985	BLD	3
34	Kobozhsky	2 069	1989	MIN, BLD	3
35	Kushtozero	1 107	1983	MIN, BLD	3
36	Larch forest	2 258	1978	MIN BLD	3
37	Lukhtozero	4 014	1983	MIN, BLD	3
38	Melgunovsky	535	1984	MIN BLD	3
39	Mikhalevo	852	1994	BLD	3
40	Modno	994	1963	MIN, BLD	3
41	Mologa	1 007	2008	MIN, BLD	3
42	Otnensky	6 937	1989	MIN, BLD	3
43	Ozerikha	1 330	1994	BLD	3
44	Padun	1 213	1994	BLD	3
45	Pine forest, Chuchkin	1 890	1993	BLD	3
46	Pine forest, Gladkyi	1 492	1990	BLD	3
47	Pine forest, Ikonnyi,	2 494	1993	BLD	3
48	Pine forest, Kozlikha	391	1997	MIN, BLD	3
49	Pine forest, Mazsky	636	1996	MIN, BLD	3
50	Pine forest, Nyushmensky	1 787	1990	BLD	3
51	Pine forest, Olenevsky	2 538	1993	MIN, BLD	3
52	Pine forest, Palemsky	2 130	1988	MIN, BLD	3
53	Pine forest, Shilengsky	924	1988	MIN, BLD	3
54	Pine forest, Spassky	4 585	1993	BLD	3
55	Pine forest, Sudsky	2 817	1996	MIN, BLD	3
56	Pine forest, Sysoevsky	2 436	1993	MIN, BLD	3
57	Pine forest, Yarbozero	2 445	1999	MIN, BLD	3
58	Pinga	2 216	1999	MIN, BLD	3
59	Rattsa	3 201	1994	BLD	3
60	Shalgo-Bodunovsky Forest, (included in protected zone of National Park Russky Sever)	1 511	1984	SPR	1
61	Shelomovskoe	730	1996	BLD	3
62	Shichengsky	13 610	1987	MIN, BLD	3
63	Shimozero	8 169	1983	MIN, BLD	3
64	Sigskoe, mire	1 378	1994	MIN, BLD	3
65	Smorodinka	206	1994	BLD	3
66	Soidozero	2 242	1985	MIN BLD	3
67	Sondugsky	10 387	1987	MIN BLD	3
68	Urochishche Khazovo	202	1994	BLD	3
69	Urochishche Lopata	756	1993	BLD	3
70	Urochishche Orlovskaya Grove	1 276	1988	MIN, BLD	3
71	Urochishche Sharma	505	1988	BLD	3
72	Urochishche Strelna	1 756	1985	MIN, BLD	3
73	Vaganikha	189	1987	MIN BLD	3
74	Vanskaya Luka	2 490	1989	MIN, BLD	3

75	Verdengsky	1 245	1987	MIN, BLD	3
76	Verkhne-Andomsky	4 038	1983	MIN BLD	3
77	Verkhnyaya Strelna	6 703	1997	MIN, BLD	3
78	Voronovo	733	1989	BLD	3
79	Vyazy (Elm grove)	213	2000	MIN, BLD	3
80	Yansorsky	830	1984	LOG	3
81	Zaozerye	10 901	1990	BLD	3
Nature monuments					
82	Andoma Geological Section (included in Onega protected nature complex)	not defined	1978	MIN, BLD	3
83	Boulder Dvugorbyi	0.1	1963	MIN, BLD	3
84	Cape Byk	65	1987	MIN, BLD	3
85	Dendropark in Ustyuzhna Town	4	1966	-	4
86	Devyatinsky Perekop	300	1983	-	4
87	Druzhinskie Yamy	4	1984	LOG	3
88	Elm forest, Temnyi Mys	106	1963	MIN, BLD	3
89	Elm forest, Veksa	2	1963	MIN, BLD	3
90	Geological outcrop on Shardenga River, Skorodum Village	53	1991	MIN, BLD	3
91	Geological outcrop on Sharzhenga river, Vakhnevo Village	175	1991	MIN, BLD	3
92	Geological outcrop, Aristovo	50	1985	MIN, BLD	3
93	Geological outcrop, Myakolitsa	142	1985	MIN, BLD	3
94	Geological Outcrop, near Purtovino Village and Isady Village	300	1989	MIN	3
95	Geological outcrop, Ozerki Village	300	1989	MIN	3
96	Glacial boulder, Elk	0.1	1963	MIN, BLD	3
97	Glacial boulder, Utyug	0.3	1987	MIN, BLD	3
98	Kodozero	231	1991	-	4
99	Kontakt, geological outcrop	10	1988	MIN, BLD	3
100	Lake Bolshoe-Volkovo	95	1982	-	4
101	Lake Chaikino	88	1982	MIN, BLD	3
102	Lake Chernoe	304	1991	-	4
103	Lake Mitvorovo	400	1978	MIN, BLD	3
104	Lake Okunevo	36	1996	BLD	3
105	Lipovaya (Petryaevskaya) grove	1	1963	MIN, BLD	3
106	Meadow Dyakonovskaya Glade	4.5	2006	MIN, BLD	3
107	Mikhaltsevskaya, grove	36	1982	MIN, BLD	3
108	Mountain Isakova	437	1989	MIN MIN	3
109	Mountain Maura	36	1966	MIN, BLD	3
110	Mountain Sandyreva	15.5	1966	MIN, BLD	3
111	Mountain Stone (Kamennaya)	32	1963	BLD	3
112	Mountain Tsipina	90	1966	MIN, BLD	3
113	Oak groves (Dubnya)	8.8	1966	-	4
114	Old Park, Bolshoe Vosnoe village	5.5	1963	MIN, BLD	3
115	Old Park, Borisovo-Suda village	30	1963	MIN, BLD	3
116	Old Park, Ermolovo village	9	1982	-	4
117	Old Park, Gorka village	0.75	1966	-	4
118	Old Park, Gribtsovo village	2.1	1966	MIN, BLD	3
119	Old Park, Kraskovo village	1.2	1963	MIN, BLD	3

120	Old Park, Kurkino village	5	1963	MIN, BLD	3
121	Old Park, Kuznetsovo village	not defined	1963	MIN, BLD	3
122	Old Park, Mikhailovskoe village	6.7	1963	MIN, BLD	3
123	Old Park, Mozhaiskoe settlement	2.8	1963	MIN, BLD	3
124	Old Park, Nikolskoe village	12	1963	MIN, BLD	3
125	Old Park, Pokrovskoe village	11.7	1963	MIN, BLD	3
126	Old Park, Spirino	0.63	1988	LOG	3
127	Old Park, Svyatogorye	not defined	1963	MIN, BLD	3
128	Old Park, Yunosheskoe village	5	1966	MIN, BLD	3
129	Old Park, Yurovo village	5	1982	MIN, BLD	3
130	Opoki	not defined	1963	MIN, BLD	3
131	Park, Danilovskoe village	3.9	1963	MIN, BLD	3
132	Park, Dudorova	3.5	2001	BLD	3
133	Part of Tagazhma River Valley	1 000	1983	-	4
134	Pine forest, Baranovsky	180	1978	MIN, BLD	3
135	Pine forest, Berezhok	255	1987	MIN, BLD	3
136	Pine forest, Chagrino Village	3.7	1963	MIN, BLD	3
137	Pine forest, Chernye Peski	177	1983	MIN, BLD	3
138	Pine forest, Kudrinsky,	666	1978	BLD	3
139	Pine forest, Malakhov	185	1978	MIN, BLD	3
140	Pine forest, Markinsky	2.36	1988	BLD	3
141	Pine forest, Maryinsky	333	1994	BLD	3
142	Pine forest, Odomchensky	329	1978	MIN, BLD	3
143	Pine forest, Pustoramensky	7	1987	MIN, BLD	3
144	Pine forest, Pyatnitsky (included in Onega protected nature complex)	79	1978	MIN, BLD	3
145	Pine forest, Sokolsky (included in NP Russky Sever)	800	1978	MIN, BLD	3
146	Pine forest, Tsarev	78	1994	BLD	3
147	Pine forest, Vaskin	175	1978	MIN, BLD	3
148	Pine forest, Viktorovsky	326	1978	MIN, BLD	3
149	Pine forest, Yashkin	138	1963	MIN, BLD	3
150	Pine forest, Zakharovsky	70	1978	MIN, BLD	3
151	Podsosenye	100	1982	MIN, BLD	3
152	Ridge Olarevskaya	159	1987	MIN, BLD	3
153	Salt spring Bobrovsky,	200	1985	MIN, BLD	3
153	Severnye orkhidei (North orkhids)	74	1982	-	4
155	Shishkina Niva	195	1963	MIN, BLD	3
156	Sonsovaya Alleya	4.1	1963	MIN, BLD	3
157	Spring Chudotvornyi	73	2006	MIN, BLD	3
158	Spruce forest, Kiriki-Ulity Village	51	1963	MIN, BLD	3
159	Stream Belyi Ruchey	51	1983	MIN, BLD	3
160	Stream valley Patrov Ruchey	20	1983	-	4
161	Sulphur springs, Shelokhach village	10.9	1963	MIN, BLD	3
162	Tsvetnye Kremni ecosite	100	1985	MIN, BLD	3
163	Waterfall, Vaskin Klyuch	50	1987	MIN, BLD	3
Protected nature complexes					
164	Onega: includes two regional nature monuments, Andoma geological section and Pyatnitsky pine forest	25 140	2009	MIN, BLD (zone of traditional agricultural: MIN)	3

Tourist – recreational areas					
165	Growth, Zelenaya Roshcha	3 714	2007	MIN, BLD	3
166	Karpovo	89	2009	MIN	3
Protected mires					
167	Alambas/ Yamshok	426	1978	LOG, MIN, BLD	2
168	Alekseevskoye - I	1 606	1978	LOG, MIN, BLD	2
169	Avdyuzhskoye	2 333	1978	LOG, MIN, BLD	2
170	Babye	1 187	1973	LOG, MIN, BLD	2
171	Belaya Velga	5 210	1978	LOG, MIN, BLD	2
172	Big mire / Koloshomskaya Chist	3 263	1978	LOG, MIN, BLD	2
173	Big mire / Lupozerskoye	2 345	1973	LOG, MIN, BLD	2
174	Big mire / Severnoye (Slopeshnoye)	2 468	1978	LOG, MIN, BLD	2
175	Bolshoye	1 716	1978	LOG, MIN, BLD	2
176	Big mire (Chernoye)	324	1978	LOG, MIN, BLD	2
177	Bolshoye Domoshirovskoye / Manuilovskoye	689	1978	LOG, MIN, BLD	2
178	Bolshoye Mayurskoye	1 914	1989	LOG, MIN, BLD	2
179	Bolshoye Mitinskoye	845	1989	LOG, MIN, BLD	2
180	Chermyaninskoye	2 200	1989	LOG, MIN, BLD	2
181	Chistoye	712	1989	LOG, MIN, BLD	2
182	Chivitskoye/ Chivichkoye	1 552	1978	LOG, MIN, BLD	2
183	Devyatinskoye / Ukomskoye	1 332	1978	LOG, MIN, BLD	2
184	Dobroozerskoye	12 288	1973	LOG, MIN, BLD	2
185	Duplische	1 054	1978	LOG, MIN, BLD	2
186	Duplische, southern part / Duplische	275	1978	LOG, MIN, BLD	2
187	Glubotskoye	1 252	1978	LOG, MIN, BLD	2
188	Goristy	200	1978	LOG, MIN, BLD	2
189	Gorka / Gorkovskoye	1 002	1978	LOG, MIN, BLD	2
190	Gramotenskaya Chist	226	1989	LOG, MIN, BLD	2
191	Ikhalitskoye-I	518	1989	LOG, MIN, BLD	2
192	Jyrmengskoye, Big mire	2 393	1973	LOG, MIN, BLD	2
193	Kamchugskoye	4 867	1978	LOG, MIN, BLD	2
194	Karasye / Ukomskoye	766	1978	LOG, MIN, BLD	2
195	Katromskoye / Nikolo-Katromskoye	2 034	1989	LOG, MIN, BLD	2
196	Karpovskoye / Velikoye	414	1978	LOG, MIN, BLD	2
197	Kemskoye	5 497	1978	LOG, MIN, BLD	2
198	Kemskoye	1 368	1978	LOG, MIN, BLD	2
199	Kitovo	2 392	1989	LOG, MIN, BLD	2
200	Kobozhskoye (Malakhovskoye)	5 506	1989	LOG, MIN, BLD	2
201	Kondas	15 707	1978	LOG, MIN, BLD	2
202	Korshminskoye	2 337	1989	LOG, MIN, BLD	2
203	Kortyuzhzkoye / Karpovskoye	571	1989	LOG, MIN, BLD	2
204	Kostanovo	829	1978	LOG, MIN, BLD	2
205	Kotras	349	1989	LOG, MIN, BLD	2
206	Kozlovskoye	3 750	1989	LOG, MIN, BLD	2
207	Krasnoye	353	1979	LOG, MIN, BLD	2
208	Krestenskoye / Krestetskoye	12 807	1973	LOG, MIN, BLD	2
209	Kuzhonkino, Great Mosses	7 019	1978	LOG, MIN, BLD	2
210	Lebezhskoye	197	1989	LOG, MIN, BLD	2
211	Lebyazhya Chist	3 884	1989	LOG, MIN, BLD	2

212	Levinskoye	266	1989	LOG, MIN, BLD	2
213	Lochvezhskoye	1 016	1989	LOG, MIN, BLD	2
214	Machkovo (Mayskoye)	1 416	1989	LOG, MIN, BLD	2
215	Malakhovskoye / Kobozhskoye	15 291	1978	LOG, MIN, BLD	2
216	Markovskoye (Suursuo)	1 951	1989	LOG, MIN, BLD	2
217	Matyushkinskoye	1 168	1978	LOG, MIN, BLD	2
218	Medovoye (Yakhrenskoye)	1 067	1973	LOG, MIN, BLD	2
219	Medwezhya Pokhta-1	3 460	1978	LOG, MIN, BLD	2
220	Medwezhya Pokhta-2	3 381	1978	LOG, MIN, BLD	2
221	Mezhevoye	2 869	1989	LOG, MIN, BLD	2
222	Mityukovskoye (Ozerkee) / Zybun	1 640	1989	LOG, MIN, BLD	2
223	Moroshechnik	252	1978	LOG, MIN, BLD	2
224	Murashovskaya Chist	10.83	1989	LOG, MIN, BLD	2
225	Olebyino (Melnikovskoye / Olebyino)	1 975	1978	LOG, MIN, BLD	2
226	Olino / Kukar	1 799	1989	LOG, MIN, BLD	2
227	Ostrov-Morotskoye	59 695	1978	LOG, MIN, BLD	2
228	Ozernoye (Lipovitskoe)	1 851	1978	LOG, MIN, BLD	2
229	Padalikha-1 / Vondozh	1 590	1973	LOG, MIN, BLD	2
230	Padalokha -2 / Vondozh	1 622	1973	LOG, MIN, BLD	2
231	Panteleevskoye	246	1978	LOG, MIN, BLD	2
232	Parovoye	5 276	1978	LOG, MIN, BLD	2
233	Pechenhskoye / Chistoye (Tutkovskoye)	1 080	1978	LOG, MIN, BLD	2
234	Pechyorzkoye / Pecherskoye	893	1978	LOG, MIN, BLD	2
235	Pesochnoye	769	1978	LOG, MIN, BLD	2
236	Podomkhovskoye / Prochesnoye	1 723	1978	LOG, MIN, BLD	2
237	Poldarskoye-1 / Poldarskoye	164	1989	LOG, MIN, BLD	2
238	Poldarskoye-2 / Poldarskoye	63	1989	LOG, MIN, BLD	2
239	Pomyanovskoye	273	1978	LOG, MIN, BLD	2
240	Porogskoye	360	1989	LOG, MIN, BLD	2
241	Preobrazhenskoye	2 757	1978	LOG, MIN, BLD	2
242	Puzheozero	187	1978	LOG, MIN, BLD	2
243	Pyavochnoye	28 221	1978	LOG, MIN, BLD	2
244	Rabangsko-Dorovskoye	10 492	1978	LOG, MIN, BLD	2
245	Repnoye/ Denisovtsky pentus	1 608	1978	LOG, MIN, BLD	2
246	Seldengskoye	234	1989	LOG, MIN, BLD	2
247	Selischinskoye / Selischenskoye	2 352	1978	LOG, MIN, BLD	2
248	Shadrino	775	1973	LOG, MIN, BLD	2
249	Sharzengskoye	122	1973	LOG, MIN, BLD	2
250	Shelomovskoye	641	1989	LOG, MIN, BLD	2
251	Shem-mire	4 109	1989	LOG, MIN, BLD	2
252	Shurbovo	259	1978	LOG, MIN, BLD	2
253	Sokolye	2 175	1978	LOG, MIN, BLD	2
254	Stolypin's ecosite Sokolya Chist	11 682	1989	LOG, MIN, BLD	2
255	Strelskaya Glad, Klopinino	3 825	1978	LOG, MIN, BLD	2
256	Sukharnoye / Kamenskoye	741	1989	LOG, MIN, BLD	2
257	Sukhonskoye	5 055	1978	LOG, MIN, BLD	2
258	Sukhoye severnoye / Sukhoye	559	1978	LOG, MIN, BLD	2
259	Sukhoye, southern part / Sukhoye Yuzhnoue	929	1978	LOG, MIN, BLD	2
260	Svinukha	196	1989	LOG, MIN, BLD	2

261	Teterye (Chistotnoye) -1	100	1989	LOG, MIN, BLD	2
262	Teterye (Chistotnoye) -2	112	1989	LOG, MIN, BLD	2
263	Tserkovnoye / Tserkovno-Pechenskoye	458	1978	LOG, MIN, BLD	2
264	Uskolskoye	1 800	1978	LOG, MIN, BLD	2
265	Vanyutinskoye / Bezyumyannoye	1 302	1978	LOG, MIN, BLD	2
266	Vazhenskoye	3 055	1989	LOG, MIN, BLD	2
267	Velikaya Chist	189	1978	LOG, MIN, BLD	2
268	Velikii Mokh	3 686	1978	LOG, MIN, BLD	2
269	Velikoye	1 590	1989	LOG, MIN, BLD	2
270	Velikoye/ Lyva	960	1978	LOG, MIN, BLD	2
271	Veresovoye	665	1989	LOG, MIN, BLD	2
272	Volkhovo	879	1978	LOG, MIN, BLD	2
273	Votsarskoye	3 038	1973	LOG, MIN, BLD	2
274	Vyshkinskoye	2 0945	1989	LOG, MIN, BLD	2
275	Vyunetskoye	2 526	1978	LOG, MIN, BLD	2
276	Yakushevskoye	345	1978	LOG, MIN, BLD	2
277	Yamboloto-Rogachboloto / Yam-mire	1 621	1978	LOG, MIN, BLD	2
278	Yanesh	2 855	1989	LOG, MIN, BLD	2
279	Yelanskoye-1	687	1978	LOG, MIN, BLD	2
280	Yelanskoye-2	319	1978	LOG, MIN, BLD	2
281	Yembskaya Chist	302	1978	LOG, MIN, BLD	2
282	Zamoshye	410	1978	LOG, MIN, BLD	2
283	Zazorskoye / Zadorskoye	475	1978	LOG, MIN, BLD	2
284	Zybun (Big mire) / Zybun (Chervonnoye)	1 139	1973	LOG, MIN, BLD	2
Protected areas of the regional level					
285	Kornilyevo-Komelsky, Monastery of the Blessed Virgin Mary	0.25	2008		
286	Nature reserve Irma	59	2001		
287	Nature reserve Old Desert	97	2005		
288	Nature reserve Volgush	5 686	2001		
289	Nature reserve, Pine nursery	1.2	1999		
290	Nikolskoye	4 670	2009		
291	Peace Park	193	1998		
292	Pine forest, Ivonynsky	3 999	1992		
293	Recreation area Krucha	1 596	2008		
294	Spring of Saint Kornilius Komelsky	0.4	2008		
295	Spring "New spring"	30	1968		
296	Spring in honor of the icon of the Blessed Virgin Mary Three Hands	0.1	2008		
297	Springs near the headspring of the Belyi Ruchei creek	13.5	2002		

C. Leningrad Region

Number	Name and type of protected area	Area (ha)	Estab-lished	Protection regimes	Groups of protection regimes
Protected areas of the federal level					
Strict nature reserves (Zapovedniks)					
1	Nizhneswirsky	41 615	1980	SPR	1
Zakazniks					
2	Complex federal zakaznik Mshinskoye Mire	60 400	1976	MIN, BLD	3
Protected areas of the regional level					
Zakazniks					
3	Botanical zakaznik Gostilitsky	1 595	1976	MIN, BLD	3
4	Botanical zakaznik Lindulovskaya grove	986	1976	MIN, BLD	3
5	Botanical zakaznik Rakitinsky	777	1976	MIN, BLD	3
6	Complex biological zakaznik Gladyshevsky (showing area in Leningrad Region; total area 8 419 ha including parts in St. Petersburg).	7 630	1996	areas including particularly valuable natural complexes and objects: **MIN, BLD;** areas for recreational use: **MIN, BLD;** areas with extensive land use: **MIN**	3
7	Complex zakaznik Belyi Kamen	3 000	1979	MIN, BLD	3
8	Complex zakaznik Berezovye Islands	55 295	1996	MIN	3
9	Complex zakaznik Chistyi Mokh	6 434	1976	MIN, BLD	3
10	Complex zakaznik Kotelsky	12 681	1996	areas including particularly valuable natural complexes and objects: **MIN, BLD;** areas with intensive land use: no protection; areas for recreational use: **MIN, BLD;** areas with extensive land use: **MIN**	3
11	Complex zakaznik Kurgalsky	59 950	1994	MIN	3
12	Complex zakaznik Lebyazhy	6 345	2007	areas including particularly valuable natural complexes and objects: **LOG, MIN, BLD;** areas with intensive land use: no protection; areas with extensive land use: **MIN, BLD**	3
13	Complex zakaznik Lisinsky	28 413	1976	MIN, BLD	3
14	Complex zakaznik Oak groves near Velkota village	375	1996	MIN, BLD	3
15	Complex zakaznik Rakovye Lakes	10 521	1976	MIN	3
16	Complex zakaznik Shalovo-Perechitsky	5 943	1976	areas including particularly valuable natural complexes and objects: **MIN, BLD;** areas with intensive land use: no protection; areas for recreational use: **MIN;** areas with extensive land use: **MIN**	3
17	Complex zakaznik Syabersky	11 400	1976	MIN, BLD	3
18	Complex zakaznik Vaaramaenselkä ridge	7 614	1996	areas including particularly valuable natural complexes and objects: MIN, BLD; areas with extensive land use: MIN, BLD; areas with intensive land use: MIN; areas for recreational use: MIN	3

19	Complex zakaznik Vyborgsky	11 295	1996	MIN	3
20	Hydrological (wetland) zakaznik Lamminsuo mire	380	1976	MIN, BLD	3
21	Hydrological (wetland) zakaznik Ozernoe mire	1 044	1976	MIN, BLD	3
22	Hydrological zakaznik Glebovskoe mire	14 700	1976	MIN	3
23	Hydrological zakaznik, Northern Part of Mshinskoye Mire	14 700	1996	MIN, BLD	3
24	Landscape zakaznik Cheremenetsky	7 100	1976	MIN, BLD	3
25	Zoological (ornithological) zakaznik Lake Melkovodnoe	3 900	1976	MIN, BLD	3
Nature monuments					
26	Complex nature monument Lake Yastrebinoe	630	1976	MIN, BLD	3
27	Complex nature monument Lava River Canyon	160	1976	LOG, MIN, BLD	2
28	Complex nature monument Ragusha River -1	1 034	1996	MIN, BLD	3
29	Complex nature monument Sablinsky	220	1976	BLD	3
30	Complex nature monument Source of Oredezh River in the Dontso ecosite	950	1976	MIN, BLD	3
31	Complex nature monument Staroladozhsky	220	1976	LOG, MIN, BLD	2
32	Geological nature monument Devonian and Ordovician outcrops on Saba River	650	1976	LOG, MIN, BLD	2
33	Geological nature monument Devonian Outcrops and Galleries on Oredezh River near Borshchovo village (Lake Antonovo)	270	1976	LOG, MIN, BLD	2
34	Geological nature monument Devonian outcrops on Oredezh River near Belogorka village	120	1976	LOG, MIN, BLD	2
35	Geological nature monument Devonian outcrops on Oredezh River near Yam-Tesovo village	225	1976	LOG, MIN, BLD	2
36	Geological nature monument Gustoi Island	54	1976	LOG, MIN	3
37	Geological nature monument Shcheleiki (including 100m buffer zone, total area 2 872.5 ha)	118	1995	LOG, MIN	3
38	Hydrological and Geological nature monument Radon springs and lakes in Lopukhinka village	270	1996	LOG, MIN, BLD	2
39	Hydrological nature monument Lake Krasnoe	1 012	1976	MIN	3
40	Nature monument Memorial Estate of Nikolay K. Roerikh	59	2009	MIN	3
Nature parks					
41	Veps Forest (=Vepsky Les)	189 100	2001 (established 1970 as regional zakaznik, later transformed into nature park)	areas with extensive land use: no protection; recreational and economical area use: no protection; nature reserve Veps Forest: LOG, MIN, BLD; nature reserve , Ashchozersky: LOG, MIN, BLD; nature reserve Lindz-mire: LOG, MIN, BLD; nature reserve Lerinsky: LOG, MIN, BLD; nature reserve Urya-Kanzhaya: MIN, BLD; nature reserve Hanging lakes: LOG, MIN, BLD; nature reserve Carbon xenoliths: LOG, MIN, BLD	outside reserves: 4; Inside reserves: Veps Forest: 2; Ashchozersky: 2; Lindz- mire: 2; Lerinsky: 2; Urya-Kanzhaya: 3; Hanging lakes: 2; Carbon xenoliths: 2.
Protected areas of the regional level					
42	Protected nature landscape Bianky's meadow	20	2008	LOG, MIN	3
43	Protected nature landscape Haapala	396	2008	MIN	3
44	Protected nature landscape Verojärvi Lake	42	2008	MIN	3
45	Zakaznik Ilola	3 819	2008	MIN	3

D. St. Petersburg

Number	Name and type of protected area	Area (ha)	Estab-lished	Protection regimes	Groups of protection regimes
Protected areas of the regional level					
Zakazniks					
1	Gladyshevsky, showing only area in St. Petersburg; total area including area in Leningrad Region is 8 419 ha)	765	1996	MIN, BLD	3
2	Northern Shore of Neva Bay	330	2009	LOG, MIN	3
3	Yuntolovsky	977	1990	MIN	3
Nature monuments					
4	Duderhoff heights	65	1992	MIN	3
5	Komarovo sea coast	180	1992	-	4
6	Sergievka Park	120	1992	-	4
7	Strelna sea coast	40	1992	-	4

E. The Republic of Karelia

Number	Name and type of protected area	Area (ha)	Estab-lished	Protection regimes	Groups of protection regimes
Protected areas of the federal level					
Strict nature reserves (Zapovedniks)					
1	Kandalaksha (showing total area, including parts in Murmansk Region)	70 530	1932	SPR	1
2	Kivach	10 880	1931	SPR	1
3	Protective buffer zone of Kivach Strict Nature Reserve	5 793	1990	-	4
4	Kostomuksha (area 49 258 ha since 26.02.2013)	47 457	1983	SPR	1
5	Protective buffer zone of Kostomuksha Strict Nature Reserve	45 600	1981	-	4
National parks					
6	Kalevala	74 343	2006	strictly protected core zone: **SPR** strict protected zone: **LOG, MIN, BLD** zone of special protection regime: **LOG** recreational zone: **MIN, BLD** zone of tourist services **MIN, BLD** zone of household purposes: **MIN, BLD**	strictly protected core zone: 1 strict protected zone: 2 Other functional zones 3
7	Paanajärvi	104 473	1992	strictly protected core zone: **SPR;** zone of special protection regime: **LOG** zone dedicated to development of the ecological tourism: **MIN, BLD;** zone for regulated recreation: **MIN, BLD;** zone dedicated to tourist services **MIN, BLD**	strictly protected core zone: 1 Other functional zones 3
8	Protective buffer zone of Paanajärvi National Park	6 860	2003	-	4

9	Vodlozero, showing total area: 130 000 ha in Karelia, remainder in Arkhangelsk Region.	468 340	1991	strictly protected core zone: SPR strict protected zone: MIN, BLD recreational zone: MIN zone with allowed sustainable forestry: MIN zone demonstrating traditional land use and for recreation MIN	strictly protected core zone: I Other functional zones 3
Zakazniks					
10	Zoological zakaznik Kizhi	50 000	2008	MIN	3
11	Zoological zakaznik Olonets	27 000	2008	LOG, MIN	3
Resort areas					
12	Forest of Martsyalnye Vody healing resort	7 317	1988	-	4
Protected areas of the regional level					
Nature parks					
13	Valaam archipelago	24 700	1999	MIN	3
Zakazniks					
Complex landscape zakazniks:					
14	Andrusovo	890	1991	BLD	3
15	Arctic Circle (Polyarnyi Krug)	28 300	1990	-	4
16	Iso-Iijärvi	5 778	1995	MIN	3
17	Kuzova	3 600	1991	MIN, BLD	3
18	Muromsky	32 600	1986	MIN, BLD	3
19	Podkova	659	1997	MIN	3
20	Shaidoma	29 600	1981	-	4
21	Syrovatka	31 342	2009	MIN, BLD	3
22	Tolvajärvi	41 900	1995	MIN	3
23	Vazhozero	9 492	1994	MIN	3
24	Voinitsa	8 376	2008	MIN, BLD	3
25	Western Archipelago	19 527	1996	LOG, MIN, BLD	2
26	Yudalsky	1 524	1991	-	4
27	Zaozerye	2 710	1991	MIN	3
Complex marine zakazniks:					
28	Soroksky	72 900	1996	MIN	3
Botanical zakazniks:					
29	Anisimovshchina	5.4	1984	MIN, BLD	3
30	Biological zakaznik in Spasskaya Guba Leskhoz	5.7	1984	MIN, BLD	3
31	Biological zakaznik near Tsarevichi village	0.1	1984	MIN, BLD	3
32	Deciduous and dark coniferous forests	392	1972	MIN, BLD	3
33	Highly productive stands with larch and common alder	110	1976	MIN, BLD	3
34	Kakkorovsky	26	1984	MIN, BLD	3
35	Lake Beloye ozero	7.5	1984	-	4
36	Lake Kovshozero	60	1984	-	4
37	Porozhki	0.17	2001	MIN	3
38	Sortavalsky	100	1978	-	4
39	Toloknyanka (Arctostaphylos uva-ursi)	1 359	1981	-	4
Hydrological (lacustrine) zakazniks:					
40	Lake Taloye ozero	1.5	1984	MIN	3

Hydrological (wetland) zakazniks:					
41	Mire Chuvnoi-suo	1 400	1974	MIN, BLD	3
42	Mire Koivu-Lambasuo	1 800	1976	MIN, BLD	3
43	Mire near Nyukhcha village	3 539	1974	MIN, BLD	3
Landscape nature monuments:					
44	Mountain Klym-gora	617	1993	BLD	3
Botanical nature monuments:					
45	Deciduous forest with lime and elm	23	1981	MIN, BLD	3
46	Kedr sibirsky *(Pinus sibirica)* -64	1.9	1981	MIN, BLD	3
47	Kedr sibirsky *(Pinus sibirica)* -65	1.9	1981	MIN, BLD	3
48	Kedr sibirsky *(Pinus sibirica)* - 84	not defined	1995	-	4
49	Kedr sibirsky *(Pinus sibirica)* -64	2.4	1981	MIN, BLD	3
50	Natural stand with elm	1.1	1981	MIN, BLD	3
51	Natural stand with lime and elm	5	1981	MIN, BLD	3
52	Near Kurkijoki village	8.3	1981	-	4
53	Pines, Sosna gornaya (Mountain pine)	0.6	1984	MIN	3
54	Pines, Sosna Murreya *(P. contorta var. murrayana)* -62	3.6	1984	MIN	3
55	Pines, Sosna Murreya *(P. contorta var. murrayana)* -71	0.1	1984	MIN	3
56	Siberian larch *(Larix sibirica)* - 73	3.7	1984	MIN	3
57	Siberian larch *(Larix sibirica)*- 72	49	1984	MIN	3
58	Sukachev's larch *(Larix sukaczewii)*- 77	4	1984	MIN	3
59	Sukachev's larch *(Larix sukaczewii)*- 78	5	1984	MIN	3
60	Sukachev's larch *(Larix sukaczewii)*- 79	30	1984	MIN	3
61	Sukachev's larch *(Larix sukaczewii)* - 76	6	1984	MIN	3
62	Thuya zapadnaya *(Thuja occidentalis)*	not defined	1984	-	4
63	Topol belyi *(Populus alba)*	not defined	1984	-	4
Geological nature monuments					
64	Chelmuzhskaya foreland	900	1984	LOG, MIN	3
65	Chertov Stul	75	1981	-	4
66	Girvas section of Suna River Canyon	6	1981	-	4
67	Island Dyulmek	0.35	1984	MIN	3
68	Island Severin-Saari	0.54	1984	MIN	3
69	Island Yuzhnyi Olenii	75	1981	-	4
70	Kintsisiemi Cape	50	1984	MIN	3
71	Shunga incision	10	1981	-	4
72	Sundozero	30	1981	-	4
73	Uuksu Esker Ridge	1 245	1984	LOG, MIN	3
Hydrological nature monuments					
74	Spring Karasozero (Three Ivans) (including 200 m protective buffer zone)	125	1993	MIN, BLD	3
75	Spring Kroshnozero	not defined	1984	MIN	3
76	Spring Lososinka river (including 250 m protective buffer zone)	not defined	1984	MIN	3
77	Spring Onezhsky (including 150 m protective buffer zone)	not defined	1984	MIN	3
78	Spring Solyanaya Yama (including 200 m protective buffer zone)	not defined	1984	MIN	3
79	Spring Sulazhgora (including 100 m protective buffer zone)	not defined	1984	MIN	3
80	Urozero	2 301	1997	MIN, BLD	3

81	Waterfall Belye Mosty	88	1999	MIN	3
Wetland nature monuments					
82	Mire along Lel-Rechka River	95	1997	MIN	3
83	Mire near Boyarshchina Village	24	1997	MIN	3
84	Mire near Elmus Lake (with 200 m buffer zone)	1 918	1989	MIN, BLD	3
85	Mire near Lake Lelikozero	200	1997	MIN	3
86	Mire near Lake Medvezhye	15	1995	-	4
87	Mire near Lake Utozero	24	1995	-	4
88	Mire near Nurdas Lake (with 200 m buffer zone)	454	1989	MIN, BLD	3
89	Mire near Olonka River	42	1995	-	4
90	Mire near Petrikova Bay	43	1997	MIN	3
91	Mire near Rzhanoe Lake (with 200 m buffer zone)	30	1991	MIN, BLD	3
92	Mire near Somba River	559	1995	-	4
93	Mire near Vendyury village (with 200 m buffer zone)	1 115	1989	MIN, BLD	3
94	Mire near Volgielambi Lake (with 200 m buffer zone)	278	1989	MIN, BLD	3
95	Mire Sulansuo, mire (with 200 m buffer zone)	125	1989	MIN, BLD	3
96	Mire, Akonyarvskoe	68	1995	-	4
97	Mire, Alen	149	1995	-	4
98	Mire, Chilim	608	1995	MIN	3
99	Mire, Chimilskaya polyana	25	1995	-	4
100	Mire, Dikino (with 200 m buffer zone)	213	1989	MIN, BLD	3
101	Mire, Kalegubskoe Bog	168	1997	MIN	3
102	Mire, Kokhtusuo	812	1995	MIN	3
103	Mire, Komarnitskoe (with 200 m buffer zone)	510	1989	MIN, BLD	3
104	Mire, Konye (with 200 m buffer zone)	86.2	1989	MIN, BLD	3
105	Mire, Konzozerskoe	123	1995	-	4
106	Mire, Kovera Bog	14	1995	-	4
107	Mire, Ladvinskoe (with 200 m buffer zone)	166	1989	MIN, BLD	3
108	Mire, Lebyazhye Bog	700	1995	-	4
109	Mire, Lesnoye (with 200 m buffer zone)	21	1991	MIN, BLD	3
110	Mire, Levotsuo	943	1995	MIN	3
111	Mire, Maloe Sarmyagskoe	280	1995	-	4
112	Mire, Medvezhye Bog	131	1995	-	4
113	Mire, Merisuo (with 200 m buffer zone)	487	1991	MIN, BLD	3
114	Mire, Mikhailovskoe	29	1995	-	4
115	Mire, Mikkelskoe (with 200 m buffer zone)	494	1991	MIN, BLD	3
116	Mire, Monastyrskoye	22	1995	-	4
117	Mire, Novikovskoye Bog	32	1995	-	4
118	Mire, Oigoretskoe (with 200 m buffer zone)	513	1989	MIN, BLD	3
119	Mire, Ozovoe	79	1995	-	4
120	Mire, Pairetskoe (with 200 m buffer zone)	545	1989	MIN, BLD	3
121	Mire, Pala (with 200 m buffer zone)	204	1989	MIN, BLD	3
122	Mire, Papinoja	99	1995	-	4
123	Mire, Pigma (with 200 m buffer zone)	525	1989	MIN, BLD	3
124	Mire, Porucheinoe, mire	158	1995	-	4
125	Mire, Posadsko-Navorozhskoe, 625 (with 200 m buffer zone)	1 121	1989	MIN, BLD	3
126	Mire, Posadsko-Navorozhskoye IX	286	1995	-	4

127	Mire, Posadsko-Navorozhskoye VIII	870	1995	-	4
128	Mire, Posadsko-Navorozhskoye XI	2 082	1995	-	4
129	Mire, Razlomnoye (with 200 m buffer zone)	39	1989	MIN, BLD	3
130	Mire, Ropaki	995	1995	-	4
131	Mire, Sambalskoye	430	1995	-	4
132	Mire, Savorozhenskoe	560	1995	-	4
133	Mire, Selga (with 200 m buffer zone)	134	1991	MIN, BLD	3
134	Mire, Shirokoe	259	1997	MIN	3
135	Mire, Shomba	365	1995	-	4
136	Mire, Shubinskoye	22	1995	-	4
137	Mire, Sosnovoye (Zhidkoe)	860	1995	-	4
138	Mire, Southern Gabozerskoe (with 200 m buffer zone)	228	1991	MIN, BLD	3
139	Mire, Tambitskoe (with 200 m buffer zone)	51	1989	MIN, BLD	3
140	Mire, Terga Bog	44	1995	-	4
141	Mire, Tiksha (with 200 m buffer zone)	531	1989	MIN, BLD	3
142	Mire, Vazhinskoe (with 200 m buffer zone)	7 235	1989	MIN, BLD	3
143	Mire, Verkhovoe (with 200 m buffer zone)	66	1991	MIN, BLD	3
144	Mire, Vostochno-Segezhskoe	761	1995	-	4
145	Mire, Zamoshye	178	1997	MIN	3
146	Mire, Zapovednoye	1 361	1995	-	4

F. Murmansk Region

Number	Name and type of protected area	Area (ha)	Estab-lished	Protection regimes	Groups of protection regimes
Protected areas of the federal level					
Strict nature reserves (Zapovedniks)					
1	Kandalaksha, showing total area, partly situated in Murmansk Region, partly in Republic of Karelia	70 530	1932	SPR	1
2	Pasvik	14 727	1992	SPR	1
Strict nature reserves / Biosphere reserves					
3	Lapland	278 435	1930	SPR	1
4	Protective buffer zone around Lapland Strict Nature Reserve	27 998		-	4
Zakazniks					
5	Kanozero	65 600	1989	-	4
6	Murmansk Tundra	295 000	1987	LOG	3
7	Tuloma	33 700	1990	-	4
Botanical gardens					
8	Polar-Alpine botanical garden and research institute (protected area only)	1 332		MIN	3
Nature monuments					
9	Geological: Astrofilites of the Eveslogchorr mountain	4	1985	-	4
11	Geological: Epidozites on the Verkhnyi Navolok Cape	7	1985	-	4
10	Geological: Jybileynaya mine	0.5	1985	-	4
12	Hydrological: Mogilnoye Lake	17	1985	-	4

Protected areas of the regional level					
Zakazniks					
13	Fishery zakaznik Ponoi	98 600	2002	MIN	3
14	Fishery zakaznik Varzuga	45 093	1982	-	4
15	Biological zakaznik Simbozero	39 568	2003	-	4
16	Complex zakaznik Kolvitsa	40 900	1983	MIN	3
17	Complex zakaznik Kutsa	52 000	1994	MIN	3
18	Complex zakaznik Seidyaur	17 972	1982	LOG, MIN, BLD	2
19	Zoological zakaznik Ponoi	98 600	1981	-	4
Nature monuments					
Botanical (forest) nature monuments					
20	Biogroup of spruces at the timberline	0.50	1986	MIN, BLD	3
21	Junipers, Magazin-Musyur elevation	3 000	1980	-	4
22	Kedr sibirskyi (*Pinus sibirica*) in Nikelskoe Lesnichestvo	0.20	1986	MIN, BLD	3
23	Larch stand, Tayboly	1	1980	MIN, BLD	3
24	Larches in Kovdskoe Lesnichestvo	1	1986	MIN, BLD	3
25	Larches, Lovozero leskhoz	12	1980	MIN, BLD	3
26	Larches, Nizhne-Tulomskoye reservoir	4	1986	MIN, BLD	3
27	*Larix sibirica* plantation	5.6	1986	MIN, BLD	3
28	*Larix sibirica* plantation	0.9	1986	MIN, BLD	3
29	Pine plantation	0.4	1986	MIN BLD	3
30	Pines and larches, Khibiny station	2	1980	MIN, BLD	3
31	Pines at the timberline	4.6	1986	MIN, BLD	3
32	*Pinus sibirica* in Kovdskoe Lesnichestvo	2	1986	MIN, BLD	3
33	*Pinus sibirica* of the Krivets forest cordon	2	1986	MIN, BLD	3
34	Pines on Zapadnaya Litsa river	3	1980	MIN, BLD	3
35	Pines, Nyamozero	5	1980	MIN, BLD	3
36	Pines, Okunevoye Urochishche	20	1980	-	4
Botanical (species-protection) nature monuments					
37	Arnicas (*Arnica*) and poppies (Papaveraceae) in Indi-chyok gorge	1	1980	MIN, BLD	3
38	Arnicas in gorge near Palga Lake	1	1980	MIN, BLD	3
39	*Bryonia dioica* site near Viddpakkh Mountain	1 500	2009	LOG, MIN, BLD	2
40	Eutrophic mire, southern edge of Khibiny mountain massif	10	1980	MIN, BLD	3
41	Gorge “A cryptogam gorge”	2	1980	MIN, BLD	3
42	Gorge Aikuaivenchorr	2	1980	MIN, BLD	3
43	Kitkuai River valley	3	1980	MIN, BLD	3
44	Mountain Punkaruaiv	5	1980	MIN	3
45	Mountain Flora	10	1980	MIN, BLD	3
46	Encalypt mosses of the Yuksporrlak mountain pass	3	1980	MIN, BLD	3
Hydrological nature monuments					
47	Komsozero and 500 m wide shore strip	250	1983	MIN, BLD	3
48	Therapeutic Muds of Palkina Bay	400	1980	MIN, BLD	3
49	Waterfall, Chapoma River	200	1986	MIN, BLD	3
50	Waterfall, Chavanga River	100	1986	MIN, BLD	3
51	Waterfall, Shuonyjoki River	1	1986	MIN, BLD	3
Geological nature monuments					
52	Amazon Stones of Parusnaya Mountain	1	1980	MIN, BLD	3

53	Amethysts of Korabl Cape	5	1986	MIN, BLD	3
54	Basaltoid lavas on granite-gneiss base near Rizh-Bay	9	1980	-	4
55	Fluorites, Elokorgovsky Navolok	2	1980	MIN, BLD	3
56	Glacial Boulder	0.1	1980	-	4
57	Granitoids, Mikkov Island	10	1980	-	4
58	Pegmatites of Malyi Punkaruaiv mountain	2	1980	-	4
59	Roche moutonnee near Semenovskoe Lake	0.50	1980	-	4
Natural-historical nature monuments					
60	Ekostrovskoe Kintishche	105	1980	MIN, BLD	3
61	Petroglyphs near Chalnmy-Varre settlement	1	1980	-	4
Complex nature monuments					
62	Ivanovskaya Bay	7 480	2009	LOG, MIN, BLD	2
63	Sea bird colonies of Dvorovaya Bay	610	2009	LOG, MIN, BLD	2
Geological-geophysical polygons					
64	Geological-geophysical polygon Shuoni-Kuets	300	1980	-	4
65	Geophysical station Lovozero	4	1980	-	4
Protected areas of the local level					
66	Nature Monument Eykhfeldt grove	0.3		-	4

Planned nature monument Orlovsky Cape on Barents Sea coast. Murmansk Region. Photo: Gennady Aleksandrov.