12. Development of survey methodology

– for biologically valuable forests (up to 50,000 ha) in the North-West Russia

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Background

Russia is often quoted as one of few European countries in which large areas of virgin forest still remains. However, the situation is rapidly deteriorating and the remaining intact forests in the European Russia are mainly situated in the northern part next to the arctic tundra. Forests and woodlands in the southern boreal, boreonemoral and nemoral Russia are to a large extent as fragmented and exposed to human impact as the correspondent forest types in Western and Central Europe. Temperate broadleaf forest is one of the most severely disturbed and endangered biomes worldwide, nevertheless it is very important for maintenance of biodiversity in the global scale. The situation in the forests of European Russia is of utmost importance also for the biodiversity in Northern and Central Europe as a whole.

Forestry plays a substantial and increasing role in the Russian economy. Far-reaching reforms are on-going in the Russian forest sector. Long-term leasing of land continues to be an important feature of the structure. Increasing forestry activities in post-soviet Russia, intrude the forests that before had been protected from commercial logging operations This activity pose severe threats to biodiversity values in remaining old growth forests – particularly in the southern boreal, boreonemoral and nemoral forest zone, where forests have been under significant human pressure since long time. At the present, logging activities are taking place in areas not under strict protection, and include substantial parts of the Protected Areas. Apart from logging, other activities can pose threat to the forests, including building, mining, and construction of reservoirs.

The existing system of Protected Areas in general is insufficient both in total area and in representativeness. Obviously, there is an urgent need for its improvement.

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Certification of forests according to different standards is now increasing in Russia. This makes it possible to voluntarily preserve areas of forests with high nature conservation values. To make this possible, it is important that these areas are identified. Certification with such knowledge will be an efficient step towards more sustainable forestry and a better preservation of the biodiversity in forests.

For both these processes it is necessary to have information on location and data of forests with high biological values – i.e. forests with the highest concentrations of threatened biodiversity not compatible with forestry practices – and data on them. (In this text, "Forests with high biological/ biodiversity/nature conservation values" are used as synonyms).

A problem is that most surveys of forest with high biodiversity values less than size of Intact Forest Landscape (50,000 ha) in Russia until present have been dealing with northern boreal (northern taiga) forest. Methods and assessment criteria are developed and are in use in several northern regions. Well-functioning and cost-efficient methods for surveying forests of high nature conservation values in the nemoral zone are missing in Russia. Also in the boreonemoral (in Russian terminology = southern taiga) and middle boreal (middle taiga) zones, cost efficient and thorough survey methods need to be developed. And it is here the Russian-Swedish project "Development and application of survey methodologies for biologically valuable forests south of the taiga" aims to contribute.

The urgent need for surveys creates a need of competent people conducting the surveys. Therefore one of the important tasks is to elaborate a course formula where key persons could be trained in threatened forest biodiversity, forest ecology and survey methods.

Project objectives

Our intention is to elaborate an efficient scientific-based methodology to map and describe biologically valuable forests by merging best experiences from Nordic countries (Nitare & Norén 1992, Norén et al. 1995, Haugset et al. 1996, Tenhola & Yrjönen 2000, Baumann et al. 2001, Gjerde & Baumann 2002, Løvdal et al. 2002, Rune 2002, Yrjönen 2004), the Baltic States (Andersson & Kriukelis 2002, Andersson et al. 2003, Andersson et al. 2005, Bermanis & Ek 2003) and Russia (Yaroshenko et al. 2001, Аксенов et al. 2003,).

The project aims to develop criteria and indicators for forests that can be selected as biologically valuable forests. This means that methods for pre-selection of potentially biologically valuable forests shall be elaborated as well as practical tools for assessment in the field. The project also aims to set up a course formula for training of surveyors of biologically valuable forests. In the course of the project also recommendations for best management and protection of biologically valuable forests will

be addressed. The project is working in the Leningrad, Pskov and Novgorod regions and the Republic of Karelia.

Project organisation

The project is funded by Swedish Environmental Protection Agency and is realized as partnership between Swedish Forest Agency, Committee on Natural Resources and Environment Protection of Leningrad region, Saint-Petersburg Forestry Research Institute, Saint-Petersburg State University, Foundation Pro Natura (Sweden) and Baltic Fund for Nature (Russia). The adjustment of the methodology is realised in cooperation with Swedwood Karelia Ltd, Swedwood Tikhvin Ltd and Metsäliitto Podporozhje Ltd. A number of activities are made in cooperation with the project "Implementation of Red Data Book Species and Indicator species as tools to assess forests with high nature conservation value in Northwestern Russia" funded by Nordic Council of Ministers. A number of other Russian and Finnish scientific and nature conservation organisations take active part in the project implementation.

Definitions

To make the method understood and recognised by all parties in the forest sector it is necessary to have a set of clear terms. Therefore efforts have been made to define the concepts used in the method.

The main logic when formulating the duties for nature conservation in forests and tree-covered habitats has been that the target for nature conservation efforts are forest habitats and forest qualities endangered or not reproduced in the normal commercial forestry. The most important part is then old growth and pristine forests. Another important part is forests with natural disturbance regimes (e. g. flooding) that have declined due to land use or forestry. We also consider that some very rare forest types are threatened by commercial forestry and therefore shall be included in the forests looked for. We have used the term Biologically Valuable Forests (BVF) for such forests.

The forest areas assessed as BVF can be from a stand (vydel) – or part of it – up to 50,000 ha. The assessment and data collection is done at two levels in case of larger areas.

Biologically valuable forest (BVF)

The biologically valuable forest (BVF) is defined in two parts as follows:

1) Forest with qualities not produced in the commercially used forests

1a) Forests with certain species (habitat specialists) not able to survive in the commercially used forest

1b) Old growth and pristine forests of all size classes

1c) Mature forest under influence of natural and semi-natural disturbances which are not reproduced in the commercially used forests (wooded pastures – managed and abandoned, natural fire successions, natural flooded areas)

2) Rare forest types and biotopes in the forest landscape with small area (e.g. waterfalls, springs, canyons, ravines, forests under influence of superficial lime stone, rocky outcrops of various rock types)

- It is necessary to distinguish the selected forests from Woodland Key Habitats (WKH) (Nitare & Noren 1992, Norén et al. 1995, Andersson & Kriukelis 2002, Andersson et al. 2003, Andersson et al. 2005, Rune 2002, Bermanis & Ek 2003). The WKH survey operates only at stand level. In BVF also the massif level is surveyed and data collected in connection with this.
- It is necessary to distinguish the surveyed forests from those mapped in the Intact forest landscape mapping (Аксенов et al. 2003, Yaroshenko et a.l 2001). These forests are large intact areas of more than 50,000 ha. For such surveys another method is needed.
- It is necessary to clarify that the survey of BVF is not equivalent with a full survey of HCVF (Jennings et al. 2003). In the HCVF definition, apart from forests important for biodiversity, there are forests of economical importance for local people, forests of cultural and archaeological value and forests that are of general importance for environmental protection (e. g. against flooding and erosion). All these forest categories need a completely different set of methods for mapping.

Habitat specialists and *Indicator species* are used as tools for assessment of the biological value of the surveyed forest area; – They can be considered as direct criteria of forest biological values. The use of species in nature surveys has long tradition and in forest surveys they have been widely used in Sweden (Karström 1992, Bratt et al. 1993, Nitare 2000) and also in the Baltic Woodland Key Habitat surveys. In Sweden there was no distinction between *Habitat Specialists* and *Indicator Species* although there were rather well developed and continually updated Red

Data Book lists available. This distinction was developed in the WKH surveys in the Baltic States.

Habitat specialist
Habitat specialists are all species depending on specific qualities in the forest woodland and not surviving in commercially used forest in the long-term. In most cases these species are to be found in the Red Data Book of the region or the federation. Due to the large work involved to establish lists of endangered and vulnerable species in the Red Data Book the lists of species used here differ from the Red Data Books, especially among lichens, fungi, mosses and insects. The existence of a habitat specialist in a forest and the probability that it will survive there, qualifies the forest as biologically valuable forest. And these species themselves are part of this value.

Indicator species
Indicator species have rather high demands on their living conditions, but not as high as habitat specialists. They will decline in the commercially used forests, but the existence in the long-term is probably not threatened. The existence of an Indicator species in a forest stand is not qualifying to be a biologically valuable forest. On another hand, large amount of several indicator species are a strong indication of that the forest is a biological valuable forest.

The indicator species and habitat specialists that are recommended to be used for assessment of BVF at stand level in the Leningrad, Novgorod and Pskov regions and the Republic of Karelia are treated in the Species identification manual produced in the frame of this project.

The species used for assessment of biological values at massif level have not been categorised in habitat specialists and indicator species.

The most useful and easy-to-learn tools when assessing at stand level whether a forest area is a BVF or not is elements and structures of different types. These are indirect criteria which are not possible to quantify in exact figures by cost efficiency reasons. For the landscape key elements, as rocks, water courses, slopes, ravines, etc, it would be very complicated to set up quantity classes, and for dead wood and old trees this would be a very time consuming process in the field. Therefore all key elements are estimated by quantity in a logarithmic scale of three degrees. More emphasize has been made on qualities and therefore also stages of decay and moisture (dry exposed, mesic, wet situations) are notified concerning logs.

Key element
Specific components that make the forest suitable for habitat specialists. These are divided in biological key elements (trees or remnants of trees) and non-living physical features landscape key elements.

The concepts old growth forest and pristine forest are very often used terms in the connection with biologically valuable forests. When we use them in this project we define them as follow.

Old growth forest
Forests still having structures of old trees and coarse dead wood are called old growth forests.

Pristine forest
Forests which show no signs of human impact from commercial use are called pristine forests.

Many forest qualities make sense only when they occur on large (non-fragmented) forest areas. This is valid for area demanding sensitive vertebrates, ecological processes and spatial ecological functionality. In the BVF survey, therefore a set of data is collected only for larger forest areas – massifs. This means that for a massif there shall be one or more data set collected at stand level and one data set collected at massif level.

To make the difference between the stand level and massif level clear they are in this project defined by their size.

Stand
A forest area up to the size of one compartment (quarter, kvartal in Russian. The stand can include areas from more than one kvartal but the total size shall not exceed what is the average size of a kvartal in the surveyed district. It can be less than one subcompartment ("vydel" in Russian).

These relatively small areas are enough for maintenance of populations of plants, fungi, lichens, invertebrates and very limited number of mammal species.

Massif
A massif is in Novgorod, Pskov and Leningrad regions a forest area exceeding 100 ha. A massif in the Republic of Karelia is more than 500 ha. A massif can not exceed 50,000 ha.

Such areas are also important for rather large and mobile vertebrates – especially mammals and birds – and for ensuring natural processes and dynamics.

To assess ecological functionality on massif level the concepts of core area and matrix are used.

Core area and matrix
The terms core area and matrix are used when surveying at massif level.

- Core areas are identified BVF at stand level.
- Matrix is non-BVF areas between and surrounding the identified core areas. Matrix can be forest (usually with some human impact), open wetlands, water, open land, etc.

Survey method

The method includes different ways of pre-selection of potentially valuable forests, criteria and indicators to assess forests in the fields, ways to document the values and to compile the result. Data collection and assessment is made are in two scales: stand level (up to one compartment) and massif level (over 100 ha in Leningrad, Pskov and Novgorod regions and over 500 ha in Republic of Karelia up to 50,000 ha).

During the year 2007 there where developed criteria and indicators for assessing biological values in field (including valuable features related to landscape elements, biological elements as dead wood and old trees, species indicating high biological values of the forest – vascular plants, bryophytes, lichens, fungi, wood-inhabiting beetles, molluscs, birds and mammals, forest type, natural disturbance regime, forest history and negative human impact). Development of pre-selection methods using forestry databases and maps, topographic maps, aerial photos and satellite images and methods for assessment values at massif level was outlined and will be continued in 2008. The relation between surveys in various geographical scales and responsibilities with regards to preservation of the biological values is given in Figure 1.

The method is adapted to conditions in Leningrad, Novgorod and Pskov regions and Republic of Karelia; special focus is made on values specific to southern boreal and boreo-nemoral forests. A constant effort has been to make the method cost efficient since forest areas in Russia are immense and the number of surveyors of forest biodiversity is limited.

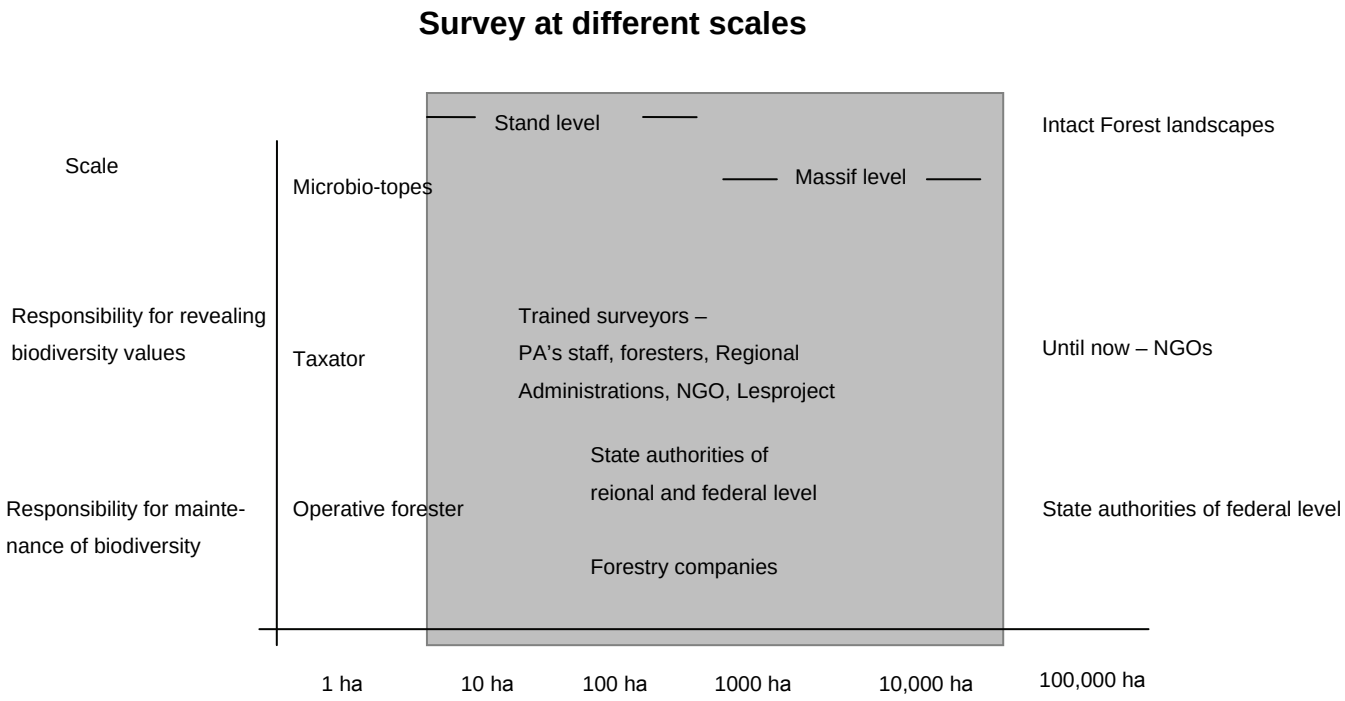

Figure 1. The relation between surveys in various geographical scales and responsibilities with regards to preservation of the biological values. The scale of BVF survey is marked with grey.

The first step is to pre-select possible BVF's. Sources and criteria used for pre-selection of BVF candidate areas are shown below. For the use of satellite images we relied on the NGO Transparent World, Moscow (http://www.transparentworld.ru/).

Source	Criteria
Aerial photos	Absence of human impact, natural forest structure, canopy structure, landscape key elements
Satellite images	Absence of human impact, natural forest structure
Topographic maps	Landscape key elements (slopes, ravines, water formations)
Geological maps	Rare rock types, rocks with nutrient rich minerals
Soil maps	Nutrient rich soils, sandy soils, rare soil types
Forestry maps	Old forests, water protection zones
Forestry database	Old forest (large set of age criteria, protection forests, other direct or indirect indications of biological values in the database), special values
Local people and foresters	Personal knowledge of old growth or otherwise unusual forests

To assess biological values at stand level in the field the following criteria are used:

- Presence of rare forest biotope types
- Presence of habitat specialists (vascular plants, mosses, fungi, lichens, invertebrates)
- Presence of indicator species (vascular plants, mosses, fungi, lichens, invertebrates)
- Presence of biological key elements
- Presence of landscape key elements
- Presence of natural processes and disturbances
- Absence of human impact

For the assessment criteria used at massif level – both field data and other data are used:

- Size
- Proportion of core area
- Core area quality
- Ecological functionality
- Presence of sensitive area demanding species (birds and mammals)

These criteria are more in detail described in *the Survey manual.* Our objective is to strengthen the criteria so they will be used in an objective way. On the other hand the criteria must be practical – too detailed measuring operations are not possible due to limited resources.

For the classification of the forest dynamics and forest history we have used and further adapted to south boreal and nemoral zones the work done by Silver Taiga Foundation (Mariev et al. 2005) (http://www.komimodelforest.ru).

Biologically Valuable Forests (BVF) and High Conservation Value Forests (HCVF)

The survey of BVF is elaborated to be a tool to map and assess BVF in many contexts, principally focused on biodiversity values. The concept HCVF was initiated to be a tool in connection with FSC certification of forestry. It has shown to be useful for other purposes as well. HCVF encompass in addition to biodiversity values also values of cultural and archaeological types, economical value for local populations and forests having function as environmental protection (flooding, fire, erosion, etc). To map and asses these values, other methods are needed than those used for biological values. The relation between BVF and HCVF, (Figure 2), is such that the BVF is aimed to be a subset of the HCVF in the surveyed area – the types 1–3. It should be added though, that the BVF method is insufficient for the mapping of HCVF of the type 1.4 – Forests of critical

temporal use (Jennings et al. 2003). In Russia HCVF of the type 2 also obviously include *intact forest landscapes* which are larger than BVF.

HCVF 1: Significant concentrations of biodiversity values
HCVF 2: Significant large landscape level forests
HCVF 3: Forest areas that are in or contain rare, threatened or endangered ecosystems

HCVF 4: Forest areas that provide basic services of nature in critical situations (e.g. watershed protection, erosion control)
HCVF 5: Forest areas fundamental to meeting basic needs of local communities
HCVF 6: Forest areas critical to local communities' traditional cultural identity

Figure 2. The HCVF categories (dark grey) and those categories mapped by the BVF method.

Results

Development of survey method

The workgroups and the project leaders as well as parts of the scientific committee and other experts made common efforts to elaborate a first version of the method and criteria and indicators for surveys of biologically valuable forests parallel with the production of the survey manual. The 2007 version of the method was completed in the beginning of April 2007.

The method was the basis for the training of surveyors in spring and summer 2007. During this time numerous proposals for amendments and improvements have been gathered. Together with conclusions made during the pilot surveys and other scrutinising and evaluating activities these will serve as the base for the updated version to be produced in 2008.

Production of illustrated manuals

Two manuals were produced during the winter and spring 2007. One manual covers survey method and its background and logics, the second covers species recommended for use as indicators for biologically valuable forests at stand level in Novgorod, Pskov, Leningrad regions and the Republic of Karelia.

The manual on survey method comprises 170 richly illustrated pages covering all aspects of the survey method. The main authors of the manual are Leif Andersson and Nadezhda Alexeeva together with experts from Silver Taiga Foundation, Syktyvkar – Alexander Mariev and Dmitry Kutepov (boreal forest dynamics) – and expert from St. Peters-

burg State Forest Technical Academy and St. Petersburg State University – Vasily Neshatayev (forest type classification).

The species identification manual comprises 242 pages covering ca 80 species of vascular plants, ca 80 species of bryophytes and the same number of lichens, ca 120 fungi, 10 wood-inhabiting beetles, 20 molluscs and 1 mammal (flying squirrel). All the species are illustrated by one or two high class photos. 33 photographers from Sweden, Russia, Denmark, Finland, Estonia, Latvia and Lithuania have contributed with photos. The authors of the species manual were Galina Konechnaya (Komarov Botanical Institute of the Russian Academy of Science, Herbarium, St. Petersburg / St. Petersburg State University, department of Botany) – vascular plants, Ljubov Kurbatova (Komarov Botanical Institute of the Russian Academy of Science, laboratory of lichenology and bryology, St. Petersburg) – mosses, Alexey Potemkin (Komarov Botanical Institute of the Russian Academy of Science, laboratory of lichenology and bryology, St. Petersburg) – liverworts, Ekaterina Kuznetsova and Dmitry Himelbrant (St. Petersburg State University, department of Botany) – lichens, Ivan Zmitrovich (Komarov Botanical Institute of the Russian Academy of Science, laboratory of fungi systematics and geography, St. Petersburg) – fungi, Aphyllophorales, Vera Malysheva (Komarov Botanical Institute of the Russian Academy of Science, laboratory of fungi systematics and geography, St. Petersburg) – Clavaroid fungi, Olga Morozova (Komarov Botanical Institute of the Russian Academy of Science, laboratory of fungi systematics and geography, St. Petersburg) – fungi, Agaricales and Gasteromycetes, Eugene Popov (Komarov Botanical Institute of the Russian Academy of Science, laboratory of fungi systematics and geography, St. Petersburg) – fungi, Ascomycetes, Vera Kotkova (Komarov Botanical Institute of the Russian Academy of Science, laboratory of fungi systematics and geography, St. Petersburg) – fungi, Aphyllophorales, Telephoraceae, Leif Andersson (Pro Natura, Sweden) – beetles and flying squirrel, Rita Zakaite and Grita Skujienė (University of Vilnius, Department of Zoology, Lithuania) – molluscs. The editors of the manual were Leif Andersson and Nadezhda Alexeeva.

Training of surveyors, survey leaders and relevant foresters and biologists

During the spring and early summer 2007 55 key persons have been trained in survey method and identification of indicator species. Two courses were given on each place in Kurgalsky–Kotelsky–Oak Groves near the Village of Velkota regional nature reserves and in Vepssky Les Nature Park. The first courses were focused on nemoral forest types, elements and species whilst the courses in Vepssky Les were focused on aspects in middle taiga zone. The course was certified by St. Petersburg state University, Faculty of Biology and Soil.

Course leaders were Leif Andersson and Nadezhda Alexeeva, together with experts from Silver Taiga Foundation (Syktyvkar), Center for Prob-

lems of Ecology and Productivity of Forests of the Russian Academy of Science (Moscow), Institute of Physicochemical and Biological Problems of Soil Science of the Russian Academy of Science, (Moscow), NGO Transparent World (Moscow), Komarov Botanical Institute of the Russian Academy of Science (St. Petersburg), St. Petersburg State University, department of Botany and department of Geobotany and Plant Ecology.

Participants were biologists from various NGO's in Northwest Russia and Moscow (WWF, Greenpeace, Transparent World, Silver Taiga, SPOK, Baltic Fund for Nature, Lenoblpriroda Fund), biologists from universities and scientific institutions in St. Petersburg and Moscow, foresters from St. Petersburg Forestry Research Institute and St. Petersburg State Forest Technical Academy, staff (both foresters and biologists) from a number of protected areas in Northwest Russia (Valdayski NP, Kenozerski NP, Sebezhski NP, Russki Sever NP, Vepssky Les Nature Park and Kurgalsky regional nature reserve) and consultants in forestry and nature conservation (Fund Green Forest, Neftegazgeodezia Ltd).

In addition 15 persons of the Swedwood Karelia Ltd and Swedwood Tikhvin Ltd staff (foresters and biologists) and foresters from leshozes, where Swedwood has leased forest, have been trained in the survey method. The courses for Swedwood were arranged in Vepssky Les Nature Park, Leningrad region and in Kalevala–Voinitsa area, Republic of Karelia. Course leaders were Leif Andersson and Nadezhda Alexeeva together with Anna Roukolainen, Karelian Research Centre of the Russian Academy of Science.

Pilot surveys were made in the Kurgalsky regional nature reserve in October 2007. Survey work has been carried out in the forests leased by Swedwood in Karelia and Leningrad region. Calibrations of the surveys made 2007 have been done in all the surveyed areas. Cooperation has also started with the Finnish forest company Mestäliitto for use of the method on the area leased by Metsäliitto Podporozhje Ltd in Leningrad region.

References

Атлас малонарушенных лесных территорий России / Аксенов, Д.Е., Добрынин, Д.В., Дубинин, М.Ю. и др. – М.: Изд-во МсоЭС; Вашинтон: Изд. World Resources Inst., 2003. – 187 с.

Восточноевропейские леса: история в голоцене и современность: в 2 кн. / Центр по проблемам экологии и продуктивности лесов. – М.: Наука, 2004. Кн.1 / Отв. ред. О.В. Смирнова. – 2004. – 479 с.: ил. Кн. 2 / Отв. ред. О.В. Смирнова. – 2004. – 575 с.: ил.

Федорчук, В.Н., Нешатаев, В.Ю., Кузнецова М.Л. Лесные экосистемы северо-западных районов России. Типология, динамика, хозяйственные особенности. – Санкт-Петербург, 2005. – 382 с.

Aksenov, D. Karpachevskiy, M., Lloyd,S. & Yaroshenko, A. 1999. The last of the last: The Old-growth Forest of Boreal Europe. – Taiga Rescue Network. 67 p + maps. (http://www.transparentworld.ru/ProjectsP/Last_of_the_last/lastlast.pdf)

Andersson, L. & Alexeeva, N (Eds). 2007. Species to be used for assessment of bio-

logical values at stand level A field identification manual. – Tentative edition for education and evaluation. 242 p.

Andersson, L., Mariev, A., Kutepov, D., Neshataev, V. & Alexeeva, N. 2007. Survey of biologically valuable forests (BVF). Background and working instructions. – Tentative edition for education and evaluation. St. Petersburg. 170 p.

Andersson, L. & Kriukelis, R. 2002. Pilot Woodland Key Habitat Inventory in Lithuania. – Forest Department, Ministry of Environment, Lithuania & Regional Forestry Board of Östra Götaland, Sweden, Vilnius. 88p. (http://www.pro-natura.net/Final-report-Lithuania-2002.PDF).

Andersson, L., Kriukelis, R., & Skuja, S. 2005. Woodland Key Habitat Inventory in Lithuania. – Lithuanian Forest Inventory and Management Institute, Kaunas & Regional Forestry Board of Östra Götaland, Linköping, Sweden. Vilnius. 249 p. (http://www.pro-natura.net/WKH-report-Lithuania-full-version.pdf).

Andersson, L., Martverk, R., Külvik, M., Palo, A. & Varblane, A. 2003. Woodland Key Habitat Inventory in Estonia 1999–2002. – Regio Publishing, Tartu. 192 p.

Baumann, C., Gjerde, I., Blom, H.H., Sætersdal, M., Nilsen, ,J.-E., Løken, B. & Ekanger, I. (Eds.) 2001. Miljøregistrering i skog – biologisk mangfold. – Håndbok i registrering av livsmiljøer i skog. Skogforsk, NIJOS, Lantbruksdepartementet.

Bermanis, R. & Ek, T. 2003. Inventory of Woodland Key Habitats in Latvian State Forests. Final report 1997–2002. – State forest Service, Latvia (Riga), Regional Forestry Board of Östra Götaland (Linköping), Sweden & Joint Stock Company ”Latvijas valsts meži”, Riga.

Bratt, L., Cederberg, B., Hermansson, J., Lundqvist, R., Nordin, A. & Oldhammer, B. 1993. Särnaprojektet. Inventeringsrapport från en landskapsekologisk planering. – Dala.Natur 10:5, Mora. 216 p.

Gjerde, I.. & Baumann, C. (Eds.) 2002. Miljøregistrering i skog – biologisk mangfold. Hovedrapport. – Skogforsk. Norsk institutt for skogforskning. Ås. 224 p.

Haugset, T., Alfredsen, G. & Lie, M.H. 1996. Nøkkelbiotoper og artsmangfold i skog. – Siste Sjanse, Naturvernforbundet i Olso og Akershus.

Jennings, S., Nussbaum, R., Judd, N. & Evans, T. 2004. The High Conservation Value Forest Toolkit. – ProForest. (http://www.proforest.net/publication/)

Karström, M. 1992. Steget före – en presentation. – Svensk Bot. Tidskr. 86:103–114.

Løvdal, I., Heggland, A., Gaarder, G., Røsok, Ø., Hjermann, D. & Blindheim, T. 2002. Siste Sjanse metoden: En systematisk gjenomgang av prinsipper og faglig begrunnelse. – Siste Sjanse, rapport 2002–11, Norge, Oslo. 157 p. htttp://biolitt.biofokus.no/rapporter/sistesjanserapport_2002–11.pdf)

Mariev, A., Kutepov, D., Mikheev, R. & Poroshin, E. 2005. Recommendations on logging operations with conservation of ecological values in intact (pristine) forests in the Komi republic. – Ministry of Natural Resources of the Russian Federation, Forestry Agency for the Komi Republic, Silver Taiga Foundation & Priluzje State Forestry Unit. 46 p.
http://www.komimodelforest.ru/eng_docs/Logging_in_pristine_forests_21Nov05.doc

Nitare, J. (Ed.) 2000. Signalarter. Indikatorer på skyddsvärd skog. Flora över kryptogamer. – Skogsstyrelsens förlag, Jönköping. 392 p.

Nitare, J. & Noren, M.. 1992. Nyckelbiotoper kartläggs i nytt projekt vid Skogsstyrelsen. The Swedish Woodland key-habitats of rare and endangered species will be mapped in a new project of edish National Board of Forestry. – Svensk Bot. Tidskr. 86 (3): 219– 226.

Norén, M., Hultgren, B., Nitare, J. & Bergengren, I.. 1995. Instruktion för Datainsamling vid inventering av nyckelbiotoper. – Skogsstyrelsen, Jönköping. 105 p.

Rune, F.. 2002. Key habitat designation in Denmark developmen, pilot studies, subsidy scemes & management. – Danish Forest and Landscape Research Institute, Department of Forestry. 48 p.

Russian-Finnish Project ”Landscape Ecological Planning of Forestry on the Karelian Isthmus”. 2001. Landscape Ecological Forest Management Plan. Lindulovskoe Subdivision (Lesnichestvo), Roshsinsky Forest Management Enterprise. – Saint-Petersburg. 49 p.

Tenhola, T. & Yrjönen, K.. 2000. Biological diversity in the Finnish private forests – Survey of valuable habitats. – Ministry of Agriculture and Forestry, Interim Report 2000.

Yaroshenko, A.Y., Potapov, P.V. & Turubanova, S.A. 2001. The Last Intact Forest Landscapes of Northern European

Russia. – Greenpeace Russia and Global Forest Watch. 77p. (http://www.forest.ru/eng/publications/north/intact_forest_en.pdf).

Yrjönen, K. 2004. Kartläggning av de särskilt viktiga livsmiljöer som nämns i skogslagen. Slutrapport. – Jord- och skogsbruksministeriet, Finland. Publikationer 9a/2004.