The last large intact forests in Northwest Russia

Protection and sustainable use

Tor Kristian Spidsø & Ole Jakob Sørensen (Eds.)

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Preface

The Norwegian Directorate for Nature Management (DN) and Nord-Trøndelag University College (HiNT) decided in autumn 2005 to apply Nordic Council of Ministers (NCM) for financial support to arrange a Nordic-Russian conference with focus on protection and sustainable use of the last large intact forests in northwest Russia which is important to preserve western taiga biodiversity. The reason for this was partly that as Fennoscandian forests now are almost totally exploited over time, and very few and mostly also very small areas are left with pristine old-growth forests, Russia still have some large areas of forests lands left where ecological processes are still going on with only small impact of human activity (except for global air-pollution etc). Russian environment authorities, as well as Russian Forestry authorities have now, as well as Russian and Nordic NGO's, and Nordic environmental authorities and Russian and Nordic research institutions have recognized that protection of these forests is important to have future possibilities to study natural ecological processes in western taiga forests, and to preserve its biodiversity. In addition – we have also observed and understood the fact that protection of such forests are complicated also by the fact that forestry activities is a basic for local communities as well as regional and national economy in North-West Russia. In this way socio-cultural values have to be addressed as well as environmental conservation needs.

We wanted a conference to address both questions within the same audience, and as the institutions that finally agreed to join the conference project, we found the way to do so was to integrate a workshop to the conference part.

The Conference is a joint project initiated by the Norwegian Directorate of Nature Management (DN) and North-Trøndelag University College (HiNT) in cooperation with Archangelsk State Technical University (ASTU), Swedish Univ. of Agricultural Sciences (SLU), Tampere College, Kuru Inst. of Forestry (TC-KIF) and Finnish Environment Institute (SYKE) with Nordic Council of Ministers (NCM) as a main sponsor. All institutions in responsibility for the conference have contributed financially and/or practically.

The Conference was hold in Steinkjer 4–6 December 2007 and the workshop in Lierne 6–7 December 2007 and some participants had the possibility to visit Trondheim and get information on forestry within a city in Trondheim at the 9 December 2007.

Conference hosts:

North-Trøndelag University College (HiNT)
Directorate for Nature Management (DN)

Program and scientific committee:

Ole Jakob Sørensen, HiNT. Conference chair
Ellen Arneberg, DN. Co-chair
Tor Kristian Spidsø, HiNT. Secretary
Sergey Koptev, ASTU, Archangelsk, Russia
Alexander A. Bakhtin, ASTU, Archangelsk, Russia
Per Angelstam, SLU, Sweden
Timo Järvenpää, TC-KIF, Finland
Tapio Lindholm, SYKE, Finland
Linda Berglund, WWF – Sweden

In addition we will acknowledge the following institutions which have sponsored the Conference and Workshop, practically and/or financially:

The Norwegian Barents Secretariat
ALLSKOG BA
Norske Skog a/s
Statskog a/s
Nord Trøndelag County Municipality – Dept. of regional development
County Governor of Nord-Trøndelag –Dept. of forestry and agriculture
Steinkjer municipality
Lierne municipality
Trondheim City Municipality – Forest division
Kjartan Trana (Photos of the Great Grey Owl).

WWF – Archangelsk represented by director *Andrey Shchegolev* was to great help creating contact to possible participants and institutions in Russia. We will also acknowledge the translators of the Conference: *Lev Levit, Aleksei Repin, Stein Larsen* and the former students of ASTU and HiNT *Vladimir Naumov and Tatjana Trubina*, who also have made several of the translations between English and Russian – as well as Norwegian to Russian when needed. The Conference Summary and Statement has been worked out by *Ellen Arneberg* and *Jan-Petter Hüberth Hansen* and translated into Russian by *Lev Levit*. The proceedings have been edited by *Tor Kristian Spidsø* and *Ole Jakob Sørensen* at HiNT.

The publication also includes a paper by *Angelstam et al.* on “Sustainable Forest management; – From policy to practice by communication, education and public awareness using landscapes as laboratories in Europe’s west and east”. The manuscript is produced after the Confer-

ence, but its contents were strongly addressed at the conference and as such a product of the conference and workshop of importance for coming projects and processes.

Archangelsk Oblast has since the conference also produced their own regulations and subregulations based on the new Russian Forest Code. We have learned that information from and attitudes addressed at the conference regarding environmental care of forests and forest landscapes have been implemented in the new regulations, for which we will pay respect to The Forestry Administration of Archangelsk Oblast!

Steinkjer 14-03-2009.

Ole Jakob Sørensen

Tor Kristian Spidsø

Summary

Introduction

New challenges are facing our forest and woodland landscapes. An increasing number of goods and services should be provided more efficiently in the same forest. At the same time decisions about what actually takes place locally is determined more and more at transnational and even global levels. In addition, energy supply and global climate change scenarios suggest that increased levels of uncertainty need to be handled. Such multilevel links means that use of forests and woodland imply extensive export of both positive and negative economic, ecological and socio-cultural footprints at different scales, usually without being aware of them.

Only in the northern part of Europe, and mainly in the areas defined as the Barents Region of the Russian Federation, there remain large indigenous forest areas. These areas are shrinking and if lost they cannot be restored.

Large intact forest areas are unique and represent the last possibilities for maintaining natural ecosystems, so far little influenced by human activities such as large logging operations. Both international conventions (CBD, Bern) and organizations like IUCN, Greenpeace and WWF have focused on the need for the protection of many of these areas. The importance of protection is undoubted, but protection will also represent a challenge to the important forest industry for the regions in question. In addition, rural societies may be considerably affected as the economy connected to forestry is the main source of income for many, unless incomes from other goods and services are developed.

This complex situation is recognized both in forest management units and corresponding industrial companies as well as the environmental authorities in the Barents Region and different NGO's. The aim of this conference and workshop was to review experiences and develop ways to combine initiatives for protection and sustainable forest management, including ecological, economic and socio-cultural dimensions, of these last remaining original old-growth forests of North-West Russia.

Important issues to be reviewed

- The status and threats of the last remaining large intact forest areas of North-West Russia.
- The importance of biodiversity conservation of the last remaining large intact forests of North-West Russia.

- The importance of forest goods and services for forest users at local, regional, national and international levels.

Objectives

- Highlight the importance of biodiversity conservation in the large in-tact forest areas of North-West Russia from local to global levels.
- Clarify current knowledge and initiatives on planning, protection and management for implementation of sustainable forest management policies.
- Create tools that provide transparent information to local societies on new needs for forest landscape management and rural development in local societies.
- Discuss the consequences of the new forest legislation on the management of the old growth forests of North-West Russia
- Look into how protection measures, forestry certification and other tools can be combined as a base for future recommendation and action.
- Recommend plans for future work/projects for scientific research/ education as well as practical implementation and development to forestry, forest management and forest industry as well as local societies.

Sørensen og Overskaug

The presentations of this proceeding cover many aspects of sustainable forest management. *Davydov* introduces us to old spiritual taiga cultures and also make us open to consider different sites of religious or spiritual origin – as places where biodiversity can be secured and included in coming management strategies. Local culture and protection of large areas can also be arguments for protection of the Pinegsky Forest area, where the Ura village is a symbol for old settlements in remote taiga areas. *Overskaug and Sørensen* gives an introduction to the concepts of Island and Landscape Ecology and how these approaches gives arguments for saving functional habitats and landscapes, thoughts put into constructive ideas for the region in question by *Efimov*.

Efimov give us ideas and reasons for international effort to preserve a system of larger habitat corridors and stepstones for biodiversity reasons – both for conservation and for further possibilities to disperse in all directions, – important for a future where global climate change is most likely to become a reality. *Dobrynin* also focus on the same challenges. *Gromtsev* and co-authors have given us the results of the situation for “Indigenous forests” of Eastern Fennoscandia including North-Western parts of Russia and stress that the Russian situation is a key for biodiversity preservation and future development. They also stress the fact that the original 3 broad migration/dispersal corridors have reduced functionality due to both urbanizations processes as well as forestry practise. But it is still not too late to act.

Bjelkåsen and *Thingstad* with their co-authors gave examples from studies of forest structures and the bird-fauna in the Pinegsky Forest. The forest succession observed were quite unique to what we can experience in Fennoscandia regarding complexity of different aged fire successions and now a noticeable gap-dynamic operating in mainly the spruce-dominated old-growth forests with a combination of wind-felling, parasitic fungi and bark beetle (*Ips sp.*) attack. The avifauna was compared to results from a similar study in very fragmented senior aged forest in Norway, showing that bird diversity was relatively similar, but the dominance of old succession adapted species were quite different regarding density. *Trubin* gave a lecture on the possible history and future stability of these forests.

Adequate methods for surveying Biologically Valuable Forest (BFV) landscapes was given by *Alexeeva and Andersson*, a thoroughly work and “Cook-book” for researchers and managers that want to implement new ideas to sustainable forest management.

Angelstam and *Elbakidze* with their co-authors took us into the experiences and work with implementing SFM and the creation of the Model Forest concept, and *Zemtsovskaya* introduced us to how a timber company now are implementing Forest Certification in their enterprise which have leased for logging parts of the large old-growth forests of Pinegsky forest massive.

Arneberg presented the official program and status for forest protection in Norway, a process that is still in progress, and *Mogård* how a forest owner association is dealing with both forest protection and implementation of biodiversity care in planning and practice, as well as how Certification is now a part of standard procedures of the association’s policy.

The effects of implementation of the new Forest Code for Russia, and how it will be followed up locally was presented by *Artamonov* and for Archangelsk Oblast by *Krotov and Trubin*. Certification of forestry is nowadays gradually being implemented in Russia, and *Ptichnikov* informed about how FSC have influence on conservation of intact forest massives in NW-Russia.

The conference and the workshop also focused on how local societies are influenced by different forms of national nature protection efforts. *Sørensen* and co-authors gave examples from historic troublesome processes and coming solutions where regional and national agencies try to help out local societies with combined efforts and financial help to create new – often smallscaled companies and working places based on the establishment of national parks in the region. Here – also The Norwegian State Forest use of their internal fund to create work locally as a needed part of social (municipal) sustainability. The efforts done and results are so far not underlaid scientific research in Norway, but *Mikailova* did present research

from similar situations from the creation of Kenozhero National Park – a park that also have been supported financially from Norway.

The Conference's *Summary and Closing Statement* though gives the best summary of the main overall result of the conference and workshop presentations and discussions. The challenges seem to be collectively understood and a solid basement for future cooperation. But we also recognize that suggestions for solutions still might differ between organizations according to their roles and duties. The *Summary and Closing Statement* can anyhow serve among Russian parts as well as at international level as a tool and guideline for future cooperation and strategies. *And – writing this one year after the conference we can experience that cooperation among Russian as well as international actors positively are improved and in function.*

1. The Great Gray Owl, (*Strix nebulosa*), Borodataja nejasit

Ole Jakob Sørensen & Vladimir Naumov¹

Photo: Kjartan Trana

The great grey owl (*Strix nebulosa*) was selected as a symbol species for this conference. It is a species widely distributed in the northern taiga forest region of both Eurasia and North America.

In Scandinavia it is a species with a north-eastern zoo-geographic distribution, – a real inhabitant of the Barents regions old growth forests. The species selects its nesting habitats in old, but often semi-open forests, where it most commonly use old nests of other birds of prey as the goshawk (*Accipiter gentilis*), ruffed leg buzzard (*Buteo lagopus*), and more seldom nests made by other large birds putting their nest in the lower parts of large coniferous or aspen (*Populus sp.*) trees.

As many other birds that mainly stay the winter time in its breeding habitats, it has the old forests as its main habitat, where they need a quite large (3–10 km²) territory for their survival. Its preferred habitat, the old-growth forests, interspersed with small openings (gaps), bogs and rather open vegetation on the forest floor, is the best hunting habitat for this large, flying predator with a wingspan on approx 1.5 m.

¹ Nord-Trøndelag Univ. College. Faculty of Natural Resource Sciences and Information Technology. Box 2501. N-7729 Steinkjer. Norway. ole.j.sorensen@hint.no

The great gray owls feed mainly on small rodents all over their distribution area. As small rodents typically vary a lot in population density from years to year, the reproduction reflects this situation, but the territorial pair often stands in its area all the year and between the peak years in rodent cycles. In year of rodent failure, young and other non-territorial birds are known to migrate and disperse and then often observed in non-preferred habitats and outside their normal range. The pair on photo have been observed using the same area for at least 17 years now, showing that favourite habitats are of crucial importance for survival.

The great grey owl is regarded a red-listed species in the Barents Region – as its habitats is stressed by forestry. Its preferred nesting habitats are being reduced – and the species dependence on other large predatory birds for making nests makes it even more vulnerable. New old growth, but cultural forests might become too dense for creating favourable hunting habitats – as well as its dependence on rather large territories of similar habitat types.

It truly belongs to the clan of birds dependent on larger areas of old-growth forests together with the capercaillie (*Tetrao urogallus*), three-toed woodpecker (*Picoides tridactylus*), Siberian tit (*Parus cinctus lapponicus*), Siberian jay (*Perosoreus infaustus*) and pine crossbeak (*Pinicola enucleator*), whose population healthiness now need consideration in our taiga landscape management.

2. Forest as a phenomenon of spiritual culture

Alexander N. Davydov²

Historical roots of the sacred groves of Kenozero Land

The description of the sacred groves of Kenozero Land is found in my article “Solovetsky Green Meridian” and SNS “svyashschennye roshschi” (sacred groves) of the National Park “Kenozersky” in the light of Delos Initiative” in this publication. The analogous of the sacred groves in Kenozero can also be found in all the taiga forests of West Siberia. Among the Khanty and Mansy peoples there are very strong traditions of sacred groves of coniferous trees, connected to shamanism. An example I would like to mention is the sacred grove Khalev-Oyka, which is a sanctuary of the Mansy people community of the village Aneevo in the West Siberia, located 5 km from the point where river Posol flows to the river Sosva. The sanctuary is described by Izmail Gemuev (1990), who visited the place in 1986. A narrow path follows the taiga forest for about 0.5 km from the village Aneevo to this sacred grove. There is a glade in the centre of this sacred grove. Gemuev describes a post on the glade, with the top of it covered by a birch bark “cap”. There is a thin pole fastened to the post by several cloths. On a photo in his article, (p. 79), we can see another post with several clothes fastened to a spruce tree. I would like to mention the parallel with pelena on the Holy crosses of Kenozero Lake Area and cloths on the post and a spruce tree of the sacred grove Khalev-Oyka (Figure 1).

There is a small wooden table (“passan”) near the post. This table is used for ritual food for the sacred protector of the Aneevo village, which name is Khalev Oyka. This is another parallel with the chapels of sacred groves of Kenozero Lake Area, where small taaales often are placed near the chapels, on which the peasants of the villages have their ritual meals in patron saint’s days.

Another important feature of the sacred grove Khalev-Oyka is a ritual storehouse (sumyah). Inside this storehouse there are a wooden sculpture of Naj-otyr (epic hero) and arsyn, which are clothes, as offerings to him (Figure 2). Gemuev (op cit.) also described another sumyah, which at that time was destroyed. There were another arsyn, offerings to Khalev Oyka in that ritual storehouse. These are parallels with pelena on the sacred

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crosses of Kenozero Lake Area, and the cloths on the post and the spruce tree of the sacred grove Khalev Oyka.

Figure 1. Sacred grove of Khalev-Oyka (Gemuev 1990, p. 79)

Figure 2. Ritual storehouse from the sacred grove of Khalev-Oyka (Gemuev 1990, p. 85)

The Capercaillie and “Bird of Happiness”

The ridge of the storehouse in Khalev-Oyka was decorated by a wooden sculpture of the capercaillie (*Tetrao urogallus*). This wooden capercaillie was a sacred protector of the sanctuary and the people visiting the place (Gemuev op cit., p. 85). According to the traditional believes of the Khanty and Mansi people, the capercaillie is a sacred protector of a man and his soul in the forest, and also in another world, which a soul can visit when a person is sleeping. The cradle-chairs of the Khanty and Mansi are decorated by small sculptures of capercaillie.

The Bird of Happiness (Ptitsa Schastja) now becomes a widespread souvenir from the Russian North (Figure 3). Those birds are also known in Norway. Visiting Finnmark by the yacht “Borey” in 1988 I met several old peoples who told me that Russian soldiers, prisoners of Second World War in German camps gave small wooden birds to Norwegians, as a gratitude for their help, mainly by giving them food.

Figure 3. *Ptitsa Schastja (The Bird of Happiness)*. Master Yu. V. Hody. Photo by A.N. Davydov

Historically it is known that this wooden sculpture was a magic symbol of Happiness in the houses of Russian peasants, and these sculptures were hanged in the “Sacred” or “Red” corner (svyatoy or krasny ugol) in the wooden houses of the Russian North. I would like to mention a case; – In the houses of the Mansi people Gemuev (op cit.) describes the capercaillie’s tails in a fan form. At that time only some of the old people of the Mansi remembered that the capercaillie’s tail was a sign of well-being and protection of the family living in the house. The tradition is rather old, in the early written source (Makarii 1853, p. 8), the celibate priest Makarii describes such kind of a capercaillie’s tails on the walls of the Mansi houses.

The neighbors of the Ugric tribes were the Selkup peoples. Also among the Selkups the symbols of protection was connected with the capercaillie (Gemuev 1990, p. 86).

“Cultural contamination”

The above mentioned facts give us opportunity to make the conclusion that the historical roots of the sacred groves on Kenozero came with the Finno-Ugric tribes, who settled this territory before the Russians came. Similar phenomenon of sacred groves was mentioned by Nikolay Kharuzin in the XIX century (1889) in Karelia. In the 1990's Kapitonov & Kapitonova (2002) studied 39 sacred groves of the Udmurt, the Bessermynan and the Mari peoples in the Volga River Area.

All of the examples of the sacred groves in the Russian North are connected with old Pre-Christian tradition and often came from the ethnic groups who were settled on the territory before the Russians came. These ethnic groups were later assimilated by the Russian people, and Christian believes were implanted into the spiritual tradition of North-Russians. The spiritual landscape of the Russian North has been formed in the process of intercommunication of the Russian Orthodox (Byzantine) tradition with an ancient Finno-Ugric substrate. The sacred groves of Kenozero Land are good examples of the relations and intercommunication of the Culture of Forest with the Culture of Fields (Davydov 2000).

“When the white birch came...”

The Russian North is a historical-cultural area located between ethnic borders of Russian people with Komi in the East, Karelian in the West, with Nenets in the North, and Sami at the Kola Peninsula. Most of the territory of the Russian North is now the Archangelsk Region. The southern border of the area is located in the Vologda region. The culture and beliefs of the Finnish (Finno-Ugric) speaking tribes, who lived here before the Russians came, such as the legendary Chud Zavolochskaya, formed the Finnish substrata in the North-Russian culture.

The main characteristics of the cultural landscape of the Russian North are relations between the Forest and the Field. The legends and the wide spread oral tradition says that the territory of the North taiga forests was populated by The Chuds (the word means in Russian a “queer”, “stranger”). “The Chud went under ground when the white birch came” – is a saying that shows the changes of cultural landscapes in the ethno-historical process, connected with the penetration of agriculture into taiga forests. The Chuds were taiga forests' hunters and fishermen, who lived in the mud-huts. According to oral tradition of North-Russian peasants those mud-huts later became Chud's pits (which are from the old times “when the white birch came and Chud went under ground”). The Chud pits (“chudskie yamy”) are one of the characteristic features in the cultural landscape of the Russian North.

The birch is a well-known sacred tree of the East Slavian people. In the taiga forests zone the agricultural activities were connected with the cutting of vast areas of trees and then burning it for fields. The deciduous

trees came first into the borders of those fire-sites, and first of all – birch tree. The similar process of changes of the landscape can be mentioned with the network development of villages and roads. The word-combination “a white birch” (*belaya bereza*) is very typical in the Russian North, because of white color of birch bark. Birch is often grounded in the church-yard in Central Russia.

Not a Palm, but a “Pussy-willow”,

– (A contamination of sacred trees in the European North of Russia)

There is described a legend about one sacred willow in the Archangel Region. The legend was widespread in the basin area of the Severnaya Dvina river where it joins with the Emtsa river. According to the legend, described in the Diary of family Zaborsky, (which has been written continuously since the year 1800 by men through several generations), There was in Zachachye village a “sacred Chud’s willow” located on a meadow near the Kiban lake. The willow was 9,2 meters high and 10,3 meters around. Peasants said, that leafs of the sacred willow were so big and being used for baking of shanga (traditional North-Russian cakes). The legend says that this willow was a sacred tree of the Chud. According to the Diary of family Zaborsky, this willow was cut in 1800, but even the post of the tree was estimated as “a sacred tree” until the year 1897, when it was destroyed (Minina & Sharov 2007, p. 10). In this case I would like to say two proposals. First, – not only coniferous trees were sacred among different tribes of Chud. Second, – not always was chud’s beliefs a substrate into the North Russian culture.

At the same time, Russians also had some vision about the willow, as an unusual tree. In this case I would like to remind such phenomena of Russian Folk Orthodox Festival like the *Verbnoe voskresenie* (a Pussy-Willow Sunday). This is a folklore name of the last Sunday before Easter in Russia; its official name in Orthodox Church is “The Festival of The Entry of Lord to Jerusalem”. As we know, Jesus Christ after creation the miracle of rising Lazar from dead came into Jerusalem as Messiah, – on donkey, and people greeted him by swaying palm leafs and singing “Hosanna!”. This event is marked in Christian Calendar as a special week: the Week of Vaij (the Palm Week) (Hopko 1991, pp. 153–156). Since early period of Christianity, palm tree leafs has become a Symbol, like fishes, an anchor or a cross.

As known, in Russia, especially in the North, there are no palms because of cold climate. In a sacred tradition of the North of Russia, a winter recognized as death, but summer as life. So the period of spring was very important as a time of transition to life from death. In cold climate the nappy buds of pussy-willow is the first sign to show the transfiguration of Nature. In folk beliefs the image of pussy-willow are connected with ideas of Fertility. According to the legend, a willow is a fertile

woman once claiming that she was more fertile than Mother-Earth. Mother-Earth then became very angry on the woman and transformed her into the willow tree, and downy nappy buds are her children.

In the Russian North climate the coming of nappy buds on branches of pussy-willow tree concurred with the Orthodox Church Festival of The Entry of Lord to Jerusalem. So, a pussy-willow took the place of palm tree. The branches of pussy-willow tree were used in the ceremonies and the processions of a Festival of The Entry of Lord to Jerusalem, like branches of palm, even in Moscow Kremlin.

People collected the branches of pussy-willow tree with nappy buds and came with it into the church. After Communion these branches of pussy-willow tree with nappy buds became sacred and full of vital force. In all of Russia people beat each other by the branches of pussy-willow tree with nappy buds and said to each other typical sayings “Verba khlest – biet do slez!” (a pussy-willow whips and beats until tears come!). These words together with symbolic whipping contaminated with old magic belief, are connected with a kind of a sexual context.

The branches of pussy-willow tree with nappy buds have influence on the fertility of people and of cattle. Peasants baked a special rye balls with pussy-willow nappy buds inside. Then those balls were the magic food for sheep and for people. The branches of pussy-willow tree with nappy buds would, after sanctification, become a sacred protector of a house against lightning. Such pussy-willow branches also become form of defense as people sometimes put them into the coffin letting a dead man guard himself and frighten away a devil.

The branches of pussy-willow tree with nappy buds will in the churches, after sanctification, be put on the icons by people. These pussy-willow branches will stand on the place the whole year until next Pussy-Willow Tree Sunday. When the new pussy-willows comes, the old ones are either put into the river or stickseed into the ground in the field, as a protection of future harvest (Shangina 2003, pp. 82–85).

The pussy-willow tree is a good example of the “contamination” of the sacred tree image as the landscape changes from the Mediterranean to the North Taiga of Russia. Sacred functions transform palm into pussy-willow in Christian Orthodox rituals, but the remnants of old Pre-Christian beliefs connected with pussy-willow itself, has survived in the forms of a Folk Christianity.

The “Master of Forest” – Leshij

It is impossible to speaking about forests avoiding its spirits. During the last 2 centuries ethnographers have described several hundreds (thousands!) of stories about leshij. The name of this spirit came from the term les (a forest). “Every animal, as far as every bird which is living into the forest together with all forest lands obeyed to leshij” (Afanasev 2006, p.

318). Creators and managers of Protected Areas have in some way to pay a special attention to the function of the leshij.

Traditionally, the forest was not something hospital to the agricultural population, to Culture of Field. It was a hard job to root out the trees and to collect stones from the fields before the first harvest peoples got a hold into the taiga forest. At the same time, the forest played a great role in the economy of peasants of the North of Russia. Hunting and collecting of berries and mushrooms has always been a part of life of ordinary peoples in the North, as well as the cutting of trees for their houses, firewood, granaries, wind mills and watermills. Wooden churches and chapels become a great example of Northern Russian architecture. Russian peasants in the North are born in a wooden house, grown in a wooden cradle, has eaten his food by wooden spoons, wooden plates and wooden cup, and being buried in a wooden coffin. So, the relations with forest were deep and important.

The portrait of the “Master of forest” is many-sided. In folklore and mythology the leshij can look like “a tree, a bush, a post, even as a forest itself” (Krinichnaya 1993, p. 6). The research of Neonila Krinichnaya shows that the oldest portrait of the leshij has some similarities with coniferous trees. But according to other sources body height of the leshij is different: In the forest he is like a tree, in the grass – like a grass. He is singing with such a strong voice that it sounds like the storm and thunder in the forest. Sometimes he has bears skin as a cloth. Peoples described the leshij as a bear, a wolf, or as an old man – a herder of wolves. The leshij can transform himself into white wolf, bear, cat, horse, sheep or a man. The necessary attributes of leshij is that he is naked and shaggy, and he has no shadow. The retinue of leshij consists of animals as bears, wolves, foxes, moose/elks, even hares and rats (Krinichnaya 1993).

A person has to be polite to the leshij, especially being in the forest. To say the word “leshij” is rather dangerous: – You call the Master of forest and he will come! What will be then? Most often a person will get lost in the forest. To get help him to find the right way he will then need to take off his cloth and dress on topsy-turvy (Krinichnaya 1993).

To address somebody to leshij is very bad. The person could be kidnapped by the leshij. Especially it is dangerous for females, who could be kidnapped by the leshij and then become married on him.

The leshij lives in the deep forest, which in the North of Russia is called matochnik. His dwelling is surrounded by impassable forests and magic water border (mires, which are not frozen in winter). The leshij can live in an old spruce tree. Those, who cut this tree, would be punished (Krinichnaya 1993, p. 20). This fact gives us another opportunity to get back to the sacred groves of Kenozero Lake Area.

The word matochnik of local dialect returns us to the Finno-Ugric substrate of the culture of the Russian North. We can remind the Finnish word matka, which meaning is – a “way”.

The relation of Finnish peoples to the Master of Forest has not been completely negative. Even more, the Finnish name of “leshij” got into the list of personal names, as Professor Tapio Lindholm mentioned, – Finnish male name Tapio means – leshij.

Bear

The favorite animal of leshij is the bear. “Leshij is a big fan of wine, but he does not drink a bucket of wine without treating a bear with this wine. The Leshij has a bear as his servant, not any other animal. When a drunken leshij go to sleep, a bear guards him from every danger, especially from “vodyanoy” (a spirit of waters)” (Afanasev 2006, p. 318).

Bear is a special species in the North of Russia. Hunters never say “I am going to hunt for a bear”, but normally he says – “I am going to visit a master” (“Ya poidu provedat khozyaina”). The word khozyain (“a master”) took the place of the word medved’ (a bear), which is taboo in the speech of hunters; – especially if they are going to hunt a bear. Actually the word “medved” means “[tot, kto] med est”, “(that, who) are eating honey”, “medoezhka” – “a honey eater”, which name also covers the sacred name of a bear. A sacred name of the bear can also be found in another Russian word, “berloga”. Berloga means “a bear’s lair” (ber – is “a bear”, loga, logovische – “a lair”). It is also proposed that this name covers the original name of this animal, because the name only shows the color of animal; – Brown. But, we still don’t know the original sacred name of this animal. Alexander Leontev and Marina Leonteva suggest as a hypothesis as they have found, in Sanskrit, the oldest written name of bear to be “rksha”, which means “those who torments, destructive” (Leontev & Leonteva 2007, p. 206).

In Russian old tradition of paganism, the bear played an important role, probably similar to bear’s cult among some ethnic groups in Siberia, whose bear’s cult is rather famous and well described. We can find the remnants of this cult in the phenomenon of “somoroshui igry” (games of skomorokh). Skomorokh were dancers, musicians and singers of the Kiev Rus, which were punished by Russian Orthodox Church, as representatives of paganism (Voronin 1941). Furthermore, Leontev and Leontova (2007, p. 175–208), call Russians in their hypothesis as “the bear’s people” which is the name of their totem ancestor.

Some of Russian Cities have a bear on their emblems. The oldest one is Yaroslavl. The Town was established by Grand Duke Yaroslav Mudry (Yaroslav the Wise) about the year 1010 on the place of the elder settlement called Medvezhy Ugol (Bears Corner) which has double meaning: “God’s forsaken place”, and “a place with many of bears and a good bear-hunting” (Goroda Rossii 1994, p. 537).

The term “Bear”, which also can mean “Russia/Russians”, has become a widespread international, unofficial symbol of Russia and/or the

Russian army, is also accepted by the Russian people. The emblem of Moscow Olympiad in 1980 was a bear. Also “Edinaya Rossiya – Medved’” (“The United Russia A Bear”), one of the most popular the political party in Russia nowadays has a bear on its emblem.

As a final remark, I would like to mention, that there was in the 1990-ies organized cross-border cooperation on the regional level with Russia in the North. This new international cross-border unit includes three Regions from Norway (Nordland, Troms and Finnmark counties), two Regions from Sweden (Norrbotten and Vesterbotten counties), two Regions from Finland (Oulu and Finnish Lapland counties), three Regions from Russia (Archangel and Murmansk Oblasts and Republic of Karelia). The name of the new international cross-border regional cooperation is titled as the Barents Euro-Arctic Region, which abbreviation sounds very familiar: BEAR.

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3. “Solovetsky green meridian” and SNS “Svyatye roshschi” (sacred groves)

– of the national park “Kenozersky” in the light of Delos initiative

Alexander N. Davydov²

The “Delos Initiative”, an International context of importance to nature protection strategies

The 2nd International Workshop “Delos2” was held 24–28 October 2007 in Ouranopoli (Greece). The workshop was organized within the framework of The World Conservation Union (IUCN) and World Commission on Protected Areas (WCPA). The organizer of the workshop was the Mediterranean Institute of Nature and Anthropos (MedINA), Athens, Greece. The steering committee of the workshop led by the Joint co-ordinators of the IUCN Delos Initiative: the Director of MedINA, Professor Thymio Papayannis, and Dr. Josef Maria Mallarach (President of “Silene” Association, Spain). The participants of the workshop were 22 experts from 12 countries.

The main topics of the discussion were the Guidelines of IUCN/WCPA and its Task Force on Cultural and Spiritual Values of Protected Areas – the structure and the main meanings to document and describe sacred places and sacred species of plants, birds and animals on Nature Protected Areas. Another topic of the workshop was to discuss forms of cooperation between environmental managers and monastic communities.

J.M. Mallarach and Th. Papayannis, the Joint co-ordinators of the IUCN Delos Initiative said: “For some people nature is sacred. For others the natural world is part of the divine Creation. Still others believe that the divine Spirit resides in every natural element, in rocks and trees and wild beings. In all cases, spiritual beliefs are related to nature in one way or the other and warrant a joint appreciation. For practical reasons, looking at an integrated manner upon the sacred and the natural, it may lead to a combination of conservation efforts that can result in a synergy with benefit to both sides” (Papayannis & Mallarach 2007).

The first day of the workshop (25.10.2007) was chaired by Rob Wild (UK, leader LTS International – IUCN Taskforce on Cultural and Spiritual Values), J. M. Mallarach and Gonsalo Olivedo (IUCN). It was

opened with a blessing by Ecumenical Patriarch Bartolomeus and greetings of the representative of monastic communities of the Holy Mount Athos and Prefecture of Halkidiki. The vice-president of IUCN, Mr. Puri Canals, underlined the actuality of the Delos Initiative.

Then case-studies of spiritual values on Protected Area were presented. Zuanat Zakia (Morocco) introduced the case of Jabal La'lâm site in Morocco. According to Zuanat Zakia's conclusion, – "The Jabal La'lâm site represents by its geographical situation, its natural aspects, its spiritual interest, the conditions of a space that deserves to be protected. A hopefully comprehensive expertise is to be done in the field by Delos Initiative who will guide all the national people who are concerned through an integrated appointment which will repair anomalies that have already happened and preserve against other dangers". Jeneda Benalli (USA) told about the tragedy of San Francisco Peaks, the mountain massive with sacred peaks of Indian tribes. These peaks are now started to be used as skiing resort. Sebastian Catanoiu (Romania) spoke about the Protected Area Bulia Vinturarita, where rare species of mountain animals and plants are protected. The area is also famous for protection of Orthodox holy places and old folk traditions. Professor Khan Kiung Ku (South Korea) explained the historical fate of the sacred mountain, Mani San, of the Korean people. Then the participants of the workshop had a scientific excursion by boat around Athos Peninsula. Bas Verschuuren (The Netherlands) introduced a case study of sacred places of aboriginal tribes of Australia and some problems of its protection. Gloria Pungetti (Italy) explained the experience of protection of cultural landscapes of "Forestre Castinelli" in Italy.

The second day of the workshop (26.10.2007) was chaired by Bas Verschuuren (The Netherlands, University of Wageningen, leader of IUCN Taskforce on Cultural and Spiritual Values), Josef Maria Mallarach (Spain, President of Association "Silene", Delos Initiative Coordinator) and Zuanat Zakia (Morocco, anthropologist of the Institute of African Studies of the University of Mohammed V-th in Rabat).

J.M. Mallarach (Spain) introduced the case study of the catholic Benedictine monastery Poblet with the positive experience of environmental activities of the monastic community and integration of spiritual and environmental knowledge. The same lecturer, in cooperation with Sebastian Catanoiu (Romania), introduced a case study of the experience of Rila monastery in Bulgaria, which they had visited together before the conference. The environmental programme of the Holy Mount Athos was introduced by Petros Kakouros (Greece). The theme of activities of monastic communities with environmental education and protection of Nature was continued by Sister Theodota Nantsou (Greece), who introduced the experience of nun's convent on Crete.

The last session of the workshop was dedicated to recommendations and guidelines for study and use of spiritual heritage on Nature Protected

Areas. This document was presented by Rob Wild (UK, IUCN). According to the document, – “Sacred Natural Sites have been incorporated across all the IUCN PA categories: (Ia) Strict Nature Reserve, (Ib) Wilderness Area, (II) National Park, (III) Natural Monument, (IV) Habitat/Species Management Area, (V) Protected Land/Seascape, (VI) Managed Resource Protected Area” (Wild 2007).

Thymio Papayannis (Greece) concentrated on the protection of Holy Nature Areas in the industrial developed countries. Gonsalo Oliveido (IUCN/WCPA) touched in detail the relations between protectors of Holy sites and managers of Protected Areas. Josef Maria Mallarach explained the importance of Delos Initiative in the process of protection of Spiritual and Natural Heritage. Certain general conclusions have been drawn that may be considered as principles on which future work would be based.

Perhaps the most important is that the sacred has been one of the most powerful drivers for conservation, inspiring diachronically feelings of awe, veneration and respect. Sacred natural sites, landscapes, species or particular elements have been an effective form of nature conservation over the ages, some of them being of local importance, while others having a much broader significance (for wider groups, cultures, traditions and regions).

In parallel, it must be recognized that nature has intrinsic values and meanings, including cultural and spiritual, and is understood by followers of various faiths and spiritual traditions as a divine manifestation of some deeper, sacred reality, in whatever form that may be considered.

As a result, the spiritual aspects of sacred sites in protected areas can contribute greatly to the conservation of their natural heritage in multiple ways: directly through sustainable management of sacred lands, and indirectly through raising the awareness of the faithful, inspiring people and involving them in conservation actions (Papayannis & Mallarach 2007).

The Solovetsky Green Meridian (SGM)

At the International workshop “Delos2”, Alexander N. Davydov, Ivan N. Bolotov and Galina V. Mikhailova (INEP UB RAS, Russia) presented a paper on “Solovetskie Islands: A Holy Land Surrounded by the Waters of Arctic Ocean”. The case study was dedicated to the sacred places of the Solovetsky Islands and the protected areas of “Solovetsky Meridian”.

The Solovetsky Green Meridian (SGM), contains the Solovetsky Archipelago (Solovetsky State Historical-Architectural and Natural Museum-Reserve), the planned National Park “Onezhskoe Pomorje” (Onega peninsula), the National Park “Vodlozersky” (Vodlozero lake with surrounded taiga forest and mires), the Nature Park “Kozhozersky” (Kozhozero lake), the National Park “Kenozersky” (Kenozero lake) and the National Park “Russky Sever” (located in the Vologda region),- which makes a network of protected areas from Beloe more (White Sea)

until Beloe ozero (White Lake). The sacred sites, represented in the SGM are of different types. Here we will describe in brief some examples of spiritual habitats to be found in the SGM (Figure 1 and 2).

Figure 1. Solovetsky Green Meridian

Figure 2. Solovetsky Monastery. Photo B.P. Shishlo

Kozhozero is a territory of a “Monastery Lake” with the hermitage of Nikodim – a Saint of the Russian Orthodox Church. The Monastery was started by the monks Nifont, Serapion and Avraamy. Nifont came to the lake Kozhe (Kozhozero) in the middle of 16th century. The hermitage was started by him at Lopsky Island. In the year 1563, a pilgrim Sergy came to Nifont. This pilgrim was the former prince of Kazan, a Tatar Moslem Tursas. He was captured by Tsar Ivan the Terrible when Kazan was

stormed by his army. He later lived in Moscow in the family of his relative, boyar Pleshcheev, and baptized on the name Sergy. On Koze Lake, he became a monk and his spiritual supervisor Nifont gave him the name Serapion. After Nifont two monks visited Moscow and introduced the idea of the new monastery. The idea was accepted and the first church of Epiphany was built in 1581. The new monastery got from the Tsar Ivan the Terrible the whole lake Kozhe and the territory around the lake for 4 versty (which is a bit more than 4 km). From 1603 until 1639 the famous hermit Nikodim lived in the monastery. He was congregated as a Saint of the Russian Orthodox Church in 1662 as St. Nikodim Kozhezersky. Since the 1920-ies, the monasteries buildings have been neglected, the lands of the monastery used for pastures, and the ruined buildings used for cattle. Since 1998, the monastery has been reviewed three times, started by the activity of the monk Mikhey. In 1999 the International Environmental Expedition "Kozhozero-99" was organized and the process of creation of Kozhozersky Nature Park was started. It is now concluded to the organizing on Kozhozero "The Christian Environmental Centre", with the cooperation of the Kozhozersky Nature Park and the revitalized monastery (Davydov & Efimov 2006).

The sacred history of Onega peninsula is connected with maritime culture, and there are many places of several local saints who were victims of sea-storms.

Vodlozero is the place with the St. Elias Church. St. Elias is in the Russian Folk Orthodox tradition contaminated with lightning and storms, and so especially attached to terrible forest fires.

Solovetsky Archipelago is the place with the biggest number of the labyrinths. At the same time, these islands are the place of The Spaso-Prebrazhensky (Saviour-Transfiguration) Monastery, which is the most famous monastery in the North of Russia, even the toponyms of the place repeats the names of Holy Land, as "Golgotha" (Calvary), etc.

The sacred groves of Kenozero

I would like to touch the phenomenon of sacred groves on Kenozero Lake, located in the South West of Archangel Region. Since 1991 this territory has belonged to the National Park "Kenozersky". The author of this article has during the years 1981–1994 conducted field research in this territory and collected a number of stories of local people about the sacred groves.

In the National Park "Kenozersky" more than 30 settled villages are located. Most of the villages are old-type settlements with numerous traditional wooden houses, granaries, saunas, barns, trashing-floors etc. There are also many monuments of the Russian Orthodox Church. Wooden churches of 17th century are situated in the villages Porzhenskoe

and Pochezero. There are about 35 wooden chapels spread at different places in the National Park (Figure 3) (Davydov 2000).

Figure 3. National Park “Kenozersky”

“Sacred groves” can be defined as “examples of the most ancient forms of Protected Areas, which are connected with ritual (religious) rites” (Boreiko 1998, 2000). About 45 sacred groves in the National Park “Kenozersky” are described. Most of them are located near the villages, such as Korovya Myza, Ovechya Myza, Vershinino, Tyrnivolok (2 sacred groves), Nemyata, Zakharovo, Fedosovo (2 sacred groves), Porzhenskaya, Ryzhkovo, Semenov, Kositsyno, Ust’ Pocha, Pochezero, Telitsyno, Sivtsevo, Glazovo, Gora, Cholma (2 sacred groves), Tarasovo, Ostashevskoe, Svinoe, Karpovo, Tambichlahta, Filippovskaya, Matera,

Ryapusovo, Mailahta, Tyryshkino (2 sacred groves), Gorbachikha, Eki-movo, Sysova, Zikhново, Bukhalovo, Gorodskoe, Mamonov ostrov, Er-shovo, Boyarinovo, etc. (Figure 4, 5).

Figure 4. *Svataya roshscha* (sacred grove) near the village Vershinino. Photo Galina V. Mikhailova.

Most of the sacred groves are sacrificed/sat aside by the Russian Orthodox folk tradition. In many sacred groves there are located wooden chapels and churches or Holy crosses. It is a tradition to put a special shroud (*pelena*) on the Holy Cross. The word *pelena* in Russian language came from the verb *pelenat'* (to swaddle). A towel, or small piece of textile could be used as a *pelena*, but the typical is with special embroidery. This embroidery shows the purpose to which the *pelena* was made. The typical is the embroidered image of the Holy Cross, which is adjoined with the image of a head, an arm, a foot or a leg, a child, or even a cow! The local people told me that images means that the *pelena* is a special type of a prayer, which is connected with the peasant's ask to God, to help a concrete person to be healthy or to be saved from a headache (image of a head), from illness of his/her arms, foots, legs. An image of a child on the *pelena* often means a prayer for a grandchild. An image of a cow on the *pelena* was described to me by the story about a cow lost in the forest, but after *pelena* was made and put on the Holy Cross, the owner found the cow. A big number of the *pelenas* are located in the Orthodox chapels, which stayed in the sacred groves. Sometimes only two or three trees (pine or spruce) are located near the chapel, as remnants of a holy grove.

Figure 5. Remnants of the sacred grove near the village Glazovo. Photo Alexander N. Davydov.

A number of stories about holy groves were collected from local peasants during my fieldtrips on Kenozero in 1981–1994. All the stories also tell about a sacred punishment to a person, who breaks the regulations in the sacred groves. Those peoples could have been rough and impolitely in the sacred grove: they collected trees and branches of trees from holy grove for fire; they even broke the branches of a bush in the holy grove, collected plants or flowers from the place or were rough in their speech being in the holy grove; – and the sacred punishment came to all those people. There were different forms of the sacred punishment: a sinner became ill, or died, or his house burned, or a cow of him was killed by bear, etc. The sacred groves of Kenozero are coniferous trees (pine and/or common spruce). Local people mark out those groves in the surrounding woodland. These groves have a special name, being called *svataya rosha* (sacred grove). The fact of presence of coniferous sacred groves is unusual in the Russian tradition (for Russian people the sacred tree is the birch). (Another article in this book describes the historical roots of sacred groves (Davydov 2009).

In 2000 there was a special forest field study of sacred groves on the Kenozero Land run by the experts of Archangel State Technological University, Archangel Forestry Expedition and the National Park “Kenozer-sky”. They described the location of each sacred grove (Forestry, number

of quarter, topography, micro-landscape, etc.), forest condition, species and age of trees. For each sacred grove a special passport was designed (Tretjakov et al. 2002, pp. 1079–1083). In general, all of these documents are a good basis for defining the sacred groves of Kenozero Land, as Sacred Natural Sites (SNS) in the term of the Delos Initiative.

Now it seems to be necessary to elaborate a special programme of co-operation between the National Park “Kenozersky” and local people, taking into consideration local rites and traditions (Davydov 1990, 2004, 2008). “It is evident that a close collaboration between the custodians of sacred sites (traditional or contemporary) and the managers of protected areas is necessary to resolve problems and to establish synergy of benefit to the conservation of both spiritual and natural heritage” (Mallarach & Papayannis 2007). On this basis I would make this proposal of recommendations to the Nordic-Russian Conference:

- To discuss the opportunity to nominate Solovetsky Green Meridian as the site of mixed Cultural and Natural Heritage and a form of Sacred Natural Site (SNS).
- To recognize SNS as a new category which should be incorporated in all of the creation of protected areas and development programmes.
- A Nordic-Russian conference should address to the organizers of the next Habitat Forum (Sweden, 2008) to include into its Programme an explanation of IUCN/WCPA “Delos Initiative”.

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4. About protection of natural and cultural heritage

– on the territory between Severnaya Dvina and Pinega Rivers (Archangel Oblast)

Alexander N. Davydov & Valery A. Efimov²

Nowadays a large (more than 1,000,000 ha) massive of intact taiga forests in the area between Severnaya Dvina and Pinega Rivers are very unique and valuable (Figure 1). For an evaluation of contemporary conditions of forests, biodiversity and cultural heritage of this territory, the International Environmental Expedition “Yula-2001” to the Basin of Yula River (Pinezhsky and Vinogradovsky districts of Archangel oblast) was organized in the year 2001 (Chervyakov et al. 2007).

Figure 1. Large forest land of intact taiga forests in the area between Severnaya Dvina and Pinega Rivers.

The expedition was organized by the Institute of Ecological Problems of the North, the Ural Branch of the Russian Academy of Sciences (INEP) together with the State Committee of Protection of Environment of Archangel Region. The participants of the expedition were specialists and researchers of INEP, SevPINRO, Archangel Forestry Expedition, and Archangel Branch of the Union of Artists of Russia. The foreign experts

from the Finnish Environment Institute (SYKE, Finland), The Ministry of Environment, Directorate for Nature Management (Miljøverndepartementet, Norway), and Committee of Environment of Västerbotten County (Sweden) also were participants of the expedition (Figure 2).

Figure 2. The participants of the International Environmental Expedition "Yula-2001". Yula River Archangel Region.

The main goal of the expedition was the evaluation of the contemporary conditions of the old-growth intact forests, biodiversity and landscapes in order to elaborate recommendations for its protection on the territory of Archangel region. The participants of the expedition had an observation flight of the basin of Yula river (around 150 km), they had about 85 km of field routes including 40 km by rivers and 45 km foot routes (Yula river, tract Myshyak, lake Beloe, Entola river, Murdey brook, tract Sin-yaya, Semras river, tract Stepinskaya izba, Ura river, tract Belaya, Ura village). During the fieldtrip experts studied different types of old-growth forests, the landscape-environmental specifics of the territory, contemporary conditions of biodiversity and cultural heritage of the area (system of hunting huts and wooden architecture of the Ura village).

After the experts get acquainted with the nature complexes of the Basin of Yula River, they concluded that the old-growth intact forests and biodiversity of the territory is necessary to protect for a long perspective by organizing of especially protected nature area (PA). Also there were necessary to realize nature-conservative measures and regulations in the process of cuttings (water protection zones, parts of stands with rare and declined species of plants and habitats of rare and declined animals, reindeer moss lichen pine forests, parts of stands on river's sources etc.). The

experts of the expedition recognized as the basis for those conclusions the presence of complex of natural heritage, as intact forests, such as:

- The typical and unique landscapes of the Middle taiga;
- The old-growth intact forests of different types represented on large areas, in general the forests of 160 years old and more, as an example, the model trees are of the age about 450 years (Figure 3, 4)
- The unique parts of stands of old-growth forests with pyrogenic traces on the different phases of succession;
- The big diversity of typical and unique Middle taiga intact forests.

Figure 3. A pine tree with a special butt part in the old-growth intact taiga forest. Basin of Yula River, Archangel Oblast

Figure 4. An aspen tree in the old-growth intact taiga forest. Basin of Yula River, Archangel Oblast

The expedition found more than 20 species of plants of Red Data Book of Archangelsk region and Red Data Book of Russia. The studied area is characterized by high diversity of birds (more than 100 species) and rather high diversity of birds of prey (golden eagle, white tale sea eagle, osprey, common buzzard, goshawk, and sparrow-hawk) and high density of hunted animals (pine marten, squirrel, otter, bear, glutton (wolverine) and capercaillie). The population of forest reindeer is rather low as a result of intensive hunting and the population needs to be recovered.

The area has its natural hydrologic system of lakes and rivers. Having very clean water the Yula River and its branches might be a standard for research works and comparative studies of pollutions (Fig. 5). There are more than 15 species of fish in the lakes and rivers here. Among the most valuable are salmon, whitefish (cisco) and grayling (umber), and the remaining populations need to be recovered.

There are situated valuable objects of cultural heritage in this area (Davydov 2003). The most ancient are the archaeological sites from the Neolithic period with the flint industry of II. Millennium B.C. The local dialect and complex place-names shows the traces of ancient Pre-Sami and Old Finno-Ugric languages implanted into the North-Russian Pinega dialect. We can give some examples:

- The name of the river Yula (*jla*) means in Finnish “Upper”
- The local name of compass is *matka* means in Finnish a “way”
- The local name of the female capercaillie is *kopaluha* which parallel in Finnish (with the same meaning) is “koppolo”
- The name of the village Ura (*ura*) means in Mansi language – a “sacred storehouse where the Spirit, Protector of the area and the forest is located”

The presence of a remote village Ura village is very specific for the studied area of the Basin of Yula River (Figure 6, 7). The village stands on the bank of a branch of the Yla River is also named Ura. The village Ura has a traditional plan, and the typical and unique monuments of wooden architecture are also represented, such as long wooden houses with cattle sheds (“five-walls” and “six-walls” houses’ constructions), granaries which are standing on special wooden basements. Rather unique constructions of wooden houses were described. Some of those houses are built by hexahedron and octahedron logs. Such seldom seen type of beams has their analogs in Sweden (Norrbotten and open-air museum “Scansen”).

Figure 5. A typical part of river edge forest in the forest land of intact taiga landscape in the area between Severnaya Dvina and Pinega rivers. Basin of Yula River, Archangelsk Oblast.

The village was reached by boat-builders, because the river was the only way to carry goods from here to Pinega. There was a special type of boat, called *osinovka*, named after *osina* (an aspen tree). Near the village there were aspen trees more than 1 meter in diameter. A log 4–7 m. long was cut and the boat was built from one log. The craftsman cut the rostrum (front) and the stern of the boat and then trimmed the middle part of boat by a special axe. Thereafter the master reversed the boat, put it on logs above a fire and caused it to sweat by pouring on water. Then the master installed bands (ribs) inside the boat, – ribs made from a spruce tree. *Osinovka* was a one-log-boat, but sometimes also master prolongs boards up by adding two desks: one from right and other from left sides. Some of these boats were described by one of the authors being in the Ura village during the expedition “Yula-2001”. It is also important to study hunting area as a system of hunt-path and hunting huts, which are well represented in the territory.

The experts of the International Environmental Expedition “Yula-2001” recommended to elaborate a project of protection of old-growth intact forests and biodiversity in the area between Severnaya Dvina River and Pinega River for future generations, to plan and to run international projects for studying of ecology of the populations of wild animals, birds and plants. The most valuable territory for PA (a landscape reserve) is the Basin of Yula River from its upper parts to the middle part with the branches of Yula River, such as Siomras, Ura and Entola. In general the territory of proposed PA should not be less than 350 thousand ha. This territory is located in the middle of the intact forest large area and remote from the areas with active logging. The mentioned above area is connecting forest land, (big stand), of intact forests in the area between Sever-

naya Dvina River and Pinega River. Here, to the utmost, there are at present a mosaic of nature complexes, ecosystems and high levels of biodiversity, cultural heritage and recreational potential. An important factor is also the presence of the village Ura, which could be a basis for an International Field Research Stationary.

Figure 6. The village Ura. Basin of Yula River. Archangel Region. (Photo: Ole J. Sørensen May 2005)

Figure 7. The items of traditional peasant life in the village Ura. Basin of Yula River. Archangel Oblast.

As The Yula River is a tributary to the Pinega River, the proposed location of landscape reserve around the Yula River will help to protect a hydrologic regime, the flow of water in the territory including Pinega River, a branch of Yula River, which is an important transport and economical artery of the east districts of Archangelsk Oblast. At the same time, Pinega River has lack of water in summer period. Big extension of the proposed PA from the South to the North gives an opportunity to save the fundamental environmental functions of the intact forests in the situation of increasing industrial loggings. The territory proposed for PA is optimal for a protection of natural and cultural heritage, as far as for environment and recreation.

An important issue, connected with the creation of a landscape reserve, will be the basic organizing of an International Field Research Station for studying of old-growth intact forests and biodiversity. To organize an International Field Research Station is especially important for the area between Severnaya Dvina and Pinega rivers, on which territory the problem of dead and drying trees is very actual (Efimov 2007). To understand the reasons of the phenomena, there are necessary to run complex scientific research programs within an international setting of cooperation. There are also proposed to organize an ethno-ecological museum, which will represent the values of nature of the territory and cultural heritage of the Ura village.

It is necessary to protect biodiversity and environmental values of the area between Severnaya Dvina and Pinega rivers as an addition to the plan of PA (a landscape reserve), and to elaborate a special plan for the cutting practise of the sustainable forest use in the surrounding areas. The proposed landscape reserve in the Basin of Yula River will be the important component of the planning environmental skeleton of Archangel Region.

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5. Preservation of the last large intact forests and biodiversity of the Archangelsk Oblast in Russia,

– an important task in international cooperation.

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Introduction

It is known, that by present time, the last large intact forest lands in Europe are found only on the territory of Russia, where the Arkhangelsk Oblast takes a special place. The area of such forest lands here is about 10 million ha. Boreal forest lands in this region basically are situated in its northern part and spread from western up to eastern borders of the region (Figure 1).

Figure1. Intact forests in the European North of Russia (Yaroshenko et al.2001).

Ecological expeditions 1997–2002 – An overview

In 1997–2002 international ecological expeditions were carried out at different sites of this forests zone (the Onega peninsula, Kozhozero, Belomorsko-Kulojskoe plateau, between the rivers Northern Dvina and Pinega territory and the basin of the Mezenskaya Pizhma river), and confirmed the value of the forests, natural and cultural heritage on these territories and necessity of their preservation (Figure 2). (Yaroshenko et al. 2001)

To present time some sites of boreal forests on the territory of the Oblast are kept in the status of Especially Protected Natural Areas (EPNA or PA): Vodlozersky national park, Kozhozersky nature landscape reserve and the Primorsky and Sojansky nature landscape reserves. Until recently the most part of the forests of this zone had a nature protection mode as tundraside forests. With implementation of the Forest code in 2006 the nature protection status of these forests became problematic. The planned National park “Onega Pomorje” on the Onega peninsula, planned by the Program of the government of Russia till 2010, has not been created yet. The government of the Arkhangelsk region doesn’t solve the problem of the creation of especially protected natural territory in the Mezenskaya Pizhma river basin, what was recommended by the international ecological expedition. The project of the creation of such territory was developed by our institute and brought into the administration of the region in 2004. Especially protected natural territories of regional value (landscape reserves) remain vulnerable and its status can be cancelled at any time (Cheryakov et al. 2007a, 2007b, Davydov & Efimov 2007a, 2007b, Efimov & Davydov 2007).

Features of the existing NPS’s compared to suggested new protected areas

The geographical location of forestlands determines their distinction among themselves on a number of features. Thus, according to Tretjakov (2006), who compared the three territories of the Kenozersky National Park, the Vodlozersky National Park and the Kozhozersky Nature Landscape Reserve, found that these forests differ on percentage of forest land, age structure and types of a forest. The highest percentage of forest land on the territory of the Kenozersky National Park is 75% from the area, in the Kozhozersky Nature Landscape Reserve is 66% and in the Vodlozersky National Park is 51.1%. The age structure of the woods (the percentage of ripe and overaged forests) is higher in Kozhozersky Nature Landscape Reserve – 86% against 67% in Vodlozersky National Park and 13% – in the Kenozersky National Park. The Kenozersky National Park though has the highest diversity of forest types – 18, against 14 in the Kozhozersky Nature Landscape Reserve. The forests located near the Vodlozersky National Park and the Kozhozersky Nature Landscape Re-

serve, (they together make a huge forestland in the east of Fennoscandia – about 700,000 ha), differ on productivity and the main forest tree species. The forests of Vodlozersky National Park are less productive with prevalence of pine plantations.

The forestlands of the Onega peninsula, Belomorsko-Kulojskoe plateau and the basins of the Pjoza River and the Mezenskaya Pizhma River are also characterized by their distinctive features. The characteristic feature of the forests of Belomorsko-Kulojskoe plateau and the basin of the Mezenskaya Pizhma River is the presence of Siberian larch in their structure. Thus, forestlands offered for preservation do not repeat, but supplement each other and in this way complete a forest system of natural variety, integrity and biological diversity, what is extremely important for the preservation of natural heritage. One more distinctive feature of these forestlands is their inaccessibility (there are no roads) and very low density of population. This simplifies in many respects the creation of especially protected natural territories there.

Today, the possibility to keep and protect large areas of little disturbed and old-aged forest land and their biodiversity, is only possible through a common international attitude and cooperation, in the spirit of “Think Globally – Act Locally”. International cooperative help might though be necessary to reach such a goal.

Nowadays it is possible to keep a part of slightly disturbed old-age forestlands and their biodiversity the only by international cooperation efforts. In this connection it is necessary to convince the authorities of the Arkhangelsk region to create the new suggested protected natural territories: National park “Onezhskoje Pomorje” on the Onega peninsula, the National Park “Belomorsko-Kulojskoe” with inclusion of the Sojanskij reserve in its structure, a National Park in the basin of the Mezenskaya Pizhma river, a Landscape Reserves in the basin of the Pjoza river and a National Reserve between the Northern Dvina and the Pinega rivers territory. Moreover, it is extremely important to give the status of the World Heritage (UNESCO) to the zone of boreal old-aged, slightly disturbed, forests of the Arkhangelsk Oblast. Only in this case it is possible to hope that forests and valuable natural complexes will be conserved properly for the future generations.

The system of Archangelsk Oblasts World Heritage Cites of Natural Old-Growth Boreal Forests is visualized on Figure 2, and could include the existing especially protected natural territories:

- Vodlozersky national park,
- Kozhozersky nature landscape reserve,
- Sojanskij nature landscape reserve.

In addition the following areas suggested for protection must be included:

- The already suggested National Park "Onezhskoje Pomorje",
- The suggested landscape reserves in the basin of the Pjoza River
- The suggested landscape reserve in the basin of the Mezenskaya Pizhma River
- The a suggested landscape reserve between the Northern Dvina and the Pinega rivers

A Green-belt of Old-aged, slightly disturbed, boreal Forests of North-West Europe – a suggestion

Preservation of the last large intact forestlands and the biodiversity in the European North is still possible by the formation of green zones and green meridians common for these regions. In this way the green zone of old-aged, slightly disturbed, boreal forests of the Arkhangelsk region, (which we hope will be created), is advisable to continue into the republics of Karelia and Komi. A result will be to close a gap in the green zone with already existing green meridian in the east of the Republic of Komi (PA: Troitsko-Pechorsky reserve, national park). In the Arkhangelsk Oblast it is necessary to form a green meridian on border with the republic of Komi from the Pjoza river basin. The third green meridian between the Arkhangelsk Oegion and the Republic of Karelia is practically created (Kozhozersky nature landscape reserve, Vodlozersky national park, Kenozersky national park). It is necessary to extend it to the Vologda region (the National park; "Russian North" and further). The fourth green meridian is formed on border of the Republic of Karelia with Finland. Green meridians should be connected among themselves with green zones. This general plan of construction of an ecological skeleton of the European North of Russia, which needs further reworking, will allow to unite the network of EPNA as between northern regions of Russia and so between Russia and Scandinavia in the matter of preservation of old-age forests and a biological variety (Figure 2).

The biodiversity of taiga ecosystems on the territory of the Archangelsk Oblast is investigated very poorly. Complex researches on inventory of a biological diversity have only been started. Experience shows, that international cooperation are of great importance and gives good results in such researches. As a result of work of international ecological expeditions, expert estimations of the condition of forest ecosystems and biodiversity on those territories where expeditions worked have been received.

In 2002–2003 at financial support of Administration of the province of Västerbotten (Sweden), the project "Inventory of natural and cultural heritage on the territory of Belomorsko-Kuloiskoe plateau" was developed.

Figure 2. General map of the Environmental Skeleton (Designed by V.A. Efimov).

In 2003–2004 at the support of the Ministry of Environment of Finland the project “Inventory of natural complexes, a biodiversity and cultural heritage on the territory of Kozhozersky natural park” was carried out. As a result of complex researches modern materials about the basic components of biota have been received and data on the condition of a biodiversity in the southeastern part of Fennoscandia have been received for the first time. On materials of these researches in 2006 the collective scientific monograph “Nature and historical-cultural heritage of Kozhozerje” was published. The monograph about the nature and cultural heritage of Belomorsko-Kuloiskoe plateau is being prepared to the publication now. Such cooperation is very effective, useful and necessary to continue.

Conclusion

For the performance of tasks on preservation of last large intact forest-lands and biological diversity it is necessary to complete works on formation of the green zone of boreal forests and green meridians by creation of especially protected natural territories. Thus the international cooperation is necessary in the following issues:

- All-round support in creation of new PA;
- Realization of international ecological expeditions (first of all to the river Pjoza basin and eastern part of the Archhangelsk Oblast);
- Preparation and edition of the scientific monography “last large intact boreal forests of the Archhangelsk Oblast ”;
- Preparation of a package of materials and documents for the nomination in the fund of World Heritage (UNESCO) “Green zone of old-aged, slightly disturbed, boreal forests of the Archhangelsk Oblast”;
- Development and creation of an ecological skeleton for the Northwest of Russia.

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6. System of Nature Protected Areas (NPA)

– the Arkhangelsk Oblast and the features of Intact Forest Landscapes (IFL) and efficiency of their protection.

*Denis Dobrynin*³

Introduction

Intactness, i.e. the absence of human disturbance, is a quality of a natural landscape that cannot be artificially restored. *Intact forest landscapes* (IFL) are necessary for protection of stable populations of large animals that are especially sensitive to human impact or habitat change, lakes and wetlands and the natural dynamics of forest ecosystems. Intact forest landscapes (according to definition of Global Forest Watch) are nature areas that:

- are located in the forest area;
- cover the area of minimum 50,000 ha, minimum width – 10 km;
- are represented by a continuous structure of natural ecosystems independent of their type;
- are not divided by infrastructure objects;
- do not have any features of anthropogenic changes;
- are characterized by natural dynamics of forest ecosystems [1]

The Intact Forest Landscapes of Archangelsk

Intact forest landscapes make up 9% of the European part of Russia; 13% of the total forest area of European part of Russia [2]. The significant part of European intact forest landscapes is located on the territory of the Arkhangelsk region (Figure 1). In 2004 in the Arkhangelsk region there were 14 separate massifs of intact forests with the total area of 9,540,000 ha, which is 23.2% of the total land area in the Arkhangelsk region and 32.4% of the forest area.

It is important to recognize that the share of intact forest landscapes in the 3 sub zones of the taiga is different: IFL counts 31% of the sub-tundra forest zone, 56% of the northern boreal forest and 13% of the mid-boreal zone of the taiga. Also the efficiency of protected IFL in taiga sub zones

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is different. Thus, the southern intact forests of the Arkhangelsk region, located in the mid boreal taiga are currently not protected at all. This means that the further to the south, the greater are the risk to loose biodiversity due to influence of human activity (e.g. intact forests in the southern taiga are almost extinct). In Archangelsk Oblast we can give some features of the intact forest landscapes:

- IFL are generally the last large massifs of dark coniferous (spruce) forests in the Arkhangelsk region.
- Other forest land of the area is practically totally replaced by secondary-growth deciduous (birch and aspen) and mixed forest (mainly after clear cuts without reforestation activity).
- Thus the ecological significance of IFL is increasing. Though their conservation is problematic due to the strong dependence of logging enterprises on timber resources of intact forests.
- The territory of Dvina-Pinega intact forest massive plays a special role in radical spruce forest conservation.

Figure 1. An overview of Intact Forest Landscapes of North-West Russia, Finland, Sweden and Norway (Yaroshenko et al. 2001).

On the whole the total size of nature protected areas in the Arkhangelsk region is around 1,250,000 ha of intact forests, which counts for 13% of all IFL in the oblast. However, only 5 of 15 nature protected areas (NPA's) of the Arkhangelsk region where intact forests are located, meet the criteria of the minimal size (50,000 ha) that provides real conservation of IFL. Figure 2 gives an overview of the distribution of IFL and NPS's in Archangelsk Oblast. Two of these NPS's have federal significance: Pinezhsky strict nature reserve (Zapovednik) and Vodlozersky national park; 3 of these NPS's have regional significance: Kozhozersky,

Soyansky, Primorsky reserves (Zakazniks). The total area of IFL within 5 mentioned NPS's make up 1,144,000 ha, which is 12.1% of the total IFL area in the oblast.

Figure 2: An overview of the distribution of Nature protected areas and Intact Forest Landscapes of Archangelsk Oblast (NN 2002).

Conclusion

The key territory for preserving the diversity of northern and mid-boreal taiga forests is The Dvina-Pinega intact forest massive. The reasons are simply given by these arguments:

- It is the largest massive of mainly spruce dominated forests in the middle subband of the taiga in Europe.
- This territory is in addition characterized by the great biological and landscape diversity.
- Currently the massive is not protected by the existing NPA's and at the same time is dramatically decreasing in size due to the logging activity.
- This is why it is necessary to take urgent measures on creating NPA's on the territory of the Dvina-Pinega intact forest massive.

Primorsky and Soyansky reserves (Zakazniks) currently take more than 50% of all intact forests located within NPS's of the Archangelsk region. However mineral resources extraction carried out on this territory threaten further protection of intact forest landscapes within the above mentioned

reserves. A part of the intact forest massive on the Onezhsky peninsula can be preserved if national park “Onezhskoe Pomorie” is created.

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7. The state and problems of indigenous forests preservation in Eastern Fennoscandia

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Introduction

Long-term and large-scale logging leads to disappearance of the last areas of primeval (native) taiga forests in Europe. They may be lost or fragmented in the coming decades. Preservation of the remaining indigenous forests should in this regard be organized into different categories of protected areas to secure:

- Models of primeval nature for present and future generations;
- Centers of habitats and resettlements of indigenous fauna and flora;
- Reserves of forest species gene bank;
- Sites for monitoring and research activities;
- Facilities for various kinds of tourism;
- Places of ecological awareness and education.

These are the standards of the primeval taiga, habitat centers and resettlement of indigenous flora and fauna, forest species reserves of gene pool. Therefore, in the first phase of research it is particularly important to present the current state of the surviving areas of indigenous forests. This is of great interest to researchers and conservation organizations. In this work, special attention is given to methodological aspect of the problem.

Terminology

For the solution of the problem we need to use a unified methodological approach, first of all – a common terminology. So far, in Russia and in the world there are no strictly defined and agreed terminologies of *indigenous* forests. In English, there are many similar terms in relation to

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the Indigenous Forests – climax, undisturbed, intact, virgin, wild, primary, primeval, primal, primordial, original, old growth, inhomogeneous and others. In our opinion, *the concept of indigenous forests* should be understood as forest communities, which have:

- Arized naturally in the postglacial period;
- Never experienced a significant human influence;
- Are in the process of spontaneous development in the periodic impact of natural factors – fire, wind, outbreaks of insects and fungal diseases;
- Represent a mosaic of forest communities from the pioneer plant groups at fire burns and windfalls up to climax communities in a state of sustainable dynamic equilibrium (the processes of growth and mortality are balanced).

This is not consistent with some modern ideas, in particular non-governmental environmental organizations, stating indigenous forests as “old”, being only in the final stages of successions (with lots of old trees, dead, deadfall, etc.). It should be noted that during the analysis of boreal forests importance for animals in large areas, it is not always possible to distinguish clearly indigenous forests on the above-mentioned features. Therefore, further in these cases, we use the term “*Forest of senior ages*”(100–120 years).

The object of research and its common natural features

In general, the taiga zone of the European part of Russia is about 170 million ha, and stretches east to west from the Ural Mountains to the Russian-Finnish border. On these large areas from north to south, tundra, forest subzone of northern, middle and southern taiga and coniferous-deciduous forests (sub-taiga) sequentially replace each other. The objects for research were the most western large tracts of indigenous forest in Eurasia which have survived only in the Eastern Fennoscandia which in this context include Murmans Oblast and The Karelian Republic of the Russian Northwest:

- From here on and further below, this region is defined as the eastern part of the Baltic crystalline shield of the Murmansk Region, the Republic of Karelia and the Karelian isthmus in the Leningrad region (Figure 1). To the east, the territory extends to the Russian Plain. In Eastern Fennoscandia hilly-range forms of denudated reliefs of tectonic origin are dominant. On the Kola Peninsula low mountains are common (highest peak is 1,191m.absl). In the lower terrain the vertical zonation (forest and mountain-tundra belt) is well expressed. In general, the region is almost universally bedrock covered with a thin cover of Quaternary glacial sediments, water and lakes of glacial ori-

gins. These sediments cover the bedrock from a few centimeters in the mountains to more than 100 meters. On the shores of the White Sea, Onega and Ladoga Lakes, extensive lowland plains are common. The latter two lakes are the largest freshwater bodies in Europe. Dense river networks and abundance of lakes (in Karelia and the Murmansk region, more than 170,000 of lakes, is covering nearly 10% of the total area) are typical. The soil is very mosaic; sand-loaded podzols, interspersed by and including more rocky ground, often alternate with peat soils of different capacities. The dominance of pine forest, formed by *Pinus sylvestris* L., is clearly expressed. After clear cutting pine forests are recovered successfully.

Materials and methods of research

The identification of indigenous forests by the so-called “*indicator species method*”, widely used by researchers in Northern Europe, is not appropriate in the context of the Russian taiga. Here “indicator species” have usually and successfully still found ecological niches in forests of different age and composition which have survived after felling of coniferous forests. In this paper we have used an integrated approach to the identification of indigenous forests – with the use of space-sensing, analysis of forestry management materials and full-scale inventory. Data of habitat and mass counts from animal research were used: Kuz'min et al. (1983), Kurhinen & Shelekhov (1989), Kurhinen et al. (1989), Kurhinen et al. (2006) and Priklonsky (1973).

As a cartographic basis for the collection and extrapolation of united data a version of landscape maps and a square grid 50x50 km in the coordinates UTM was used. Combined data for the inventory of forest cover, species diversity and abundance of game species have been subjected to mathematical processing of the statistical program SUSTAT (correlation, step by step regression analysis, etc.).

The work to characterize the forest structure of Eastern Fennoscandia with such a methodical approach, (the use of cartographic basis for the collection and compilation of data networks squares 50x50 km, followed by statistical processing of massive data, together with records of animals), began in 1993. The results were published in part by Linden et al. (2000) and Volkov et al. (2002). The location and size of the squares remained the same and this gives an opportunity to monitor the dynamics of ecosystems over the past 15–20 years both as the average for the region and for the individual squares. Correctness of comparison is provided by similar, in many respects identical, methods of collecting and processing of data. Some differences in the methods are due to the development of information technologies. For example, 15 years ago, the combination of forest inventory, data on animals and borders squares was

produced manually; now – with the use of statistical computer programs and classified scanner satellite images (Figure 1).

Figure 1. Method of integrated use of cartographic materials for data collection and processing of forest inventory: forest maps and maps of the squares of 50x50 km consolidation, followed by computer processing (operation split in MapInfo[®]).

The overall situation of the state of Indigenous Forests

Until now large tracts of indigenous taiga forest in Europe have survived only in Russia. Most western large (over 100 ha) of indigenous Eurasian forests remain only in the Republic of Karelia and the Murmansk region (Figure 2). West of the Russian-Finnish border and all the way to the Norwegian Fjords (in Finland, Sweden, Norway) such forests are mainly missing (Lindholm 1999, 2003, Peterson 1999). Only small fragments of indigenous forests remain in the low parts of Sweden and Finland nearby-tundra regions. But in the past they have been affected by selective logging, which significantly impacts on their structure. In Karelia, the indigenous forests as large forest areas remained on the area around 500,000 ha (forest area, with the exception of swamps, lakes, etc.). In general, it is the relatively affordable high-productive pine and spruce woods which is the priority target for the cuts. Indigenous forests in the Murmansk region and additional young birch stands cover about 3,000,000 ha (Zaitseva et al. 2002). Basically, they are represented by moderate volume forest stands, formed under conditions of landscapes with altitudinal zonation of vegetation. Due to low productivity and transport difficulties they have no significant commercial value. On the Karelian Isthmus in the south there are virtually no indigenous forests left.

Figure 2. Protected areas with the largest areas of indigenous forest in the west of the taiga zone of Russia (The name of protected areas and its brief description are given in Table 1.) Green color is high-volume coniferous Forests of Senior Age (more than 100–120 years of age) (the data space imaging scanner). The dashed line shows the Russian-Finnish border. Right and above; the location of “taiga corridors”.

The network of “Specially Protected Areas” (PA’s) with Indigenous Forests

In East Fennoscandia and adjacent areas (in the Arkhangelsk and Leningrad regions), the largest tracts of primeval forests are within 7 existing and planned protected areas. The most basic information about them is given in Table 1. According to the law in Russia it is possible to organize a variety of categories of protected areas. *Strict Nature Reserves* and *National Parks* have the highest conservation status. Thus, in the *Strict Na-*

ture Reserves are all types of economic activities, including tourism prohibited. In *National Parks*, along with the allocation of the reserve, is extensive use of the rest of the areas possible for various kinds of tourism. In the economic zone non-thinning cuts are allowed to a limited extent. In addition to reserves and national parks, there are ten folds of landscape, botanical, marsh and other kind of reserves with small fragments of indigenous forests, which are all excluded from industrial use.

Table 1. Brief description of the largest pristine forest areas in the western taiga zone of Eurasia within operating and planning Pas

№ in the figure, category and name of the protected area (SNR – strict nature reserve, NP – national park)	Total area, 1000 ha	1000 ha/%				Landscape characteristics
		Forest area*	incl. those dominated by		Share of coniferous forests > 120 yrs.	
			Pine	Spruce		
1. Lapland SNR	278. 4	158.3/56.9	72.8/46	47.5/30	102.9/65	North-taiga low mountains with tundra
2. Paanajärvi NP	104.5	77.7/74.4	18.7/24	54.4/70	46.9/60	North-taiga low mountains
3. Kalevalsky NP Kost-mukshsky SNR	74.4 47.6	52.6/70.7 29.4/62.8	43.7/83 24.6/84	8.4/16 4.7/16	44.6/85 15.8/54	North-taiga tectonic den-dation hillyridge landscape
4. Onezhskoye Pomorje NP**	348.0	142.9/59.6	19.6/13	123.3/87	88.3/62	North-taiga lacustrine and marine plains
5. Vodlozersky NP	468.2	239.2/51.1	110.1/46.2	119.5/50.2	192.8/81.0	Mid-taiga glaciolacustrine plains (in the edge zone of the Russian plain and Fennoscandia)
6. Vepsskiy Les nature park	189.7	142.8/75.3	17.6/16.1	74.8/52.4	48.2/32.7	South-taiga morainic hilly-ridge landscape
Total	1510.8/100	842.9/55.8	307.1/36.4	432.6/51.3	539.5/64.0	

The rest of the area is open mires and lakes. In the Lapland reserve – also alpine tundra – 32%. The proportion of other land categories is usually not more than several per cent.

** In the process of approval.

The region also has a developed system of so-called *Territorial Forests Group I* – with a priority use of their environmental functions. The proportion varies from 22% (Republic of Karelia) to 54% (Murmansk Oblast) of the total taiga lands. However, due to the introduction of the new Water Law (2006), the area will decline by nearly an order of magnitude (due to the decrease of water-protection zones). The industrial development of certain categories of *Forest Group I* (nearby-tundra, water timber, etc.) is extremely limited – up to complete exclusion of clear felling. Here, too, in fact, various parts of the area of *Indigenous Forests* are

preserved. It can be argued that in Eastern Fennoscandia and adjacent areas (in the Arkhangelsk and Leningrad regions) a system of extensive territorial areas and areas of indigenous forests, protected in different modes, already operates. Thus, within the existing nature reserves and national parks 6 large indigenous forests (each area of more than 100,000 Ha, Table 1 and Figure 2) are protected. Their total area is about 1 500,000 ha (> 90% of the total area of protected areas with indigenous forests). Landscape covered with forests is almost 850,000 ha with approximately equal proportion of spruce and pine stands. The area of forests over 120 years is about 550,000 Ha. In addition, other relatively small in area facilities (reserves “Pasvik” and “Kivach” 10–15 thousand ha each, etc.) are created. On these areas study of structure and dynamics of forest communities are now concentrated.

Spatial distribution of indigenous forests: the likely trends in dynamic

Detailed analysis of all (even minor) *senior aged forests* throughout whole area to ensure that they belong to *Indigenous Forests* is highly complex and feasible only in the future. Therefore, we also analyzed the spatial distribution of forests over 100 years in Karelia. Distribution of forests in this category is a good representation of the analysis (%) of forests in this category on the map with squares of 50x50 km (Figure 3). In general, it follows the pattern found in the interpretation of the data on the distribution ranges of indigenous forests (Figure 2). Analysis of forest inventory statistics showed that the representation of forests of older age categories has not changed over the past 15 years (from 1992 to 2007) and was about 19% (average of squares). This is explained in particular that the annual volume of logging in this period did not exceed the Periodic yield (Figure 4).

Figure 3. Geographical% distribution of Senior aged forests” (more than 100 years, left), and cuttings and regeneration of young forests (right).% of the total area in each square.

Figure 4. Planned and actual volume of timber logged (1,000 m³) in Karelia in relation to the Periodic yield.

However, a disturbing trend should be noted: Territories with a relatively high percentage of fresh cuttings and saplings (inventory data 2004–2006, Figure 3.) are located in areas with a high percentage of indigenous forests, which means that these tracts of forest are intensively cut down. In addition, against the background of relatively calming statistics (Figure 4), a possible “quality” change of forest of senior age categories remains invisible: The transition of forests harvested intensively in the past goes into a category suitable for industrial use. At the same time and in small scale human-induced forests can really be logged.

Location and size of taiga corridors

It is important to prevent further isolation of remaining parts of the Scandinavian indigenous forest from the main European part of the boreal forests located in Russia. That is why we in this paper consider in detail the concept of “*Taiga corridors*” of Northern Europe, – a concept we launched in earlier zoological works (“Large-scale corridors”, Lindén et al. 2000 a, b, Kurhinen et al. 2006, Gromtsev et al. 2007). In the terms of their biological, recreational, environmental importance, their resources are of European significance, since as already noted, in Northern Europe from the west of the Russian-Finnish border to the Norwegian Fjords such unique natural sites are missing. It is obvious that there is a need to develop a common strategy in the taiga forests, taking into account the possible conservation of natural forests and the populations of vertebrate animals as part of taiga ecosystems. The strategy will be of international importance because some of the stenobiotic animals of European taiga

should have continuous habitat area from Scandinavia to the Urals. Typically, these are few like the wolverine (*Gulo gulo*), wild forest reindeer (*Rangifer tarandus*), flying squirrel (*Pteromys volans*), grouse (*Tetraonidae* sp.), siberian jay (*Perisoreus infatutus*) and others. The gaps of areas/habitats, including its disappearance after logging of primeval taiga in vulnerable locations, could lead to disastrous consequences. In fact, it comes to prevent further fragmentation of the western part of the Eurasian taiga biome in its most vulnerable part. This problem may worsen in the coming years, following the intensification of logging activity in Russia, especially in Karelia.

The extreme western part of taiga forests biome of Eurasia, located in Fennoscandia, connects with its Eurasian core part by only 330 kilometers of land, separated into three sites of different significance ("Taiga corridors 1, 2, and 3", Figure 2):

- The "*Southern taiga corridor*" (Karelian Isthmus, No. 1 in Figure 2) is the most narrow; – the width is only 40–60 km. The area overlaps multimillion-city of St. Petersburg with surroundings and is unlikely to really function as a full-fledged "taiga corridor" between southern Finland and the Leningrad region.
- The "*Middle taiga corridor*" (the gap between the Ladoga Lake and Onega Lake, Figure 2) is about 120 km wide, but in reality, even narrower at the expense of towns of Petrozavodsk and Olonets. The forests of this "corridor" are characterized by strong transformation (the proportion of older conifer forest types are in many squares less than 10%). According to our records, this is the only truly valid "Middle taiga corridor", effectively for example linking the Finnish habitat range of flying squirrel with its core in the Eurasian part. Taiga ecosystem preservation of this "corridor" is provided by the availability of Natural Park "Vepsian forest", as well as the partially preserved indigenous forest reserve "Lower Svir" and small landscape reserves in the Vologda region (on the border of Karelia).
- The "*Northern taiga corridor*" (the interval between Lake Onega and the White Sea, is divided by Lake Vygozero into 2 sleeves (Figure 2)) with an overall width of about 150 km. It is characterized by a relatively weak/little broken coniferous forests and a high species diversity of the investigated groups of animals. The representation of "undisturbed territories" (including mires) is about 50% of the total area and significantly higher than that of "man-made habitats". All this allows us to consider this "corridor" as the most important link connecting the Scandinavian taiga with its populations of boreal species living in the main part of the Eurasian taiga biome. In support of this, the area with maximum species diversity of hunting animals as well as the number of wolverines, capercaillie and black grouse in the middle of this decade were found in the "Northern taiga corridor" and connect it

with the protected areas to the Finnish border zone (Danilov 2005, Kurhinen et al. 2006, Kurhinen et al. 2006, 2007).

To the east, the preservation of taiga ecosystems “corridor” is backed by large areas of taiga forest in the Vodlozersky National Park. But a “weakening” of the corridors position is the passing of major transportation routes of North-West Russia like the October railway, the White Sea-Baltic Canal and The Highway St. Petersburg–Murmansk, as well as the urbanized neighborhoods of the towns Segezhi and Nadvoits. There is a reason to believe that the negative effects will be very significant because the destruction of the boreal ecosystem corridors will result into complete isolation of populations of boreal animals and plants in Fennoscandia. It may first of all affect the wild Forest Reindeer, the Wolverines and the Siberian Jay. This situation requires special attention to the state conservation of boreal ecosystems in this area of the “Northern Taiga Ecological Corridor” by strengthening and optimizing the network of protected natural areas. A start has been set by the organizing of “The Vodlozersky National Park” and continued in 2006 by organizing the “Kalevalsky National Park”. It would be important to strengthen this positive trend through the creation of “bridges and steppingstones” with areas of indigenous and/or old boreal forests that have been preserved between the two parks. This is a very urgent task, since large segments of primeval forests in unprotected areas will be cleared or fragmented in the next 10 years. The implementation of this task seems to be difficult and at least will require further international efforts.

Conclusion

Thus, the remaining tracts of indigenous forests have extremely important scientific and environmental significance, going beyond the boundaries of one or even two countries (Russia and Finland). They are the only standard by which you can judge all the changes in forest environment caused by human activities, and in the planning of nature one can try to minimize the negative ones. Their persistence in the Eastern Fennoscandia will help to ensure functioning of fragments of taiga ecosystems throughout Scandinavia.

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8. Structures in old growth forest stands in the Yula river basin

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This paper presents results from an excursion into the river basins of Yula and Ura in Pinega and Vinogradovsky Rajons in Arkhangelsk Oblast in the spring of 2005. The purpose was to investigate and map some of the most common forest types in this region.

In this area the terrain is flat or gently sloping. The soil is fine grained, dominated by the silt fraction. The climate is continental, with a precipitation of 4–500 mm per year. Spruce is the dominant tree species. It forms pure stands, and also stands mixed with pine. Pure pine stands occur on sites where the terrain lies higher than the surroundings and the ground water lies deeper in the ground. Broad-leaved species are scarce, but birch is present especially in early succession stages. Most stands are in medium or late succession phases, and often the succession dynamics were complex and intriguing to interpret.

Forest fires are causing the severe disturbances in the forests here. During our five days in the field, we observed one location where a forest fire had swept over a vast area, killing all spruce and birch trees, whereas most of the pine trees had survived. Minor disturbances caused by wind and parasitic fungi were observed on several spots. Most common was wind-thrown, single trees, but also spots of 1–2 ha where all trees had been wind-thrown, were observed. Due to severe drought the last years, dead or dying spruce trees occurred rather frequently. On sites with dead or stressed trees, bark beetles now were attacking and killing additional trees.

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Figure 1. Symbols used in the drawings.

Five transects mapped

Five transects were mapped and investigated, all of them situated in spruce dominated forests of differed ages and succession stages. We used the method described by Huse (1965) to create a visualisation of the stands. Each transect measured 10 by 50 m. Transect no 1 and 2 are situated on flat terrain, in no 3 and 4 the terrain are gently sloping, and in transect no 5 it is slopes 8%. On all standing trees higher than 1m, tree height and diameter at breast height were measured positions were mapped. Logs lying on the ground were mapped and classified in early or late decomposition stages.

Table 1. Number of trees and standing volume in the five transects. Norwegian volume tables were used to calculate standing volumes.

Transect No	Age of dominant trees	Number of trees/ha.	Basal area m ² /ha	Standing volume m ³ /ha	Remarks
1	250	1340	19	21,0	Spruce and birch
		100	9	10,5	Pine
2	250	1520	26	30,5	Spruce
3	300	2120	17	17,0	Living spruce trees
		280	7,5	8,5	Dead spruce trees
4	200	1720	20	14,5	Spruce
		40	1	1,0	Pine
5	100	1000	9,5	20,5	Spruce
	250	120	3	7,5	Pine
	100	600	6,5	11,5	Birch

Gap-dynamic in the old spruce forests near to Ura river – May 2005, (Photo Ole J Sørensen)

Figure 2. Vertical- and horizontal projections of a spruce-dominated stand in a medium- or late succession phase. Gap dynamics will now transform the stand towards a multi-layered, multi-aged phase.

Transect no 1

Old stand on plain terrain near the Yula River. The soil was fine-grained sand with a thick raw humus layer. Spruce (*Picea abies*) is the dominant species, but a few old pines (*Pinus sylvestris*) are mixed in. The oldest trees are about 250 years old and up to 26 m high.

The stand shows a succession after a forest fire more than 250 years ago when only the pine trees survived. Single trees and fallen, decomposing logs of birch (*Betula spp.*) show an earlier presence of this species. The stand is now in a phase of decomposition, where gap dynamics now will transform the stand into a multi-aged, multi-layered phase. It can also be hit by a fire and thus start a new secondary succession (Figure 2).

Transect no 2

This transect is a continuation from transect no. 1, but the terrain here is about one meter lower and is flooded by the Yula river, probably each spring. The soil appears to be more fertile, and the dominant trees are 2m higher and have larger diameters than in transect no 1.

This pure spruce stand here is more even, and gap dynamics has just started. Most of the fallen logs are in early decomposition stages, showing that they have been felled during the last few years. There are only a few logs in late decomposing stages. This corresponds to the stand structure that shows only small gaps, and the regeneration is of young age.

The even structure and crown canopy indicates that this stand probably have started after the same fire as transect no. 1. The fact that this transect lies lower than no. one, makes it possible that it was not burned at that time, and in this case this stand has developed over a longer period of time. In the right part of this transect, the trees were all old and large, but in the left half there are trees of different ages and heights. This distribution of heights and ages indicates that gap formation and regeneration has taken place in a long period of time (Figure 3)

Figure 3. Vertical- and horizontal projections of a spruce stand in a medium- or late succession phase. Most of the fallen logs are from the last few years. In this gaps regeneration will appear and the stand will develop into a multi-storeyed and multi-aged stand

Transect no 3.

Spruce stand near the river Ura, on fine-grained soil and gently sloping terrain. The dominant trees are 250–300 years old, and up to 27 m high. The trees are now suffering under drought stress and severe attack from bark beetles.

The structure of this stand indicates a late succession stage. Here are trees of all ages and heights and also gaps with regeneration (Figure 4). The drought and attacks by bark beetles kill the largest trees, and if it continues, it will bring the stand back into an earlier successional stage.

Figure 4. Spruce-dominated stand near the river Ura on silty soil and gently sloping terrain. The stand is in a late succession phase, now under drought stress and severe attacks from bark beetles. If the killing of the largest and oldest trees continues, the stand will be brought back to an earlier succession stage.

Old and recent gap-dynamic in force near Ura river – May 2005. (Photo: Ole J. Sørensen)

Figure 5. Spruce-dominated stand near the transect no3 on silty soil and gently sloping terrain. The stand is in an early succession phase, now under drought stress and severe attacks from bark beetles. If the killing of large trees continues, the stand will be more open and more regeneration will develop.

Transect no 4

Spruce stand with some pine trees mixed in, on fine-grained soil and gently sloping terrain near the Ura River. The dominant spruce trees are 150–200 years old, and up to 21 m high.

This transect was only 200 m from transect no 3, and has the same ecological conditions. The stand has developed after a fire 150–200 years ago. The fire did not reach transect no 3, probably because of a small stream between the two transects. The fallen logs caused by the fire are now completely decomposed and not longer visible on the ground. Here and there regeneration occurs on straight lines, indicating that it has generated on rotting logs after the fire. Most of the present logs on the ground are now in early stages of decomposition, indicating that the stand is in an early stage of succession. Only a few gaps have occurred so far, and the regeneration is of young age. Some of the largest trees are killed by drought and attacks by bark beetles, thus making new gaps and a more open stand (Figure 5).

Transect no 5

This was a mixed stand of spruce, pine and birch on fine-grained soil. The terrain was sloping 9% to the west. The pines have survived a fire 100–150 years ago and were about 250 years old. The birch and spruce

have generated after the fire. They are up to 25 m high and the pines up to 28 m high.

The stand is in a phase of elimination, where the birch is losing ground and the spruce gradually will take its place. Lying logs are mainly of small and medium diameters and in early stages of decomposition, which is in accordance with the early succession stage of the stand.

Further development of this stand will be a continuous struggle between individual trees and species. In the end the birches will be supplanted by the spruce, and the stand will be a spruce-dominated stand with a few pine trees. In interesting observation is that there is no regeneration of pine even here where there must have been seeds from the pine trees after the fire. The stand has generated from birch- and spruce seeds brought there from neighbouring stands (Figure 6).

Figure 6. A mixed stand of spruce, pine and birch in an early succession stage. The pines have survived a fire 100–150 years ago, and are about 250 years old, and the spruce and birch have generated after the fire. Now there is a tough competition for survival between individual trees and species. In this struggle the birch will gradually loose, the spruce and pine will be the winners and the stand will be dominated by spruce with a few pines mixed in.

Conclusions

The strip census only gives brief examples from a forest with a very complex diversity in succession history. They might “from distance” look quite simple with a simple so called alpha-diversity, but walking in these forests reveals a complexity of tree stands and structure that hardly nowadays can be found in Fennoscandian forests, and not at landscape level.

In pine dominated forests – signs of different forest fires can easily be recognized as the vegetation development of the forest floor is different as well as regrowth of young pine trees indicate the time since the last fire passed the spot. In old, spruce dominated forests gap dynamics are easily observed as a combination of wind- and snow broken trees surrounded by newly beetle-killed or beetle attacked and dying trees. The gaps can be quite new or extended over decades as we observed regrowth in these spots of different age classes. Fungi (and maybe the species *Fomitopsis pinicola*) were supposed and hypothesized by us to be the primary source for the gap-development. Anyhow – these forests landscapes represents today a unique possibility to observe and analyze forest succession in western taigas in a way probably impossible in the now, often long-time, human influenced and more recently cultivated forests of Fennoscandia.

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View to the mixed birch and spruce forest in Transect 5 near Ura river, may 2005. (Photo: Ole J. Sørensen.)

9. Biodiversity conservation in taiga forests

– based on island ecology approaches; towards a broad management strategy

Ole Jakob Sørensen¹ & Kristian Overskaug⁸

Focus upon landscape ecology, – the study of the relationship between spatial pattern and ecological processes on landscape scales and organizational levels, have had an increased attention during the last decades (Wu 2006). Furthermore, landscape ecology has important links to application-oriented disciplines such as forestry. Linked to the landscape ecology aspect are the theory of “Island biogeography” (MacArthur & Wilson 1967) and its “cousin”, the “Metapopulation theory” (Levins 1967). Those theories represent important tools in conservation biology.

The theories

Island biogeography

The theory proposes that the number of species found on an undisturbed island is determined by emigration, immigration and extinction. Immigration is affected by the distance of an island from a source of colonists, usually the mainland. Islands that are more isolated are less likely to receive immigrants. The rate of extinction is affected by island size. Larger islands contain larger habitat areas and opportunities for more different varieties of habitat. Larger habitat size reduces the probability of extinction due to chance events (Fig.1a & b). More habitat types increases the number of species that will be successful after immigration. Moreover, typical influencing factors are length of isolation, climate, serendipity (the impacts of chance arrivals), and also human activity. But – area size in itself is also a major component in explaining the connection between areas size and biodiversity; – most likely explained by the fact that in large habitats species with near niche-requirements can find room for viable populations without or with reduced interspecific competition. As a “rule of thumbs” it is often said that a tenfold increase of area you will double the species number existing in the area.

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Figure 1a.

Figure 1b.

Figure 1a. Simple illustration of the Island Ecology approach which explain how area size determines species numbers of a given area. Figure 1b illustrates the situation for a small and larger island near a source of possible emigrants (the nearby mainland).

A logical result of these theories will also be that shrinking of habitat areas over time will reduce biodiversity, but the effect will be seen over time due to delay effects as populations seldom is wiped out in one sweep. Another consequence of the given rule will also be that a 90% reduction of an area still will give room for half the number of species.

Metapopulation theory

Originally, the term metapopulation describe a model of population dynamics of insect pests in agricultural fields, but the idea has been applied to a wide variety of species in naturally or artificially fragmented habitats. A metapopulation consists of a group of spatially separated populations of the same species, and where the different populations interact at some level. In classical metapopulation theory, each population cycles is relatively independent of the other populations and eventually goes extinct as a consequence of demographic stochasticity; – the smaller the population, the more prone it is to extinction (Fig. 2). Although individual populations have finite life-spans, the metapopulation as a whole is often stable because individual immigrants from one population are likely to re-colonize habitat which has been left open by the extinction of another population.

Figure 2. Given that a species is living in a fragmented habitat as shown, they will most likely have surplus “Source”) populations living in some of the larger fragments, and exist as “Sink” populations in the smaller ones, but overall metapopulation functioning is good due to migration possibilities given by corridors and step-stones. Population might easily deteriorate if either one of the lager habitats or the corridor/step-stone system disappears.

The development of metapopulation theory is connected to the discussion of source-sink dynamics and the importance of connectivity between seemingly isolated populations. Metapopulation theory was first developed for terrestrial ecosystems, and subsequently applied to the freshwater and marine realm.

Applications in conservation biology

The theories and its application to the field of conservation biology are undoubted. For example, the realisation that reserves and national parks formed inside human-altered landscapes (habitat fragmentation), and that these reserves could lose species as they “relaxed towards equilibrium” (that is they would lose species as they achieved their new equilibrium number, known as ecosystem decay) have caused a great deal of concern. This is particularly true when conserving larger species which tend to have larger ranges. This led to the debate known as “single – large or several small” (SLOSS) – that is; what is the best strategy – a number of smaller habitats connected to each other or a larger and not fragmented area? Nowadays it may seem that in this species-area relationship the view that the one large reserve could hold more species than several smaller reserves is the norm in reserve design. However, there are also voices who considered this to be an unproven over-simplification that would damage conservation efforts. Habitat diversity was as or more important than size in determining the number of species protected. Though – if habitat diversity is high we also have to consider that each habitat for specialist species will function like a habitat island and as such be prone to habitat shrinking problems.

Island biogeography theory also led to the development of habitat corridors as a conservation tool to increase connectivity between habitat islands. Habitat corridors can increase the movement of species between parks and reserves and therefore increase the number of species that can be supported by creating metapopulation structures possible.

Finally, in species diversity, island biogeography most describes allopatric speciation – that is when new gene pools arise out of natural selection in isolated gene pools. Island biogeography is also useful in considering sympatric speciation, the idea of different species arising from one ancestral species in the same area. Interbreeding between the two differently adapted species would prevent speciation, but in some species sympatric speciation has occurred.

Conclusion

In conservation biology the landscape ecological theories are powerful tools in the understanding of how area protection will function in short and long time runs. The ideologically best solution in creating reserves is

most often not possible, and in reality compromises will have to be done. In such situations large reserves in combination with smaller ones interconnected by habitat corridors will be actual solutions, and even better if environmental concerns plays an important role in how landscapes outside reserves are also used.

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10. Bird communities in European taiga forest:

– A comparison between some small-grained old-growth fragments in Lierne, central Norway, and a large forest block in Archangelsk, Russia.

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Introduction

Clear-felling was introduced in the Fennoscandian boreal coniferous forest in late 1950's and early 1960's, and has thereafter become the leading logging practice. Simultaneously, extensive construction of forest roads allowed the exploitation of new areas and the use of heavy trucks for transport. This increased exploitation resulted in a rising rate of fragmentation and degeneration of old-growth forest habitats, thus reducing the natural biodiversity in a substantial part of this biome (Esseen *et al.* 1992, Edenius & Elmberg 1996, Andrén 1997); e.g. many well-documented negative impacts for avian fauna have been reported (Sandström 1991, Angelstam 1992, Andrén 1994, Edenius & Elmberg 1996, McCollin 1998, Chalfoun *et al.* 2002, Laiolo *et al.* 2004). In substantially fragmented landscapes some bird species may have requirements that are greater than the mean size of the remaining patches (Andrén 1997). Therefore the spatial habitat configurations (e.g. the graininess of the fragmented old-growth patches) of a forest landscape become most important for its suitability as a breeding area for these species. From Finland it is reported that some “taiga-species” only can maintain their “natural” population densities within continuous “virgin” forest landscapes of significant magnitude, e.g. in the order of 1,000 km² (Virkkala 1991).

In Russia the clear-felling practice started somewhat earlier (probably as early as in the 1930's). The forested areas were then mainly intact, natural old forests covering enormous areas. Felling started near to old settlements and vast clear-cuttings were made into these old forests at a broad scale as roads and railways were built successively into the wilderness. Today some large units of old growth forests still exist in Archangelsk oblast (“county”), beyond the existing infrastructure, representing the last large bodies of old taiga-ecosystems in the North-Western part of Europe (Yaroshenko *et al.* 2001, Aksenov *et al.* 2002).

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Study area

The exploitation of the Fennoscandian boreal forest landscapes over the last half century is exemplified by our two study areas in Lierne (Berglia and Raudberga) in central Norway. As is typical for many Fennoscandian boreal forest landscapes, particularly in Norway with its varied topography, our study areas were quite fragmented also in their "pristine" condition, as only 65% of the 156 km² below the tree line were originally covered by forest in the Berglia area and 72% of 94.4 km² at Raudberga. The tree line (woodland limit) here varies between 500 and 650 m a.s.l. Due to clear-felling practise since the 1950's, significant parts of these originally heavily wooded areas now consist of open, or partially open, clear-felled areas interspersed with young, productive woodland (the fastest growing phase of the re-growth). At Berglia, the area covered with old-growth forest was reduced by a further 19% in 1999 compared with the "pristine" situation where 65% of the landscape was forested. At Raudberga there has been a further 36% reduction from the original 72% coverage, leaving just 36% of this area covered by old growth. By use of Geographical Information System (GIS) the old-growth forest patches were, moreover, buffered by a 100-metre zone (a moderate penetration of an edge effect) towards clear-felled areas, bogs, lakes, roads, cultivated land, farms, houses and cabins (some small patches will be entirely included in this edge zone). This buffering procedure was only applied where the old-growth patches bordered on to other types of habitat larger than 1 ha, as smaller patches were not expected to create significant edge effects. Power lines, deciduous woodland and productive forest patches were not expected to create noticeable edge effects either, and were therefore not buffered against. As a result we disclosed a significant reduction of the core areas of old-growth forest, being 18.2 ha in Berglia during the "pristine" condition and only 6.0 ha in 1999; the corresponding figures for Raudberga were 30.0 and 13.9. The ecological consequences of the landscape alterations identified during this period are illustrated by tracing the trend of the bird guild associated with old-growth forest. We used existing and estimated density data for this guild; implying 100 terr./km² in the core areas of the old-growth patches, 50 terr./km² in the 100-metre buffer zone, 20 terr./km² in young productive forest and 15 terr./km² in the partial clear-cut areas. Given these assumptions the old-growth bird guild has been declining at ratios significantly higher than the one-to-one relationship expected if the loss of habitat areas had been the only effect. (Figure 1, see Thingstad *et al.* 2003 for further details). The difference in the spatial habitat configuration between these two areas can explain the somewhat different response of the clear-fellings between these two areas, as Raudberga shows a more coarse-grained fragmentation pattern and thereby maintain suitable conditions for a somewhat higher fraction of the old-growth bird guild.

Figure 1. Relative losses of areas covered by old-growth forest (a) and the corresponding losses of territories of the old-growth bird guild (b) in Sørli and Nordli, central Norway.

A contrast to this situation in central Norway is the large intact areas of old-growth forest of the Archangelsk oblast. They represent today a possibility of studying taiga ecology in ecosystems that we do not find in Fennoscandia. They are to be regarded as the sources for the taiga-elements in our own coniferous forests. We carried out a study on bird communities in one of these old remaining, intact forests of Archangelsk, in the Yula river of Pinega and Vinogradovsky rayons in spring 2005.

Material and methods

The point method was selected for collection of the field data. This is a method commonly used for studying extensive areas, and a cost-effective method for providing representative data of the bird community (Bibby *et al.* 1992). The data used in this study were collected from one morning census at each point (census time: 5 minutes) during late May 2004 (Lierne) and late May 2005 (Yula and Ura). A 100 metre fixed radius was used, but areas at the edges that might hold other habitats were omitted. All registrations were taken down from points that were spaced with a distance of 250 metre; their locations were in advanced selected by use of GPS-positions. In Lierne only a spruce dominated habitat type was surveyed, while four types of forest were surveyed in Archangelsk, thus

giving fewer surveyed points per forest type in the latter area (Table 1). Some of the registered bird species are given a guild belonging (cf. Table 1). Guild one consists of hole- and snag-nesting species, while guild two consists of the rest of species being associated to old-growth coniferous forest (cf. Thingstad *et al.* 2003).

Results

For visualisation of the differences in the species composition of the revealed bird communities in the five surveyed types of taiga forest a hierarchical cluster analysis was run (Figure 2). The forest edging the Ura river is a highly productive deciduous tree and bush habitat, quite different from the outer four surveyed forests dominated by different types of coniferous forest. Ura-edge might therefore be regarded as an “out-group” in this analysis. The obtained dendrogram disclose the close relation between Yula-mix (the surveyed edges at Yula, dominated by spruce, but also containing pine and some deciduous trees) and the spruce forest in the Ura area. The bird community in the relative homogeneous pine forest in the Yula area is also quite closely related to those communities that were disclosed in the two above-mentioned forest areas. Simultaneously the bird community in the spruce dominated old-growth forest in Lierne shows up to be somewhat distant from the three Russian coniferous habitats. The geographic distance between Lierne and Yula will trigger some differences in the bird species composition in itself, and as already mentioned some of the variation might also be caused by different weather conditions during the survey periods in Lierne (in May 2004) and Yula and Ura (in May 2005).

Table 1. The number of birds from the performed point surveys The surveys are located in old-growth fragments in Lierne, central Norway, and the four different types of taiga forest in the vicinity of the rivers Yula and Ura, in Archangelsk

Species	Guild	Lierne	Yula-pine	Yula-mix	Ura-spruce	Ura-edge	Total
<i>Fringilla montifringilla</i>	2	41	27	6	27	1	102
<i>Phoenicurus phoenicurus</i>	1	12	11	3	17	7	50
<i>Turdus philomelos</i>	2	32	3	1	1	0	37
<i>Regulus regulus</i>	2	26	1	3	7	0	37
<i>Erithacus rubecula</i>	0	29	1	2	2	0	34
<i>Carduelis spinus</i>	0	16	8	2	5	3	34
<i>Fringilla coelebs</i>	0	2	5	3	17	7	34
<i>Phylloscopus trochilus</i>	0	18	0	1	2	5	26
<i>Anthus trivialis</i>	0	1	12	2	4	1	20
<i>Phylloscopus collybita</i>	0	0	1	3	14	2	20
<i>Troglodytes troglodytes</i>	0	10	0	1	6	1	18
<i>Prunella modularis</i>	0	13	0	0	3	1	17
<i>Loxia curvirostra</i>	2	4	2	1	9	0	16
<i>Turdus iliacus</i>	0	6	2	1	0	6	15
<i>Dryocopus martius</i>	1	1	10	1	3	0	15

To be continued

Continued

Acrocephalus schoenobaenus	0	0	0	1	0	13	14
Turdus pilaris	0	11	0	0	0	2	13
Parus montanus	1	6	0	2	3	0	11
Dendrocopos major	1	0	5	0	5	1	11
Parus ater	1	4	0	2	4	0	10
Sylvia atricapilla	0	0	2	0	0	8	10
Muscicapa striata	1	0	6	1	3	0	10
Cuculus canorus	0	0	6	0	2	1	9
Pyrrhula pyrrhula	0	3	0	0	5	0	8
Parus major	1	8	0	0	0	0	8
Phylloscopus borealis	0	0	0	0	1	6	7
Corvus cornix	0	2	0	0	0	5	7
Bonasa bonasia	2	1	0	1	4	0	6
Tringa ochropus	2	0	2	0	2	2	6
Ficedula hypoleuca	1	0	2	2	2	0	6
Perisoreus infaustus	2	5	0	0	0	0	5
Carpodacus erythrinus	0	0	0	0	1	4	5
Cerhia familiaris	1	4	0	0	0	0	4
Turdus viscivorus	2	0	0	0	3	0	3
Scolopax rusticola	0	3	0	0	0	0	3
Strix uralensis	1	0	2	0	1	0	3
Tetrao urogallus	2	2	0	0	0	0	2
Tetrao tetrix	0	0	1	1	0	0	2
Accipiter gentilis	2	2	0	0	0	0	2
Carduelis flammea	0	1	0	0	0	0	1
Motacilla flava	0	1	0	0	0	0	1
Picoides tridactylus	1	1	0	0	0	0	1
Lagopus lagopus	0	1	0	0	0	0	1
Falco tinnunculus	0	1	0	0	0	0	1
Buteo lagopus	0	1	0	0	0	0	1
Emberiza rustica	2	0	0	1	0	0	1
Pinicola enucleator	2	0	0	0	1	0	1
Sum/N survey points		268/57	109/19	41/11	154/25	76/7	648

Guild 1 represents bird species being dependent on holes or other types of cavities in trunks or snags for their nests, while guild 2 represents old-growth associated bird species (see Thingstad et al. 2003 for further details).

Figure 2. Dendrogram showing the result from the hierarchical cluster analysis using the within-group linkage method with squared Euclidean distance as measure interval (SPSS 13.0). Log transformed values ($x + 1$) of the relative contributions of the involved species were used in the analysis

The group of birds being most dependent on plentiful access to dead wood is the woodpeckers. This requirement is highly fulfilled in the old-growth taiga at Yula and Ura. However, the dimension of the trunks might be a constraint factor according to the size requirement of the nest cavities for these species, and accordingly the forest consisting of big pines at Yula is the preferred habitat. The woodpeckers constitute 13.8% of the surveyed individuals in this forest, while they only count for less than 1% in the bird community in the old-growth fragments in Lierne. The spruce forest at Ura might be most comparable to the forest in Lierne, but also here the woodpeckers are sevenfold as abundant (Figure 3). The deviation between the numbers of registered woodpeckers in the five study units and those numbers that should be expected if they were evenly distributed in the communities, becomes statistically significant ($\chi^2 = 38.93$, $df = 4$, $p < 0.01$).

Figure 3. The relative contribution from the woodpeckers in the total bird communities in the five surveyed areas.

Figure 4. The relative contribution from hole- and snag-nesting bird species (reported as guild 1 in Table 1) in the total bird communities in the five surveyed areas.

Some additional bird species are also dependent on holes or other types of cavities in trunks or snags for their nests. These species are mentioned under guild one in Table 1. In the pine forest at Yula this guild contributes $\frac{1}{3}$ of the total bird community and approximately $\frac{1}{4}$ in the two spruce-dominated Russian forests. By way of comparison, in the old-growth fragments in Lierne this guild forms only 13% of the bird community; only the edge deciduous forest at Ura has a smaller share (Figure 4).

Also the deviation between the numbers of registered individuals in guild one and those numbers that should be expected if they were evenly distributed becomes statistically significant ($\chi^2 = 20.87$, $df = 4$, $p < 0.01$). If we in these comparisons further add the rest of the species that were found to be associated with old-growth coniferous forest in Lierne (guild 2 in Table 1), the differences between the four surveyed plots with coniferous taiga (omitting the edge habitat of the Ura) become insignificant. In all the coniferous forest in question this last assemblage constitutes more than 55% of the total bird community; the pine forest at Yula as much as 65 %, e.g. 9.5% more than its contribution in Lierne. Moreover, the “out-group”, the edge habitat at river Ura now clearly shows its divergence from the other habitats (Figure 5).

Figure 5. The relative contribution from all old-growth forest associated bird species (given as the sum of guild 1 and 2 in Table 1) in the total bird communities in the five surveyed areas.

Discussion

Dead wood as a minimum factor for biodiversity in most of the Fennoscandian taiga areas, and the abundance of hole-nesters might indicate the occurrence of several other vulnerable forest species among insects, vascular plants, bryophytes and lichens (Nilsson & Ericson 1992, Virkkala et al. 1994). A great number of hole- and snag-nesting bird species (guild 1) might therefore be a useful indicator for the more general conservation value of the forest. The great abundance of bird species belonging to guild one in the actual surveyed coniferous forests at Yula and Ura is

therefore a definite indication of the great overall conservation importance of this forest block.

Active gap-dynamics in the old growth spruce forest near Ura River (Photo Ole J. Sørensen).

As long as a forest landscape contains a sufficiently high proportion of suitable habitats, the loss of suitable habitat *per se* is the main cause of declining population sizes of old-growth associated species (Helle & Järvinen 1986, Andrén & Delin 1994). For mammals and birds being attached to the virgin taiga this seems to hold true as long as the landscape has more than 30% of suitable habitats. At further losses real fragmentation problems might arise, due to insufficient patch sizes, isolation and predation factors (Haila 1990). In our study area in Lierne this critical limit seems now to be close, as less than 35% of the landscape is currently covered with old-growth forest, the mean size of the core areas of remaining old-growth forest stands is only 8 ha, and logging activities in the old-growth leftovers is still going on (Thingstad *et al.* 2003). However, for most of the species in guild two the amount of suitable habitat in Lierne still seems to be adequate for maintenance of vital populations. At the same time, for many area-demanding taiga specialists, such as *Accipiter gentilis*, *Tetrao urogallus*, *Picoides tridactylus* and *Perisoreus infaustus*, the patch size of the old-growth stands has already become a constraining factor, implying that their population sizes are declining or depleted in the Fennoscandian taiga landscape (BirdLife International 2004). The existing material is, however, far too restricted for further evaluation of these infrequently occurring species.

Although our study is not extensive, it still illustrates the importance of preserving some of the remaining larger blocks of natural taiga as ref-

uges for maintenance of the biodiversity connected to this biome, and as reference areas for scientific studies. Furthermore, such areas might also be suitable for development of future eco-tourism projects and other environmentally friendly activities where the intact forests are used as a resource for rural development. Therefore some of the inner parts of the Yula river basin in southern Archangelsk oblast could be a candidate as a Natural World Heritage Area in a network of old growth forest reserves in the western taiga region. However, to achieve such a goal international cooperation and involvement are necessary.

Dry Lichen-Pine Forest near Yula river (Photo Ole J. Sørensen).

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From the fertile riverbank of Ura river (Photo Ole J. Sørensen).

11. New ideas concerning the spruce forests origin and stability in Archangelsk region

– in light of the last years mass drying

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Scientists have in the 1960–70's gained a good understanding of old-growth spruce forests. It was reflected in publications of leading foresters-scientists: Voropanov 1950, Semechkin 1970, Kasimirov 1971, Volkov & Kasimirov 1971, Volkov & Direnkov 1971, Stoljarov & Kuznetsova 1973). In accordance with this understanding, the northern spruce forests have grown on today's occupied territory in several thousand years. Tolmachev's (1954) studies in his monograph "*Addition to the history of dark coniferous taiga origin and development*" subpolar and berenegizis hypotheses of taiga origin under the tertiary and quaternary period. The territory of Archangelsk Oblast underwent the last Valdai glaciations, and these forests age may be estimated 10 thousand years. Redko (1981) stated that after the glaciation the area got quickly covered with forests similar to modern remainders of intact forests by their tree species composition. During this time a natural change of tree generations have occurred and peculiar age structure have formed in stands, particularly combination of absolute multiple-aged, relative multiple-aged, stepwise multiple-aged cyclic multiple-aged stands which protects their internal stability. Some of those stands maintain identical forest taxation parameters infinitely long due to even ages' distribution (absolute multiple-aged stands). In some other cases the reforestation and mortality equilibrium is disturbed by external destructive factors and those stands have been exposed to cyclical fluctuations. After series of the fluctuations the system aims to revert to the steady state or homeostasis (Borisov 1966). Other scientists call it climax forest.

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Archangelsk Forest Inventory Expedition carried out in the 1970's a special research in spruce forests in three leshozes of the oblast. It was made with the framework of a large research-and-production project "Lesproject" studying structure of spruce forests in the Russian North and perspectives of selective forestry operations. The following age structure distribution of spruce forests was revealed:

- Even-aged spruce forests – 13.6%
- relative multiple-aged spruce forests – 34.4%
- multiple-aged spruce forests – 52.0%
- of this evenly-cyclic-multiple-aged spruce forests constitute – 45.8%

The even-aged forests set conditions for the dynamics of spruce forests system and its stability is determined by the multiple-aged forests. However, the in-depth analysis of age structure for each leshoz and forecasting of development dynamics under polyvariant forest use didn't become customary for forest planning.

In the further study, tables of age classes were analyzed for 12 lesnichestvo's occupying 2.6 million ha which were not involved in forest use at that time and formed tracts of primeval spruce forests.

The generalized series of distribution of the old-growth forests area made up a normal distribution curve lying within the age range 100–260 years and holding 95% of all stands. The remaining 5% of stands were aged less than 100 years and uniformly distributed among the young age classes.

Forest inventory data from the beginning of the twentieth century were studied for 10 pieces of forested land in order to the age structure of their stands. The stands distribution into age steps 80–100 years ago proved to be identical with today's pattern of the distribution. The older statistical information about forests in the Archangelsk Oblast is absent; but there are also no historic evidences that the territory of the oblast was covered 150–200 years ago mainly by young growth and bare areas with a different species composition. The Russian annals from 14th to 17th centuries provide information about extremely hot summers, when fires destroyed towns and villages. We may assume that forest fires then were frequent events.

A repetition of those years happened in 1960 with its fire peak in the latter half of the 20th century. It was then burned out 169 thousand ha, and event that caused insignificant spruce reforestation. This means that there is no reason to assume global secular cyclic recurrence of reproduction processes in the northern spruce forests, where each cycle starts from nothing.

An idea of convergent growth oscillations explains the century-old stability of a forest land under individual dynamics of each single stands. Based on this idea an attempt was made to create a hypothetical one-and-a-

half-thousand-year model of spruce forest development. It will clarify the age distribution pattern of stands multitude in a tract and the distribution constancy in time. Under forest planning, this distribution is presented in tables of age classes and they become a base for registration of forest fund and calculation of annual allowable cut.

This model shows that the majority of forest stands in a tract are in condition of cyclical fluctuations. Forest inventory data confirm this version. According to this, cyclic-multiple-aged spruce forests will make up 45.8% (see above). The best conformity with dynamics of cyclic-multiple-aged spruce forests is shown in table 1. It shows succession development of multiple-aged spruce forests in Komi Republic made by Anishin (1969) for a blueberry spruce forests in the 1960th having 4 yield classes out of 5, where the 5th is the poorest. According to this one dynamic cycle lasts 190 years divided into the 7 stages shown in Table 1.

Table 1. Forest inventory data in Archangelsk Oblast

Stages of one cycle (duration-years)	Age range of trees in stand (years)	Mean age (years)	Young growth (#/ha)	Growing stock (m ³ /ha)	Increment (m ³ /ha)	Mortality (m ³ /ha)	Current stock dynamic (m ³ /ha)
I-Initial phase (1–20)	80–280	148	4560	148	2,604	0.0	2,604
II-Middle age (21–40)	60–300	159	3720	203	3,339	0,494	2,845
III-Ripening (41–60)	80–320	169	2,860	260	3,942	2,072	1,870
IV-Maturity (61–80 лет)	60–340	179	1,440	298	4,137	3,997	0,140
V-Stock stabilization (81–100)	80–320	190	1,184	300	3,961	5,540	-1,580
VI-Beginning of degradation (101–120)	60–340	195	2,240	269	3,349	5,312	-1,963
VII-Stand decay (121–140)	80–360	193	3,552	230	2,890	6,98	-4.09

First, – these data explain logically the nature of centuries-old lifetime of spruce forests without change of succession of tree species and destructive cataclysms. Secondly, – they include almost all variety of real forest with their inventory parameters, making large forest tracts, except uncommon even-aged stands. However it is only a fragment of forms variety in the forest tract. A portion of absolute multiple-aged forests (according to Gusev (1980) it makes 11–23%) is in equilibrium (stable) state or stands overcome similar cycles with minimal amplitude of the fluctuations. This portion and cyclic multiple-aged stands described by Anishin (1969) (III and VII stage) present maximum of the age distribution curve. Forest stand in I–II stages are the left wing of the curve and forests in VI–VII stages are its right wing. Amplitudes of the mean age fluctuations in other forest types and therefore remaining inventory parameters can be

higher or lower during one cycle. Duration of the cycle itself is also varying in significant limits.

Ratio of the age generations (40–years) is changing in stands during these stages and, consequentially, mean age varies from 148 to 195 years, but according to the forest inventory data it approach 250 years.

Analyzing the given data make it possible to supplement Anishins (1969) version. The two last stages of the spruce forest development cycle are not limited by 40 years, but they can last up to 100 years. The decay process can go not insensibly during this time, but occur at once approaching a certain critical point. Fedorov & Sarnadsky (2001) in their publication *“Particularities of spruce forest formation in Belorussia in view of their periodic mass drying”* with reference to Vorontsov (1963) asserted that the drying of spruce forests on the Russian Plain is a natural, recurrent phenomenon. It occurs in periods of the maximum solar activity with prevalence of atmospheric circulation of the eastern type, which is characterized by deep anticyclones, dominance of cold winters and fierce droughts, lowering of rivers level and subterranean waters. These effects are caused by biotic factors, by age structure of forest in our case. The authors concluded that these factors determine the decay. Other reasons (climatic, hydrological, pathogenic organisms, environmental pollution and wrong methods of forest use) belong to inflammatory and contributory reasons of mass drying. Predisposing factors are being accumulated during several decades and they wait until the inflammatory and contributory factors approach a critical mass. Depth of an ecological catastrophe depends on ratio of those factors and dimensions of the critical mass.

Conclusions

- It is possible to forecast mass drying of spruce forests.
- The forecast has to be based on data of forest inventory that include information about age structure of stands and stages of cyclic development in multiple-aged forests.
- Further development of forest inventory and planning methods, particularly forest registration of multiple-aged spruce forests, analysis of forest structure and calculation of annual allowable cut.

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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 broad-leaf 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, Løvdaal 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 North-western 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 al. 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 emphasis 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 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 were 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 assess 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.

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13. Balancing production and biodiversity

– by conservation, management and restoration in boreal forest landscapes in Fennoscandia and NW Russia: The need for performance targets

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Abstract

Considerations to and conservation of biodiversity is one of the drivers affecting the development of the sustainable forest management concept. Successful maintenance of biodiversity can be defined as all naturally occurring species with population existing in viable populations and found in representative and functional stable or dynamic habitat networks that are maintained by ecosystem processes at multiple spatial and temporal scales. The extent to which biodiversity is maintained is thus a matter of levels of ambition: (1) species may be present, but not in viable populations; (2) viable populations may be present, but only those that are not specialized on natural forest structures or having large area requirements; (3) communities of all naturally occurring species of the representative ecosystems of an ecoregion are present, but large scale disturbances and global change can threaten ecological integrity, and (4) ecosystems and governance systems have adaptive capacity and form resilient social-ecological systems (=landscapes). As a base for reaching these different levels of ambitions mapping of ecosystems at multiple spatial scales regarding the quality, size, connectivity and matrix surrounding (e.g., forest, mire complexes, tundra, agricultural land etc.) the forest areas of high conservation value is necessary. In addition, actors and stakeholders involved with biodiversity conservation should be made aware that there are often thresholds for habitat loss, which if exceeded, will lead to loss of biodiversity. A rule of thumb is that if more than 70–80% of natural forest components are lost population viability for individual species is threatened. Performance targets for ecosystem integrity and resilience remain to be formulated. Forest landscapes with a long history of intensive management in Fennoscandia are below such thresholds. Mapping of

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forests with high conservation value provide estimates of the assets for functional habitat networks. Policy analyses should then be made to determine what level of ambition of biodiversity maintenance is desired. Then one can assess the possibility of reaching this ambition by combining protection, management and restoration of forest ecosystems and processes at multiple spatial and temporal scales. Tools for biodiversity assessments are available for systematic conservation planning for the maintenance of biodiversity at strategic, tactical and operational levels. Three examples are (1) securing large intact forest landscapes within each ecoregion; (2) maintain connectivity for terrestrial and aquatic infrastructures of landscapes; (3) selecting appropriate systems for management and governance that match the social-ecological context.

Background and aims

The maintenance of biodiversity, i.e. the composition, structure and function of ecosystems, is one of several internationally recognized objectives of sustainable forest management. Empirical evidence from Europe suggests that industrial forest management is responsible for much of the loss of forest biodiversity and that the extent of the loss is a function of the amount, duration, and intensity of resource extraction (e.g., Angelstam et al. 2004a, Angelstam and Dönn-Breuss 2004, Roberge et al. 2008). Successful maintenance of biodiversity can be defined as:

- All naturally occurring species exist in viable populations, and
- Found in representative and functional stable or dynamic habitat networks,
- That are maintained by ecosystem processes at multiple spatial and temporal scales.

The extent to which biodiversity is maintained is thus a matter of levels of ambition (Angelstam et al. 2004b):

- First; Species may be present, but not in viable populations.
- Second; Viable populations may be present, but only those that are not specialized on natural forest structures or having large area requirements.
- Third; Communities of all naturally occurring species of the representative ecosystems of an ecoregion are present, but large scale disturbances and global change can threat ecological integrity.
- Fourth; Adaptive ecosystems and governance systems form resilient social-ecological systems (=landscapes).

The pattern of biodiversity impoverishment as a function of habitat alteration is often not linear (Angelstam et al. 2004c, Villard and Jonsson 2009).

This provides opportunity for comparing data from habitat mapping or monitoring programs with performance targets for biodiversity conservation. However, in practice this not common, and neither is the formulation of performance targets per se not to integrate studies of ecological and social systems (Törnblom 2008). The aims of this paper are to:

- Present a systematic approach to empirical research testing the hypothesis that species populations respond to habitat loss in a non-linear way,
- Review recent studies on how much habitat is needed without the long-term maintenance viable populations being threatened.

We then discuss how thresholds can be used for establishing performance targets in forest management and conservation planning at different spatial scales.

A systematic approach to develop performance targets

Angelstam et al. (2004b) presented a general procedure for identifying performance targets to be used in the determination of conservation targets for population viability in forest and woodland landscapes. The six steps are:

- Stratify the forests into broad cover types as a function of their natural disturbance regimes (e.g., Angelstam and Kuuluvainen 2004).
- Describe the historical spread of different anthropogenic impacts in the boreal forest that moved the system away from naturalness (e.g., Angelstam and Dönn-Breuss 2004).
- Identify appropriate response variables (e.g. focal species, functional groups or ecosystem processes) that are affected by habitat loss and fragmentation (e.g., Törnblom and Angelstam ms.).
- For each forest type identified in step 1, combine steps 2 and 3 to look for the presence of non-linear responses and to identify zones of risk and uncertainty.
- Identify the “currencies” (i.e. species, habitats, and processes) which are both relevant and possible to communicate to stakeholders (Szaro et al. 2005).
- Combine information from different indicators selected.

Review of performance targets for population viability

While it is evident that there is large variation in the habitat requirements of different species depending on the scale and level of ambition for their conservation there is nevertheless a clear pattern. If too much habitat loss occurs, species’ populations go extinct. Focusing on specialized animals

of forest and woodland being focal species for forest biodiversity at the landscape scale (e.g., Roberge and Angelstam 2004, 2006) a review of thresholds for 17 species (birds, mammals and one insect) ranged from 10 to 50%, with a mean of 19% (Angelstam et al. 2004c).

This confirms the rule of thumb from fragmentation theory that if more than 70–80% of natural forest components are lost population viability for individual species is threatened. Performance targets for the higher levels of biodiversity conservation such as ecosystem integrity and resilience remain to be formulated. A step forward in this direction would be learn about the area requirements of trophic interactions between area-demanding terrestrial species such as woodland caribou (*Rangifer tarandus*) and its predators (S. Boutin pers. comm.), or aquatic focal species like salmon (*Salmo salar*) (Törnblom 2008). Another approach is to study the natural range of variability of the area extent of natural disturbances such as forest fire.

Discussion

Systematic studies of habitat loss thresholds of focal species can be used for formulating performance targets to assess the functionality of habitat networks (e.g., Angelstam 2004, Degerman et al. 2004, Villard and Jons-son 2009). The different steps are:

- Carefully select a suite of species representing each land cover type (Roberge and Angelstam 2009);
- Use quantitative targets based on the minimum habitat requirements defined by extinction thresholds of the focal species (Angelstam et al. 2004b, c);
- Make regional gap analysis for the different land cover types (Lazdinis and Angelstam 2004); and
- Use habitat modelling based on occurrence thresholds at multiple scales to build spatially explicit maps describing the probability that existing habitat patches really contribute to the functional connectivity of that theme in the landscape (Angelstam et al. 2004d).

The latter is important, since quantitative gap analyses alone neglect aspects such as the quality, size, duration and configuration of land cover patches, and therefore overestimate the amount of functional habitat in the sense that it provides sufficient connectivity for specialized species.

But how large is a landscape from the perspective of population viability of species? Using specialized bird species, Angelstam et al. (2004d) estimated the average size of an area hosting 100 females of several specialized bird species over a long time with ideal habitat to be about 40,000 ha. However, also the dynamics of habitat patches in the landscape has to be estimated. As an example, a species using a 20-yr

period in a succession of 100 yr needs an area at least five times as large for its long-term presence compared with being present in the short term. Using the minimum occurrence thresholds at the home-range and landscape scales Angelstam et al. (2004d) estimated that the average minimum area needed for 100 females was ca 250,000 ha for a dynamic managed landscape. However, we do not know how many such local landscapes are needed within, say, an ecoregion to maintain a viable population. Assuming that viable populations would need to encompass an effective population of 500 females (Meffe and Carroll 1994), the area needed for viable populations would thus exceed 1,000,000 ha for the birds in the example above. With an average size of local forest companies' ecological landscape plans ranging from 10,000 to 30,000 ha in Sweden, this would mean that ca 50 landscape planning units ought to be included. This size is of the order of magnitude of ecoregions or large administrative regions within a country. For species with large area requirements such as raptors as well as large herbivores and carnivores this means the appropriate management unit would be equivalent to the scales of one large or several smaller European countries.

Fennoscandian forestry has good reputation due to the efficient systems for high and sustained yields of wood and fiber. In parallel to the global development traditional sustained yield forestry is thus now being challenged by approaches that aim at supplying a broader range of goods, services and values than wood and fibers (Innes and Hoen 2005, Lehtinen 2006, Merlo and Croitoru 2005). Given the long history of forest use in Sweden biodiversity conservation approaches are limited to general considerations and voluntary and formal set-asides of forests with high nature values.

However, to implement policies about biodiversity conservation with different levels of ambitions, one should clearly separate the Fennoscandian context with a long history of forest management from other contexts, such as in remote parts of the Russian Federation where there is opportunity to reach higher ambitions of biodiversity conservation (e.g., Angelstam and Elbakidze 2006). In other words, with a long history of forest landscape use, the opportunities for biodiversity conservation are more limited than if the forest history is short. Due to market pressure and ambitious forest and environmental policies Fennoscandia has developed a good knowledge base both in terms of the requirements of species specializing on naturally dynamic forest ecosystems, but also strategic planning using regional gap analysis, ecological landscape planning and operational management. This said, the Fennoscandian model does not fit regions where the ambitions are to maintain biodiversity with higher levels of ambitions, for example in the large intact forests such as at the border between Arkhangelsk oblast and the Komi Republic in the Russian Federation.

Assessment of ecological sustainability involves the monitoring of indicators and the comparison of their state with targets describing the state which is deemed sustainable. Focusing on the degree of naturalness (i.e. natural range of variability) at different spatial scales required to maintain viable populations of naturally occurring species in boreal forest there are three important questions that need to be resolved. First there is a need for empirical data about the range of variability in near-natural forest landscapes, such as the volumes of dead wood and large trees in stands, and the proportions of deciduous trees and old-growth forests. Second more complete knowledge is needed about how the amounts of these four habitat indicators are related to the presence and fitness of focal species in terrestrial and aquatic systems. Third, there is a need to compare the ecological requirements of focal species with forest certification standards and other performance targets set by different actors and stakeholders involved with the implementation of biodiversity conservation policies. Forest certification standards, which focus on satisfying market access for wood products, can be viewed as interim short-term targets, which need to come closer to quantitative empirical long-term targets to secure ecological sustainability. Thus, if the desire is to maintain biodiversity, there is a need to communicate that politically-derived targets do not always satisfy ecological requirements for population viability.

To conclude, there are four major challenges to support biodiversity conservation by applying existing ecological knowledge about how much habitat that is enough.

The first is to communicate that there are critical threshold intervals for how much habitat that can be lost without negative effects on biodiversity at the level of ecoregions such as the European boreal forest, administrative regions, entire landscapes and local sites (e.g., Villard & Jonsson 2009).

The second is to apply the systematic approach to making dose-response studies that we have outlined in this paper. This is necessary to make policies such as the EU Water Framework Directive concrete and based on empirical knowledge about how to define good ecological status.

The third challenge is avoid previous failures in restoration, reclamation, rehabilitation, and habitat creation and to (a) understand the ecological history of area, (b) look at the proper scale (i.e. catchment scale), (c) treat root causes of degradation, instead of symptoms, (d) work with local communities and to solicit their support for project goals, (e) integrate ecological principles, (f) develop proper goals, (g) institutionalize commitments with local communities and agencies, (h) monitor and adapt management accordingly.

Finally, *a fourth* challenge is to develop local and regional governance arrangements that can connect biodiversity conservation policies with on-the-ground spatial conservation assessments and planning and forest

management. Appearing landscape approaches such as Model Forests, Biosphere Reserves and proactive forest companies, authorities and organizations in the Russian Federation and Fennoscandia forms an important resource for learning (Elbakidze et al. 2007, Elbakidze & Angelstam 2008, Angelstam et al. this volume).

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14. Seven steps towards knowledge production and learning for sustainable forest landscape management and good governance

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Abstract

Global, national and business policies about natural resource management state that economic, environmental and socio-cultural dimensions should be satisfied and balanced. However, currently an increasing number of actors desire more of an increasing range of goods, services and values from forest landscapes' renewable resources. This may result in unsustainable use and conflicts, but provides also opportunities for novel innovative and synergistic collaboration among sectors at multiple levels. Two important challenges are to develop (1) accounting systems for different sustainability dimensions so that actors and stakeholders are provided with transparent information about states and trends, and (2) tools for adaptive governance and management at multiple scales. A large number of concepts for implementation of sustainability policies in actual landscapes have been developed, and local and regional initiatives of them are implemented globally. These initiatives provide excellent opportunities for learning towards sustainable landscapes and adaptive capacity in different contexts. However, by and large this knowledge is often local, and exchange of experiences is limited. To learn from existing experiences it is necessary to collect data sets that represent different landscape approaches and thus multiple landscapes or management units as case studies. Ultimately new knowledge can be compiled and compared, and experiences and approaches for learning be disseminated about both development successes and failures in different contexts. We use multiple landscapes in Europe's West and East as case studies and "landscape laboratories" for transdisciplinary knowledge production and learning. This implies use and integration of both natural and human sciences, in close collaboration with actors and stakeholders representing multiple sectors and levels. The focus is on how forest landscape goods, ecosystem services and values are produced, used, managed and governed in

different social-ecological contexts. Our suite of landscapes represents gradients in two main dimensions. The first is the variation in the history of forest landscape use ranging from harvesting large intact old-growth forest areas in the periphery of economic development to areas with a long history of sustained wood yield management closer to the market. The second is the way forest landscape governance is carried out, ranging from non-industrial private ownership and company to state ownership in Fennoscandia and forest resource leasing systems in NW Russia. We describe a systematic step-wise approach to support sustainable development and sustainability by integrative research. New approaches to trans-disciplinary knowledge production and learning for sustainable landscapes at local to global levels are discussed. Finally, we argue for the need of mutual learning based on networking and sharing of experiences, and discuss the challenges associated to this, among people, partners and landscapes, as well as the responsibility of donors and funding agencies.

Introduction

Since the appearance of the sustainability discourse during the late 1980's a range of international and national policies related to ecologically, economically, socially and culturally sustainable use of renewable natural resources have been formulated (e.g., Innes & Hoen 2005, Havnevik et al. 2006). Actors and stakeholders involved with management and governance of natural forests and cultural woodlands in rural regions are thus subject to the challenges of implementing sustainability policies on the ground in actual landscapes. Traditional sustained yield forestry and agriculture systems are thus challenged with demands of supplying a broader range of goods, ecosystem services and values than wood, fibres, energy and food (e.g., MCPFE 1993, Angelstam et al. 2005, Birot et al. 2005, Merlo & Croitoru 2005).

A range of factors at multiple levels have led to this gradually evolving new perception of natural resource use in forest landscapes, and how governance and management should be adapted to deliver these desired outcomes. The policy level term and discourse sustainable forest management (SFM) captures this. In Europe one group of concerns has roots in the conservation biodiversity. This encompasses both cultural values, which have decreased due to the decline of different forms of traditional pre-industrial agricultural village systems (von Haaren 2002, Angelstam 2006, Elbakidze & Angelstam 2007), and natural biodiversity that suffers due to too intensive forest management (Esseen et al. 1997, Angelstam et al. 2004). Another set of issues can be summarized as rural development, a policy area aiming at dealing with threatened cultural heritage values and loss of cultural and social capital in rural forest and woodland landscapes with a low human population density (e.g., Forsberg et al. 2002, Johannisson 2003, Lehtinen 2006, FORMAS 2007). Implementing these

ecological and socio-cultural dimensions of sustainability is consistent with the view that a landscape is an integrated social-ecological system, with components, structures and processes at different scales and different levels of organization (e.g., Berkes et al. 2003). At the Pan-European policy level the European Landscape Convention captures this (Anon. 2000). At the same time there is a strong desire to satisfy market demands by increased production of goods, rather than ecosystem services and ecological and socio-cultural values. On top of this there is a need of considering uncertainties relating to climate change (Johnston & Williamson 2007), and globalization (Havnevik et al. 2006). Dealing with this complexity is a paramount challenge for society.

Many regions host local and regional development projects constituted by landscape approach initiatives (Singer 2007), such as Model Forest, Biosphere Reserve, EU Leader and World Heritage Site (e.g., LaPierre 2002, Axelsson & Angelstam 2006, Axelsson et al. 2009, Jougda et al. 2006, Havnevik et al. 2006, Singer 2007). In addition there are also regular management units that work with or without special efforts towards SFM, and landscapes with a long history of applying traditional knowledge based on village systems, commons and other local governance arrangements that we can learn from.

Northern and Central Europe's West and East, including NW Russia, contain steep gradients in all dimensions of sustainable development. Here experiences from local and regional initiatives of different landscape approach concepts form an important but so far poorly utilized knowledge base. With a focus on the Russian Federation, European countries in transition from socialist planned to market economy such as Ukraine, and the Nordic countries, this paper discusses how knowledge production and learning can be enhanced. Our approach is to use a suite of existing local and regional development initiatives as case studies, or landscape laboratories (Angelstam & Törnblom 2004, Angelstam et al. 2007a, b). Responding to the need for applying new approaches to knowledge production and learning (e.g., Tress et al. 2006), we describe a systematic step-wise approach in seven steps towards realizing the vision of sustainable natural forest and cultural woodland landscape management and governance.

A systematic approach for knowledge production

By knowledge production we refer both to the creation of new knowledge, and the processes of communication and learning among users and producers of knowledge to ensure that results become available to all relevant actors and stakeholders in different sectors at multiple levels (e.g., Lee 1992, Gibbons et al. 1994). Knowledge production to support sustainable forest landscape management requires the use and integration

of both natural and human sciences, in close collaboration with the users of knowledge (e.g., Tress et al. 2006).

Andersson et al. (2005) concluded that there are several types of gaps between the current multifunctional definitions of SFM at the policy level on the one hand, and what is practiced in actual management units on the other. The range of gaps can be divided into two topics. The first is related to the key challenge of incorporating multifaceted values into management and governance. There are severe gaps between the way we describe and monitor forests and woodlands in practice (focus on wood products at the stand scale) and what ought to be the case based on the current definition of sustainable landscapes (that includes economic, ecological and socio-cultural dimensions at multiple scales). To resolve this top-down integrated planning is needed. The second is related to the limited understanding on how to develop regionally adapted functional systems for decision-making in multi-level and multi-stakeholder governance systems. For example, while the European forest eco-regions form broad longitudinal bands of boreal, hemi boreal and nemoral forests, the patterns of ownership and systems of governance, and management, form a distinct gradient between northern and central Europe's East and West. Additionally, the range of values people associate with forests is not the same in these different societal contexts. Coping with this complexity requires bottom-up approaches that are smoothly integrated with the top-down planning.

Knowledge production and learning for sustainable landscapes requires a transdisciplinary approach where human sciences (i.e. humanities and social sciences) natural sciences on the one hand, and relevant non-academic actors are involved (e.g., Tress et al. 2006). As theoretical and methodological frameworks to deal with this complexity we use the concepts *policy cycle*, including the interactions among policy, governance, management and assessment (e.g., Mayers & Bass 2004), and *landscape*, including its biophysical, anthropogenic and perceived dimensions (e.g., Grodzinski 2005). We thus do systematic integrative research, which has been divided into seven steps for each case study landscape with its integrated social and ecological systems (Figure 1, Table 1).

Step 1. To identify a case study landscape

Research in support of sustainable forest landscape development with large management units, catchments or administrative units as replicated case studies requires sampling in gradients that represent variation in different dimensions. To assure involvement of non-academic actors we focus on selecting places that represent regional centres of interests, ideally also containing units for research, education and communication with society in general. Our aim is to cover entire catchments (see Törnblom 2008). To cover the bulk of the variation in Europe's East and West, the

location of landscapes as case studies is stratified according to the following groups of factors (see also Table 1):

- The biophysical conditions (e.g., topography, bedrock and soils, eco-region);
- The environmental and economic history, including the structures of land ownerships and rights in the landscape;
- The institutional structure and system of governance and planning.

Step 2. To study the environmental and economic history

Landscapes have been shaped by different natural and cultural disturbance regimes, with different intensities and over different time spans. To understand the prerequisites for sustainable forest landscape development, the ecological, economic and socio-cultural history of forest landscapes is analyzed. There is a need to consider and understand the consequences of past human use and influence in the landscape (e.g., Gunst 1989). Inspired by Worster (1993) we focus on three aspects: (1) Natural history, or environments of the past. How did the ecosystem develop in terms of composition, structure and function? (2) Modes of production. These include technologies and ways of organizing production. How did the social and ecological systems interact? This includes socio-economic, production and power issues. (3) Ideas, ideology, perception, and values. This means to understand the role of the human being in the ecosystem.

Table 1. Overview of management units forming local landscapes.

Landscape history	Fennoscandia	Countries in transition	NW Russia	
			shield	plain
Natural reference landscape	–	Bialowieza forest (Poland and Belarus)	Varzuga river catchment (Murmansk)	Pechora-Ilych Zapovednik (Komi)
Short history	Ångermanälven catchment (Sweden)	Pripyat valley and National Park (Belarus)	Kostamuksha raion (Karelia)	Pinega river catchment (SE Arkhangelsk)
Intermediate history	Bergslagen region (Sweden)	Mezole in Smiltene (Latvia)	Kovdozersky Model Forest (Murmansk)	Priluzie raion and Model Forest (Komi)
Long history	Helge river catchment (Sweden)	Roztochya, Lviv region, and Lubny, Poltava region (Ukraine)	Segezha Pine Model Forest (Karelia)	Shchelkovo forest (Moscow region)

These units are covering 100,000 ha or more, which have been selected for detailed studies of ecological, economic and socio-cultural dimensions, systems of governance and management. The shield landscapes in NW Russia have soils and bedrocks of the same type as Fennoscandia, and the plain landscapes are dominated by a ground consisting of silt, sand and clay. This is a difference of utmost importance for the development of systems for forest management and logistics, including road building. The empty cell for reference landscape in Fennoscandia is due to the absence of this combination of properties.

Figure 1. Illustration of the step-wise approach to knowledge production and learning to support the development of accounting systems for ecological, economic and socio-cultural dimensions of sustainability, adaptive management and adaptive governance (from Angelstam et al. 2007a). Drawings by Leonid Kovriga.

Step 3. To map actors, stakeholders, products, and land use

To understand the current state and trends of ecological, economic and socio-cultural dimensions, and the governance system, it is important to consider all actors and stakeholders involved with the use and management of a forest landscape, and with the different planning and governance processes. This involves multiple levels, from local and regional to national and global. Several sub-steps should be taken:

- Map all forest landscape users, actors and stakeholders and group them into different categories;
- Describe the wood and non-wood goods, ecosystem services and values, and the products derived from them using quantitative data; if necessary estimate the total economic value using multiple methods (e.g., Merlo and Croitoru 2005);
- Identify property right structure;

- Identify the types of land use related to the use of the desired goods, ecosystem services and landscape values, this includes land use-rights to understand what kinds of interest that are connected with the particular landscape;
- Evaluate and model the potential impact of land use on land cover in the future.

Step 4. To analyze institutions, policy visions and the system of governance

The implementation of sustainability policies requires understanding of the institutions, i.e. rules and norms in use, policy visions, and collaboration among many actors and stakeholders at multiple levels with different interests and agendas within a landscape or region. A critical issue is to understand the policy visions for sustainability. Such “benchmarks of sustainability” can be derived from analyses of policy documents and interviews with representative landscape actors and stakeholders. This vision can then be used to define the “reference landscape” for different dimensions of sustainability. The evaluation of the policy cycle concerns how policy is formulated, analyses of policy contents and the level of consistency and integration among sectors and levels, how policies are translated into regulations, and how these are communicated by criteria and indicators, and implemented by management and governance in a defined forest landscape. Actors and organizations implementing policies in a forest landscape, affected actors and organizations are studied to evaluate their understanding of policies, their ability to act and their attitudes. In this way gaps in forest policy implementation, and creation, in the case study landscape can be understood.

Step 5. To measure the ecological, economic, and socio-cultural situation

The aim of this step is to measure the ecological, economic, social and cultural state of the selected forest landscape. Technically, this means to operationalize the SFM principle’s different criteria using indicators reflecting different spatial scales (Table 1). Additionally, changes occurring in the case studies, including effects on biodiversity, land use, social interactions, and cultural dimensions are studied. Equally significant for evaluations are modifications and new developments in the governance system at multiple levels that affect both the investigated landscapes and their surroundings.

Table 2. To measure the state and trend of SFM its different criteria need to broken down into different indicators that reflect different spatial scales.

Criteria	Spatial scale		
	Micro	Meso	Macro
Ecological	Indicators	Indicators	Indicators
Economic	Indicators	Indicators	Indicators
Socio-cultural	Indicators	Indicators	Indicators

Step 6. To assess sustainability dimensions and governance, and to make scenarios

Apart from dividing the sustainability concept into different criteria and indicators and to estimate their states and trends (step 5), it is necessary to compare the state and trends of indicators with performance targets representing the sustainable and preferred states as defined in policies (step 4). Defining the acceptable habitat loss for biodiversity maintenance is one example. Knowledge about the critical habitat loss for a particular species allows evaluation of the past and present impact of land use in the landscapes (e.g., Angelstam et al. 2004, Villard & Jonsson 2009). Examples of appropriate tools for evaluation of biodiversity conservation are regional gap analysis and habitat suitability modelling to prepare necessary input for landscape planning processes by different actors. Using information on current land cover trends and future actors' interests, landscape structure can be modelled based on scenarios for future development of governance, including uncertainties and climate change. The results of the assessments and scenarios should be communicated among actors and stakeholders involved in decision-making processes at strategic, tactical and operational levels.

Step 7. Synthesis and development of integrated tools

Once the six previous steps have been replicated in a sample of case studies, best practices for learning about management and governance can be identified and scaled up. Ultimately, an accounting system for sustainability and a social platform or forum for adaptive management and governance can be developed in a way that matches the landscapes' regional context. Data on indicators for different criteria and knowledge of associated performance targets allow assessment of the level sustainability of different dimensions of sustainability. This information forms the base for transparent communication of the state and trends of sustainability dimensions in the landscape among decision-makers and stakeholders at multiple levels, and to the general public through different media.

Discussion

Communication, education and public awareness

Implementation of policies about sustainable development and sustainability are closely related to the level of public awareness about the state and trends of ecological, economic and socio-cultural sustainability dimensions, and the ability to participate in decision-making processes. This is alleviated by two preconditions. The first is the combination of the knowledge and skills of information providers (e.g., teachers, scientists, researchers and stakeholders) and communicators (e.g., journalists, radio and TV producers) to communicate and disseminate knowledge on local, regional, national and international levels in order to increase public awareness concerning sustainable development. The second is that local and regional governance arrangements that represent different sectors and levels are in place. The Model Forest concept is one example. According to the Model Forest development guide, a MF should satisfy six attributes (IMFNS 2008). These are:

- A landscape large enough to address an area's diverse forest uses and values,
- An inclusive and representative partnership,
- A commitment to sustainability,
- A governance system that is representative, transparent, and accountable,
- A program of activities reflects the values, needs and management challenges among the partners, in the local community and on regional to national levels,
- A commitment to knowledge sharing, capacity building and networking, from local to international levels.
- There are, however, several challenges:
- There is insufficient knowledge about how the vision of sustainable landscapes can satisfy societal needs of goods, services and values, and how economic, ecological and socio-cultural dimensions can be realized.
- Existing knowledge is not communicated well among different sectors.
- Cultural barriers between countries in the Baltic Sea Region are a challenge for efficient communication and information exchange.

There is thus an urgent need to disseminate holistic or landscape level knowledge from producers to practitioners and stakeholders to support the sustainable development process (e.g., Lee 1993, Gibbons et al. 1994). This often termed landscape approach (e.g., Singer 2007, Dudley et al. 2006).

Towards transdisciplinary knowledge production

To realize the vision of SFM requires new knowledge and dissemination of experiences representing both development successes and failures (e.g., Angelstam & Elbakidze 2006, 2007, Elbakidze et al. 2008). During the past decade a large number of initiatives have been initiated and new approaches tried. To extract useful new knowledge from a sample of case studies, a transdisciplinary approach is needed where researchers from different disciplines work together with representative local and national actors and stakeholders. This brings new challenges to researchers, their networks, academia, and donors as well as to all other involved actors and stakeholders (Gibbons 1999, Svensson et al. 2002). In spite of this, to solve major sustainability issues in landscapes understood as socio-ecological systems we truly believe that this is the way to go.

Experiences from landscape approach initiatives such as Model Forests, Biosphere Reserves and other similar concepts provide a rich pool of experiences that can be used to gain necessary knowledge, and to develop a landscape forum for adaptive governance and management (Elbakidze et al. 2007a, b). However, by and large this knowledge is localized, and exchange of experiences among regions and sectors is limited. To solve the current challenges of implementing SFM there is a need to encourage new forms of knowledge production and learning based on improved collaboration among sectors using landscape goods, ecosystem services and values. Bridging such gaps are necessary in both Western and Eastern Europe (e.g., Borgström et al. 2006, Sandström et al. 2006, Lazdinis et al. 2007, Blicharska 2009).

This stresses the need for international sharing of knowledge about SFM relevant to European natural forests and cultural woodlands, and co-operation to produce new knowledge (e.g., Lazdinis & Angelstam 2005). Learning for sustainable forest landscape management requires (see Angelstam & Elbakidze 2007):

- Revised education programmes at multiple levels,
- The bridging of cultural barriers by connecting forests, people and markets,
- Future development regarding forest policy and legislation and the role of multi-level forest landscape governance, and
- Cross-sectored integration.

Thus, to extract information from existing research and traditional knowledge, to produce new knowledge from a suite of landscape-scale case studies and to disseminate successful experiences, requires a transdisciplinary approach. This means that applied researchers from different disciplines need to work together with representative local and national non-academic actors (e.g., Angelstam & Elbakidze 2007, Angelstam et al

2007b, Tress et al. 2006). This is a process that requires careful planning and facilitation.

The idea of establishing multilevel partnerships for sustainable forest landscapes should be promoted by encouraging networking between non-academic actors and academia representing different disciplines. In-depth exchange to bridge sectors and cultures using forest goods, services and values is the only solution for the long-term success of SFM implementation. There are good opportunities for twinning between MFs, and other practical attempts to develop SFM on the ground in Europe's East and West. Comparisons of solutions to make the transition from socialist planned economy to market economy are also useful for a range of other countries, such as the new EU member states, Ukraine, and the Caucasus. The roles of the BRIC countries (i.e. Brazil, Russia, India and China) are particularly important to consider (Goldman Sachs 2003).

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15. The implementation of Sustainable Forestry and Biodiversity Care

– at Oust Potchenga/TiTan Group in Pinega; Aims and challenges

*Margarita Zemtsovskaya*¹⁵

The OAO “Ust-Pokshengsky LPH” is a large, specialized forest harvesting company. The company is engaged in the following kinds of activities: Wood harvesting, transporting and shipment. The general area of forest site rented for logging in the territory of Karpogorsky Forest Management Unit makes 458,185 ha with an annual harvested volume of 363,600 m³ per year, which is in accordance with the allowable cutting volume. In 2004, the joint-stock company “Ust-Pokshengsky LPH” was assigned the certificate that its methods of forest management corresponded to the criteria of Forest Trustee Advice. It means, that the activity of the enterprise corresponded to the legislation, the rights of the workers and local population, and that the forest resources are rationally used and the forests of high nature protection importance are saved. The especially protected territories and zones of untouched forests in The UP-LHPs rented area makes 29% of the total forest area of rent. The necessity for certification is called for and demanded out of social, economic and ecological reasons. The presence of the Certificate creates the possibility to export our forest products on the ecologically sensitive markets in Europe. It in turn guarantees for the staff and local community:

- Stable job of the enterprise;
- Preservation of workplaces;
- Payment of wages to the workers.

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The efficiency of the certificated forestry promotes preservation of forest settlements, maintenance of their social and cultural vital needs. The social block then adds the following values to the society:

- Respect for the rights of the local population;
- Guarantees the right of free use of forests for gathering of berries, medicinal plants and cutting of fire-wood.

The ecological block assures:

- Preservation of a biological variety and its components (water resources, ground, unique both vulnerable ecosystems and landscapes);
- Maintenance of ecological functioning and safeties of a forest;
- Preservation of species which are under threat of disappearance and their habitat.

Forest cutting has certain negative influence on nature. To minimize this influence the enterprise carries out measures on protection of biore-sources, rare and disappearing kinds of plants and animals brought in the Russian Red book or regional Red book. In a number of cases, logging can also render a positive effect for animals and flora, as cutting of mono-species wood stands results in an increase of more extent, mosaic-shaped forests, resulting in enrichment of species and structure of forest vegetation adapted to these forests. In edge zones are improved tree seedlings, bushes and grassy plants vegetation, berries crop, that promotes increase of fodder base for animal species. In this way, the combination of an artificial micro relief with preservation of areas promotes species enrichment and best flora reproduction, without excluding the endangered ones.

In connection with the UP-LHPs accepted restrictions of logging in our rented area, and also presence of forest sites inaccessible or unprofitable for operation, the threat of disappearance of any kinds of plants in territory of a rent site should not exist. On a site of rent base area approximately 69,141 ha, or 23% of the total, rented area, the Green Peace and UP-LHP have signed a moratorium till December 31, 2007. This is a zone of The Dvina–Pinega untouched forests massif. In the given territory wood harvesting is forbidden, however the UP-LHA pays the annual rent of about one million rubles for the given territory. From the conference we expect acceptance of the objective decision on the given problem.

16. Forest protection in Norway

Ellen Arneberg¹⁶

Norwegian geography and nature

The total area of mainland Norway is 324,000 km², of which one third is mountainous (Figure 1). Another 38% of the total area is forest and other wooded land. This comprises 45% spruce, 33% pine and 15% birch. Only 12% of the productive forest of Norway is state owned, while the remaining is privately owned by big forest owners down to small family farms.

The Norwegian countryside is very varied. The contrast between different parts of the country when it comes to landscape, types of environment and plant and animal life is surprisingly high and is rare both in a Nordic and in a global context. Norway's location on the western margin of a large continent in the Northern Hemisphere and with the Golf Stream passing our coasts, results in an unusually mild winters and wet climate, particularly in the west. Eastern parts of Norway are in the rain shadow and have warm summers and cold winters. There is a long way from the southern part of Norway to the North both in distance and in vegetational

Figure 1. Light yellow = Mountain and open heath, Light green = Birch forest, Dark green = Coniferous forest, Yellow=Agricultural land, Red = Urban areas. (Moen 1998)

Figure 2. Vegetation Ecological Regions (Moen 1998)

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In addition to these climatic and geographical gradients, Norway has varied bedrock, superficial deposits and topography, and cultural landscapes (Moen 1998). Figure 2 illustrates the variation in Norwegian vegetation by dividing the county into different regions according to both altitude and oceanity.

Nature protection in Norway

The objectives outlined for nature protection in Norway are to preserve:

- A Representative section of the natural environment
- Key-areas with important function for species or individuals
- The diversity of threatened species of animals and plants by protecting their habitat

The main legal tool for nature protection in Norway is the Nature Conservation Act of 1970 where the most important types of protection areas are:

- National parks – big, undisturbed areas
- Protected landscapes – distinctive or beautiful areas of natural or cultural landscapes
- Nature reserves – the strictest form of protection – undisturbed or largely undisturbed areas or areas of a special type

Figure 3 shows the status of protected areas in is Norway by 1.1.2007.

Figure 3. Protected areas in Norway

The protection processes, aimed at involving all sectors and stakeholders, are outlined in Figure 4. Since 1982, environmental departments have been set up at each of the 18 County Governor's Offices. The County Governor is the regional instrument of the environmental government administration, and is tasked with translating national environmental goals into regional targets and initiatives. The County Governor also plays a lead part in the continuous follow-up of the environmental protection work on county and municipal level. The County Governor (CG) investigates areas and makes a protection proposal which is sent on local public hearing. The recommendations of the CG after the hearing are passed on to the Directorate for Nature Management. The Directorate sends the proposal on a central hearing to organisations and national institutions. A final recommendation is then sent to the Ministry of environment. The final resolution is taken by the King in Cabinet. The Directorate is subsequently responsible for allowing a compensation to land owners of which land is included in the protected areas.

Figure 4. The figure show the process involved in nature protection in Norway.

Forest protection in Norway

Forest in Norway is protected through the Nature Conservation Act of 1970 where the most important types of protection areas for forest protection are National parks and Nature reserves.

Today 1.4% of the productive forest is protected through the Nature Conservation Act where 1/3 is on state owned property. The basic idea on the forest protection work has been to try to find areas that will represent the great variety of the Norwegian forest. In order to obtain this one has

divided the country into Nature Geographical Regions (Nordic Council of Ministers 1984). Within each region the aim is to have set aside:

- Typical areas – large areas representing the typical forest mosaic
- Special areas- smaller areas which cover the localities of rare or endangered species or habitats

In 2002 Norwegian Institute for Nature Research (NINA) and The Forest Research Institute (Skogforsk) assessed the results of the forest protection plan by then. This assessment (Framstad 2002) concluded that the protected forested area needs to be increased to approximately 4.6% of the Norwegian forest in order to fulfill the objectives set for the plan, and that the focus should be (in short) on big areas and areas of low altitude and high productivity. These are the forest types underrepresented in the protection work so far.

The new strategy for forest protection is to search for areas on state owned land, church owned land, voluntary forest protection on private land and to do a systematic search for areas of special importance.

Voluntary forest protection as a new strategy

In year 2002 a cooperation between the Ministry of Environment, the Directorate for Nature Management and the Norwegian forest owners association in order to find suitable areas for protection without causing too much conflict with private land owners. The cooperation has three main steps:

- The environmental authorities define what forest types should be protected
- The forest owners offer forest areas for protection.
- Forest reserves are established according to the Nature Conservation Act.

Private land owners are compensated for the loss of income on forest products caused by nature protection. The voluntary forest protection is so far turning out as a successful method of protecting forest.

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17. Sustainable forest management

– within a framework of industrial and environmental quality certification

Ove Mogård¹⁷

Introduction – Commercial forestry as a national public matter

Forestry is important in Norway as a contributor to overall national added value. To put this in a proper economical perspective the local joint trade association of foresters in central Norway (Skognæringa i Midt-Norge) presented an illustration as a result of one day working with a modern harvester as follows:

- 20,000 NOK net cash to the forest owner.
- Enough construction materials to build 5 family homes.
- Wood fuel enough to heat those 5 homes for one year.
- One newspaper daily, for the rest of your life.
- 0.5 man-labour year in the processing industry.
- And finally, a “Carbon dioxide- green-certificate for the rest of your life”.

Even though this is a very popular science illustration, it describes the importance of forestry, and therefore the importance of well functioning systems to insure its sustainability. Figure 1 gives a view on how forestry is implemented in several levels of the society, and all have to be considered.

Most of the forest land in Norway (86%) is privately owned, mostly by family based farms. An average forest property is approximately 50 ha. This leads to the fact that forest treatment in a landscape perspective needs to concern several properties and of course several decision-makers.

A short presentation of ALLSKOG BA

ALLSKOG BA is a company, run as a co-operative of forest owner's in the central and northern part of Norway. The co-operatives aim is to take care of the forest owners interest best possible, and major task are trading the owner's timber and timber products, provide advisory services con-

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cerning logging, reforestation, planning and management as well as other businesses related to forest land. ALLSKOG BA has approximately 8,200 forest owner's, trades annually with about 850,000 m³ of timber, and employs 70 people. The annual turnover is approximately 650 million NOK.

Certification and sustainable management of 8200 forest land properties

Within the given conditions, the only way to assure a sustainable forest management is to certify the co-operative. Certification of each forest property would be almost impossible.

ALLSKOG has since 1999 handled the certification issue on behalf of all its members, and we are a certified supplier of round wood to the wood processing industry, based on a NS-ISO-14001 environmental management certificate. The level of ambition for the certificate is based upon a set of criteria agreed in 'The Living Forest Standards'. "Living Forest" is the trademark for the Norwegian standards for a sustainable forest management.

In addition to this we have chosen to also implement a certified quality assurance system based on ISO-9001 to match the environmental management system where the "Chain of custody" is based on the PEFC-standards (Program for Endorsement of Forest Certification).

Figure 1. A simple illustration of how forestry and its management impact on many perspectives in society

Implementation

Handling such a large amount of forest owners is somehow a challenge in this matter. Forest owners are considered as suppliers to the co-operative, and of course, suppliers need to fulfill certain demands to satisfy the sys-

tem. Examples of such demands, are basic documentation of resources, management plan for key biotopes, documentation of own basic knowledge to Living Forest Standards, a.s.o. A written agreement is needed for each timber lot to be traded or each logging commission to be performed.

On the other side of the chain, logging companies hired to perform the operations are considered as subcontractors. Like the suppliers, subcontractors too, need to fulfill certain demands. They need to document own competence level according to Living Forest Standards. They need a minimum standard level of machinery and equipment, and they must have own procedures described to handle workers welfare and security, as to handle environmental security. In addition we will need a written agreement for each logging commission.

Education of our staff employees, as well as the forest owners and logging operations contractors are continuously needed and a key factor to certification. At ALLSKOG BA, our employees have conducted a continuous education program, run by North Trøndelag University College, in Forest ecology and biodiversity management of forests, some subcontractors have had their own HiNT-developed education program and all forest owners are given possibility to take part in the forest organizations own educational program in sustainable forestry and Standards for Living Forests.

Conclusion

ALLSKOG BA has the need for a streamlined certification system. It is a challenge to serve daily information as we on an average day start 6 new logging operations. Information to suppliers and further education of each forest owner has a high priority. Continuous maintenance of subcontractors' competence level and information to politicians and public in general are important tasks.

Forestry certification is today the only tool we have to take care of full sustainability in the commercial forestry. Development is rapidly changing the frames. Laws and legislations will not be developed fast enough. A modern legislation is a needed platform though, to make certification systems sturdy enough to function properly. It is an assumption that a well functioning forestry is capable of fulfilling a fully sustainable development.

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18. The new forest code for Russian forestry

– and its importance as a tool for sustainable forest management and biodiversity maintenance

*Sergej I. Artamonov*¹⁸

The new Forest Code providing federal forest lands ownership was adopted in Russia in December 2006. The new Forest Code differentiates authorities in forest relations between federal state agencies and state agencies of the Russian Federation subjects.

The following authorities refer to federal state agencies:

- Legal regulation of forest relations;
- Estimation of subventions from the federal budget to the Russian Federation subjects to perform the transferred authorities, control and supervision of their expenditure;
- Performance control and supervision of the authorities transferred to the Russian Federation subjects;
- Establishment of primary territorial management units – forest districts and forest parks;
- Reference of forests to valuable, commercial, reserved ones and allocation of special protected forest areas in them;
- Setting of cutting ages;
- Forest pathology monitoring;
- State forest inventory;
- Generalization of State Forest registers data.

The following authorities refer to state agencies in the Russian Federation subjects:

- Development and approval of forest management plans and forest management regulations;
- State examination of forest development projects;
- Forest management units (leshozes) transformation into management and commercial structures;

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- Allocation of forest lots within forest lands for various uses and purposes;
- Arrangements for forest use, conservation, protection and regeneration;
- State Forest Register-keeping;
- Implementation of state forest control and supervision

Basic principles outlined in the new forest legislation to provide sustainable forest management and biological diversity conservation are:

- Sustainable forest management and biological diversity conservation;
- Maintenance of environment-building forest functions;
- Forest utilization with consideration of their global environmental value;
- Forest utilization in ways that don't affect environ

Primary ways of new forest legislation practical implementation that provide sustainable forest management and biological diversity conservation are:

- Development and approval of forest management plans of the Russian Federation subjects and forest management regulations for forest districts (forest parks) aimed at sustainable forest management and their biological diversity conservation;
- Development of research based guidelines (allowable cut, etc.) providing consistent and sustainable forest utilization;
- Forest utilization based on forest development projects that passed state examination;
- Forest protection from fires, pests and diseases;
- Forest regeneration;
- Purpose based forest division into protective (15 types), commercial and reserved forests with differentiated mode of their utilization;
- Allocation of special protected forest areas in protective, commercial and reserved forests with stricter mode of their use;
- Listing of tree and shrub species that are not allowed for timber harvest and its practical application.

Russian part of the Barents region includes: Murmanskaya and Archangelskaya Oblasts, Karelia and Komi Republics and Nenets Autonomous District. Total area of forest land stock in these Russian Federation subjects is 92.4 million ha, including forest covered lands – 67.3 million ha (73%). Protective forests cover 34.5 million ha (37%). Coniferous stands prevail in these forests covering 53.3 million ha or 79% of forest covered lands.

On-going reform triggered by the New Forest Code resulted in the establishment of 82 forest districts and 1 forest park on the territory of the Russian Federation subjects in the Barents Region. Next step is to bring current forest division into forest groups and 1st group protective forests categories into compliance with the Forest Code. At the same time protective forests area isn't scheduled to decline.

19. Forest Code implementation into the practice of forest relations in Archangelsk Oblast

– considering biological characteristics of the northern forests

Nikolai C. Krotov & Dmitry V. Trubin¹⁰

Prime statements

According to the new Forest Code, the structure of state authorities for forestry and system of forest relations were to be reformed based on the following conditions:

- Russia's forest resources, called the "Forest Fund", remain as state federal property. Forest use is allowed for any managing subject/enterprises following the market rules: Through a long-term lease (concession) of forest plots or by selling of standing timber.
- Forest state authorities is only carrying out governance duties, while management duties concerning forest protection, conservation and reproduction were transferred to forest lessees/leasers or have to be carried out by entrepreneurs by state contract terms.
- Credentials of estate administration were handed over from federal to the regional level. Therefore regional organs of the federal forest agency were eliminated and regional state authority form a special representative organ of in sphere of the forest relations (Department of forest sector).
- Declaring system of access to resources was implemented for forest business having long-term contracts of forest use (Before the system was licensing). The new FC allows the forest plots to be subleased, pawned, and further sold and included into authorized capital. But forest users also got new responsibilities connected to forest protection, conservation, management and reproduction at their own expense.

Archangelsk Oblast, as all other Russian regions, had to split the forestry responsibilities within transferred powers into governance and management duties and for each of them make appropriate agencies. Thus; governing bodies have no right to do any business. The Archangelsk reform of forestry organizations goes stepwise:

The first reform step

In the beginning of 2007 the Federal Forest Agency in the Archangelsk Oblast was eliminated and transformed to Forest Sector Department at the Archangelsk Regional Administration. Leshozes that had been part of the former Forest Agency became the regional property and were placed under the Department. Process of staff optimization in leshozes was made by September 1st 2007 and brought on a 30% staff reduction. This was unavoidable due to fundamental change of the functions of leshozes.

The earlier role of foresters as inspectors was limited to detection of forest legislation violations and not more, – earlier he was making forest work, such as forest plots allotting, reforestation, fire-fighting, and forest use. Indeed those foresters became out of work after the responsibilities repartition in 01.01.2008.

The second reform step

The second step of the reform began November 1st 2007. Leshozes of the Department were included as branch offices into the regional state institution (OGU) “Archangelskselles” (“Archangelsk agrarian forests”). But those leshozes and agrarian leshozes worked together only in two months – until 01.01.2008. The main advantage of such integration was a regular financing of the united leshozes and agrarian forests.

The Forest Sector Department has obliged leshozes to pay salary for October not later than October 31st 2007. The functioning of Leshozes was stopped in budget accounts by October, and the financing of former leshozes was sent to OGU “Archangelskselles” from November 1st 2007.

Here we have to mention how “agrarian forests” were transferred to regional level in 2006. Credentials and financing were transmitted in such an ill-considered way, that employees did not get their wages during 6 months, and directors of the agrarian leshozes risked breaking legislation by inventing different schemes of financial support.

Now all leshozes of the oblast were transformed by joining them to the OGU “Archangelskselles”. To be more precise, the former state leshozes were joined to the agrarian leshozes according to a decree of Archangelsk Governor Kiselev issued 01.11.2007. That fusion was a righteous and considered step on the road of the sector reform. Otherwise a new organization had to be urgently established with branches in all the oblast’s districts and it would imply time waste, slackened speed of the reform and significant financial expenditure.

The third reform step

Today preparation for organization of divisional bodies of executive power is going in the sphere of forest relations. Since 01.01.2008, 28 “Lesnichestvos” will be in function as the divisional bodies of the Forest

Sector Department. They will carry out governance and control duties. At the same time management organizations OGU “Avialesoohrana” (Aviation protection of forests) and “Archangelskselles” will act by state contracts and model agreements terms. The Lesnichestvos will be financed by 100% from budget and 1,342 persons will be employed there.

An important change is that the head of the Lesnichestvo, his deputy and forest officers will become public servants. Earlier they were only regarded as public servants, but had to accumulate salary funds by their own. Though it is obvious, that officials have no right to make business. From this point the lesnichestvos’ employees will be full officials with rank conferring, specific provision of pensions, seniority payments, uniforms etc. However there are tight restrictions: Any business activities are prohibited for an official, he/she only is allowed teaching, creative and writing activity. He/she has to fill in an income statement. It is prohibited to have shares in limited liability and stock companies. If husband or wife is involved in forest business, the official has to inform higher echelon and has no right to take part in decision-making connected to that business. Confirmation to a post in a lesnichestvo becomes possible only after a complex competition due to high requirements for candidates. The Department and Archangelsk State Technical University made an agreement to refresh training for personnel with knowledge gaps. A 3-years bachelor program will be specific formed for lesnichestvos’ employees. Applications for vacancies have already started to come and there are no reasons to doubt that lesnichestvos will employ qualified personnel and begin performing governance and control functions on the oblast territory from the New Year.

What will be with leshozes?

OGU “Archangelskselles” will be transformed to OGU “*Archangelsk Forestry Association*”, where The Archangelsk Department of Forest Sector is the founder. The goals and objectives of the new association are an execution of the whole forest management operations package in not-leased out forests. This association will mainly employ practical personnel, having wide experience to perform all kinds of management operations.

The State will finance all management operations in not-leased out forests at the expense of subventions through contest. If they win this contest, leshozes as branches of OGU “Archangelsk Forestry Association”, will continue to perform their accustomed work. To participation in private enterprises is not excluded in these contests. Leshozes will in this matter have fair odds the next couple of years due to the fact that only leshozes have machinery for forest operations, fire-fighting and forest nurseries. Other actors will need a few years to get planting material and technical capacity. And another main advantage of leshozes is that their staff is highly skilled personnel, people living for their work.

Where to get money?

The lesnichestvos have no reason to worry about their financial provision. State budget covers it, but salary of officials is regulated. While leshozes can earn money not only through state contracts, but also through cooperating with business and there is no salary limits here. If one earned a lot of money, he\she will draw as high salary. According to the Forest Code, the leasers are responsible for performance of the whole forest management operations package, including fire-fighting.

Leasers probably will calculate all costs and come to conclusion that it will be much cheaper and easier to make an agreement with the leshoz that is possessing specialists, equipment to make reforestation, plant nurseries and fire-fighting. As far as know, the large companies – “Ilim-SeverLec”, “Titan” and “Solombalales” have already counted both of the variants. As one sees, the forest sector reform implemented by the Forest Code comes to a new step. In the next year forest sector starts work and function in the new order.

20. FSC and conservation of intact forest massives in North-West Russia

*Andrei Ptichnikov*¹⁹

FSC certification in Russia is currently one of leading factors which support responsible forest management of forests. There is no other single initiative or activity, which have similar positive impact on forest companies as the FSC certification. NGO's campaigns against some companies in Karelia, Archangelsk and other regions in the 1990's and beginning of the 2000's initiated strong interest of several companies in FSC certification. FSC certification requirements were seen both by the companies and NGO's as the acceptable compromise of ecological, social and economic aspects of forest management. Large massives of intact forests in North-West Russia were first identified by NGO's (Greenpeace, Socio-ecological union, Center of wildlife protection) in the middle of the 1990's.

Russian forest legislation and norms never recognized intact forests or provided special management measures or regimes in such forests. The NGO's campaign to protect such forests was in many aspects opposite to existing regulations and a change of legislation and regulations in Russia is very complicated process.

In such conditions FSC was the central mechanism to ensure conservation of massives and responsible forest management around massives. It happened because of the market driven mechanism built in FSC as 2/3 of forest production was export-oriented and business reported to regional and federal government that markets require such certificates. FSC certification was accepted by Federal forest agency and some regional administration as important mechanism and different interpretations how to ensure implementation of forest legislation and in the same time fit in FSC requirement were done (e.g. Komi Republic, Archangelsk Oblast etc).

One of the cornerstones of FSC certification is the absence of conflicts and sharp disputes between stakeholders. Intact forest massives were in the focus of sharp dispute between NGO's, forest companies – leaseholders, forest services and regional administrations. So in the process of FSC certification, FSC accredited certification bodies made pre-conditions to get FSC certification by establishing written agreement between NGO's and

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companies on the use of such massives. The typical agreement is the moratorium on logging intact forest massives. Many companies signed such moratoriums with Greenpeace, WWF and some other NGO's. The major driven factor to sign such moratoriums was to reduce commercial risks from confrontations with NGO's and ensure path to FSC certification.

FSC Principle 9 considering High Conservation Value Forests (HCVF) is in Russia one of the most discussed principles, but the fact that FSC has Principle 9 is a very strong factor and argument to provide special approach to manage HCVF and conserve the most important of them and/or the most important parts of it.

If certification map of Archangelsk region was ever compiled, people can observe the fact that first certification projects were done in leased forests, surrounding massives of intact forests, such as Dvinsko-Pinejsky massive. Later on FSC certification spread over other forests.

FSC certification also requires establishing, declaration and implementation of ecological policy of the company. Certified companies have now ecological director or specialist, responsible for certification, environment and social aspects of company business. Such policies and specialists provide important feedback to company businesses from inside.

Conservation of intact forest massives in North-West Russia has been and still is a very difficult and challenging task. FSC certification requirements and NGO's pressure are two leading factors, which provide conservation of massives, or at least of some of the most ecologically valuable part of massives. Contrary to some Scandinavian countries, Russian government still has weak regulation of conservation of biodiversity in the commercial forests and conservation of HCVF. Special focus of NGO's activities might be in encouraging Russian forest agency to initiate country-wide inventory of high conservation value forests, key habitats and monitor what is going on with rare and valuable forest ecosystems in commercial zone.

After years of practical implementation in the forest sector of North-West Russia FSC certification seems to be the most powerful tool to support NGO's conservation efforts. But it would be even better if FSC Principles and criteria will be translated into official forest regulations.

21. Socio-economic development of local communities

– in specially protected areas of Archangelsk oblast

*Galina Mikailova*²⁰

On the territory of Arkhangelsk Oblast there are currently 108 specially protected natural areas (PAs) with a total area of 6,500,000 Ha. among which 5 are protected areas of federal significance (Pinezhskiy State Nature Reserve, Vodlozersky National Park, Kenozersky National Park, Siyskiy Biological Reserve, and Franz Josef Land Landscape Reserve) and of regional significance (32 reserves and 71 natural monuments). Two national parks “Onega Pomorie” and “Russian North” are proposed as new National Parks and in the process of being designed.

The “Laboratory of protected areas and ecological culture” investigates the role of PAs in the socio-economic development of settlements. For this reason the current development of settlements is analyzed, by conducting opinion polls among residents, interviews with government officials, experts and stakeholders.

The tasks of conservation of old forests and biodiversity in the Archangelsk Oblast require the identification of “white spots” and improving the existing network of protected areas. However, there is an important question: Under which circumstances will a created network of protected areas contribute to the development of local communities living in or near these areas? In our studies, we put attention to the following key points:

- *Resources*: The role of natural resources (land, timber and forest biological resources) for people's lives and development of local community.
- *Values*: A free and unfettered access to natural resources as a special value to the members of local community.
- *Traditions and rules*: Traditional lifestyle of the local community and its transformation in connection with the establishment of protected areas.
- *Knowledge and notions*: The full knowledge about, and adequacy of perceptions about rules of nature and objectives of environmental protection.

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As an example we can analyze the results of an expedition, conducted in late October – early November 2007 in Kenozersky State National Park. Kenozersky National Park (KNP) was established in 1991, with an area of about 130,000 ha. It is located near the boundary between Archangelsk Oblast and The Karelian Republic, with the Kargopol area in the southern sector of the park and the Plesetsk area in the northern sector of the park. In the investigation the views of 350 people living in the southern sector (Morschiinskaya, Anfilovskaya, Orlov, and Trufanova villages) and in the northern sector (Vershina, Ust-Poch and Poch villages) of the KNP were examined.

Prior to establishment of the park residents of the southern sector were employed mainly in agriculture, at state farms. In the northern sector, along with state farms, logging companies worked successfully. So far, part of the male population of Poch village leaves the village for logging activities.

The formation of national parks in Archangelsk Oblast coincided with the period of bankruptcy and collapse of the state agricultural and forestry enterprises. Currently, Kenozersky National Park is the only institution in this territory offering local people jobs. However, the state park is not large; – its staff counts about 130 people, but the number of people living on its territory is more than two thousand.

The main problems of the community are then lack of jobs with an inadequate income and low standard of living (Table 1.). Land (agriculture), wood products and forest biological resources are of great importance to the lives of people in remote settlements. In KNP about half of the residents consider fishing, maintenance of private farming, and the gathering of berries, mushrooms and medicinal plants to be important for sustainment of their families (Table 2, 4 and 5). Natural resources are used not only for their own consumption, but also for sale. A withdrawal from the use of such resources might deprive the possibility of subsistence for local residents.

Table 1. Distribution of answers to the question: How you can assess your standard of living today?

	Kargopol (southern) sector (%)	Plesetsk (northern) sector (%)
– high	0	1
– above average	1	6
– average	44	48
– below average	34	33
– low	21	12

The land areas with settlements are within the boundaries of the park, but it belongs to the municipality. In other words, all the territory within the defined boundaries of the park, except for the settlements, is under control of Kenozero National Park. The question of land then becomes acute if a settlement within the national park begins to grow and it will be in need (for the local community) to construct new houses, maintenance or

increase of agriculture land outside the old boundaries of municipality area.

Table 2. Distribution of answers to the question: What courses do you consider most important for sustainment of you family?

	Total number of responses	Including:	
		Kargopol (southern) sector	Plesetsk (northern) sector
– hunting	29	9	20
– fishing	176	101	75
– gathering of berries, mushrooms and medicinal plants	143	67	76
– private farming	152	48	104
– trade and exchange	14	4	10
– trades and crafts	15	2	13
– something else	29	13	16

Another important issue for local community is the use of wood resources. The local community has a constant need for firewood, which can be easily obtained from the forests. And, in addition, people want high-quality material for repair and construction of houses. The park regulations are aimed to preserve the forest, and it defines stands and places of timber harvesting which is not always appropriate for the community. Hence, there are grievances and complaints among people like: “park provides timber where it is convenient for the Park, but not for us”, and like “House park gives rotten wood to build a house”.

Natural resources are not only the resources of life, but they also have some immaterial value for inhabitants of the park, like when a person says for himself “I cannot live without forests, without the Lake” or “I love to fish and hunt”. Any restrictions are perceived as an encroachment on that value.

In Kenozersky National Park the local communities and its inhabitants though have many advantages to other people, for example in the use of fish resources. Meanwhile, the respondents expressed their dissatisfaction with the need to abide fishing rules (do not fish during spawning or to fish in the presence of “stay ticket”).

The traditional way of life with its seasonal distribution of occupations is being transformed. In connection with establishment of protected areas, the traditional places of gathering berries, hunting and fishing, might either be unchanged or proposed or to participate and used in the tourism sector. A part of population has negative opinion to such changes (Table 3).

Close to tourist centers local community can temporarily gain income by: Providing tourists with food, to provide shelter to live and to produce and sell souvenirs (Table 5). The residents of settlements located away from the tourist flow miss such a possibility of additional income.

Table 3. Distribution of answers to the question: How often do you feel comfortable IN CONNECTION WITH environmental regime operating in the Kenozersky NATIONAL PARK?

	Kargopol (southern) sector (%)	Plesetsk (northern) sector (%)
– very often	2	3
– often	8	12
– seldom	30	38
– very seldom	11	12
– not feeling	49	35

Table 4. Distribution of answers to the question: How would you like to participate in the activities Kenozersky National Park?

	Number of answers
to be permanent park employee	79
to provide accommodation facilities for park visitors	35
to provide park visitors with food	43
to produce folk crafts and/or souvenirs	28
to organize trade of craft products, souvenirs	9
to show tourists elements of traditional way of life, rituals and crafts	11
Other participation	39
I do not want to participate in activities of the park under any circumstances	94

Table 5. Distribution of answers to the question: Are you receiving income related to the existence of Kenozero National Park?

	Kargopol (southern) sector (%)	Plesetsk (northern) sector (%)
– receiving steadily	16	9
– receiving sometimes	26	21
– something else	58	70

Kenozersky National Park, as the only operating and growing company in the area, is considered as city-providing enterprise by some respondents. They believe that the park is required to address the full range of social problems of the village, just as “sovkhoz” and “lesopunkt” did during the Soviet era. Efforts to create tourist infrastructure and tourism development are not always met with understanding from local community: “Why build toilets in the woods, it is better to have them built in the village”, “park makes all for tourists, but nothing for the local population”.

On question of what wishes local inhabitants have to the park, the respondents most often wrote about the need for more attention to local populations by park managers and management i.e. expressed their hopes to address the need of settlement by the Park. Suggestions relating to environmental issues and functioning of the park is almost absent

In general, about half of the respondents showed positive attitude towards the activities of the park (Table 6 and 7). Respondents of southern sector have more positive attitude to promote tourism than in the northern sector. It is in the southern part of the park that locals are more involved in activities related to tourism (Table 5).

Table 6. Distribution of answers to the question: how do you feel about to activities of Kenozersky National Park?

	Kargopol (southern) sector (%)	Plesetsk (northern) sector (%)
– positive	55	45
– I do not care	12	19
– negative	5	11
– difficult to say	28	25

Table 7. Distribution of answers to the question: What is your attitude to tourism development in Kenozersky National Park?

	Kargopol (southern) sector (%)	Plesetsk (northern) sector (%)
– positive	74	57
– I do not care	22	32
– negative	3	10
– other	1	1

Respondents were asked to provide/suggest a model of development of their locality if the park is not created. A large part of the respondents described pessimistic pattern of development: "the whole forest would be cut down, unemployment would have been, all would be gone, and life would be stopped".

Conclusions

Out of these preliminary results, it should be noted:

- Currently, PAs cannot solve all social problems of local community. In doing so, PAs, by virtue of their functions, aim to monitor and manage local community.
- Development of tourism industry has a significant positive impact on the activities related to protected areas and contributes to local community adaptation to new conditions.
- Success in attaining the objectives of protected areas is depended on success in addressing acute social problems of local community. Only socially prosperous local community can be a guarantor of compliance with environmental regulations. Otherwise, sabotage is possible.
- Leadership of Kenozero National Park, together with the international community, has made considerable efforts to educate local residents the basics of small business in terms of tourism development. The effectiveness of these interventions would have been higher if it was targeted and took into account life experience, interests and attitudes of people.

The study points the need to further studies and monitoring of socio-economic factors in the establishment and operation of various types of specially protected nature areas.

22. Lierne municipality; – its nature, history and local culture,

– and new development following changes due to national strategies on nature protection

Ole Jakob Sørensen¹ & Arnstein Kirste²¹

Lierne municipality is one of the largest Norwegian municipalities with a total area of $\approx 3,000 \text{ km}^2$ (300,000 Ha). Approx. 60% of the area is mountains above tree-line. Norway's National Forests own 51% of the area, but only 20% of the productive forests. The municipal itself owns 4,070 Ha, including 2,230 ha productive forests, one forest company owns 8,420 ha (4,540 ha productive forests), and 46,900 ha of productive forests are distributed by 350 private owners. The forest is dominated by spruce (*Picea abies*), partly mixed with birch (*Betula pubescens*) in natural forests. The municipality is on the watershed between Norway and Sweden with 2 valleys draining east to Sweden and 2 westward into Norway. This gives the area a rather humid climate, but east-draining areas are in general drier. Due to mineral rich soil, the forests are rather productive, but stressed by the altitude and mountainous, cool climate. Vast areas are covered with luxurious herbs giving excellent grazing conditions for moose (*Alces alces*), domestic sheep (*Ovis sp.*) and bears (*Ursus arctos*).

Semi-domestic reindeer (*Rangifer tarandus*) graze all over the area following the old traditions of the local Sami people, who have used the areas over thousands of years. The Norwegians settlements came in the mid 1700th – and small, self sustained farms grew gradually up on climatic favourable spots over the following 150 years. Natural resources, with small farms combined with hunting and fishing were important and dominated the society until the 1950th and even longer. The areas settlement was during wintertime separated from the rest of Norway due to lack of winter opened roads. Frequent contacts with Swedish settlements were most common in those days.

Forests and forestry

The areas forests and nature have until the last 5 decades been little affected by forestry, but selective logging for sale (and floating of timber

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down rivers) started in the 1860th, with a new period in the 1930th and 1950th. Clear cutting, planting and silviculture were practices started at the end of the 1950th and have since become the dominating way of logging and forest management. The forest landscape has during the last 50 years been changed from being a mature, little manipulated forests into a modern fragmented clear cut forest with young forest stands. The logged volume over the last decades; approx. 50,000 m³ a year, are now and for decades to come supposed to be reduced until the new forests again have reached a maturity and volume that can be profitably harvested. The forestry activity, which in the 1950th gave work to an estimated 200 persons and a base for their families living, occupies today approx. 10–20% of this number. These persons are now mainly logging with machines and transport the timber to the paper factory by trucks. Some farms cut and sell their birch as firewood, (5,000 m³) for a price even better than its general timber value. But this resource might be reduced if birches are pre-cultivated out in the young stands. The higher elevated forests are subject to restrictions on use and logging practise, and former selective logging is more common in these areas, even by machines.

Farmers, livestock and increase of predator populations

Small scaled farming with a few sheep, milk cows and cattle for meat, mainly for family household was typical in this area until the middle of last century. Local farmers were in the 1970th encouraged to, and state supported to build up larger sheep farms, and sheep husbandry became an important local activity. More than 70 farms based their living on this farming, – a practise that now see its end as Norway and Sweden in the same period protected large carnivores as bears and wolverines (*Gulo gulo*). Both populations have re-established itself into a density that practically makes sheep farming impossible in the way it nowadays normally is practised in Norway due to heavy predation pressure on grazing sheep. After 25 years of increased bear activity, and heavy local opposition to the national carnivore policy, farmers have had to find other ways of living than sheep husbandry, and regional and national authorities' helps economically in this transformation. Now approximately 10 farms still keep on with sheep farming, but most of them have additional income possibilities.

Protection of land areas – National parks and Forest reserves

Since the late 1980's – plans were made to establish new national parks in Norway, and Liernes remote forests and mountains were suggested as new national parks. Local people found these plans hard to accept because it might reduce or at least change their possibilities of collecting natural resources from hunting, fishing, grazing, berry collection as well as transport

possibilities with Ski-do's etc., and use of possible underground mineral resources. Two national parks were established in 2006 after 15 years of debate, and boundaries of the Parks and possibilities of use have been made acceptable to locals through long lasting negotiations. In 2008 and 2009 a plan for increased protection of forest land on state property is suggested and under decision procedures of local hearings etc.

A period of change of life situation and future challenges of sustainable settlement

The traditional ways of living based on logging and forest cultivation and importance of sheep husbandry are in local recession. The society is in stress due to many additional factors often influenced by the national goals and politics. Even the creation of the parks is a part of the stress. But, the established parks also make new opportunities possible with different form of eco-tourism.

Hunting and fishing has a strong cultural tradition, and Lierne is the only place (on earth?) where kindergarten children learn how to snare Willow grouse (*Lagopus lagopus*) in practise – a nice way to introduce children to old, but still ongoing, activities. The State owned lands are locally ruled through its own selected council and employees. The income from hunting and fishing is in this way sourced directly into local community. So is the income from hunters from all over Norway who come to this area to hunt, mainly grouse birds, but also moose.

The municipals 1,500 inhabitants though struggle to keep its society going on; – the number of inhabitants is slowly being reduced in an aging population. But also young people choose to stay and want to find new ways of reasonable living within the frames of the new situations that have been put upon the society from the state. Depending on local will and optimism, the new situation can locally be positive as long as the country and the county see its responsibility and helps in steady processes of changes. In this way the Lierne municipality has a history from which consequences of conservation efforts and forest management can be learned. Some experiences are negative and some are positive, but strategies for future welfare of local people and society in general are slowly reconstructing the society's income possibilities in a positive way.

A future life in the municipal based on ecotourism?

North-Trondelag County has its own department for regional development, and financial support is possible for persons and companies that want to create new businesses. Its funding is partly from the state, partly from the county but also from the municipality itself. Combined with additional, private financing and will, new enterprises are planned in common and strategies worked out for different activities.

Figure 1. Strategic thoughts connecting tourist's wishes and ideas about the destination with facilities the society can or need to bring up. Photo: Arnstein Kirste

Figure 2. Connections between ideas for tourism and consequences of choices – what need to be developed? Photo: Arnstein Kirste

The presentations (Figure 1, 2 and 3) line up some ideas that have to be implemented in the development of new activities based on the work in strategy groups, and can here be given as examples on how official

money and private initiatives cooperate to make future living in the Lierne municipality possible.

Figure 3. Lierne municipalities answer and decision to the challenges of developing new activities based on the nature resources including the national parks. Photo: Arnstein Kirste

Conclusion

Rural development is integrated in Norwegian “District politics”, which goal is to keep local settlement and possibilities for employment at local and rural areas all over Norway. Nord-Trøndelag County’s Dept. of Regional Development, are engaged in the change of business strategies in Lierne municipality. They cooperate with the County Governors’ Dept. of Environment and its Dept of Agriculture to find solutions at personal/farm level to new future business collaboration. The use of the National Parks as a magnet for possible, increased ecotourism is one main strategy, but different solutions and projects have to be created. A kind of collective understanding that collaboration between different partners create positive effects for all is fundamentally for success in this marginal area 300 km from the regional centre of populations, businesses and main airport in Trondheim and 800 km from the Oslo area.

References

North-Trøndelag County: www.nrfk.no
Lierne municipality: www.lierne.no
Lierne office for business development:
www.lierne2.no

23. Norwegian State Forests and regional development

– some examples on cooperative strategies with local municipalities

Ole Jakob Sørensen¹, Jørgen Hoffmann²², Trond Svanø-Hafstad²³ & Tord Åberg²⁴

The Norwegian State Forest is the operative manager of the common state land in Norway covering about 20% of whole Norway. There is relatively more common land in the north of Norway. Only about 5% of the property is land with productive forests, the rest is sub mountain forests and mountain areas (Figure 1).

Figure 1. Map of Norway with an overview of State Land in Norway outside Finnmark County

The Norwegian State Forests (STATSKOG) own approx. 2/3 of the land area of the Lierne municipality, and with this they also have the rights to income from forestry, hunting and fishing as well as mineral resources and renting of land and spots for recreational cabins in the area. They also are partners in creating outdoor recreation habits and public facilities for this

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purpose. In his way, even the Norwegian State Forests play a role in development of local businesses, and also have their own investment fund, partly to help creating new activities. But the fund can also be used for scientific research and/or analysis and reporting projects meaningful to ongoing or planned activities. STATSKOG is in this way an organisation with multiple responsibilities for their own land far beyond the interests concerned with traditional forestry (Figure 2 and 3). As examples we will mention the income from hunting and fishing, renting of recreational cabins as well as the practical management of this activities, including guarding and supervision of legality of activities are delegated to a municipal, politically elected board, with their own staff people and business activities. The creation of national parks also increases the need of more supervision of tourism etc, and an increase of staff members will be a result. The income for renting out land for building of private recreational cabins goes to the State Forests, but secondary income like taxes on cabins value goes to the municipality, and people coming for different kinds of recreation use money in local shops, hiring local enterprisers etc. to the benefit of the local society. STATSKOG also plays a role as shareholders in other business companies, and as such play a role in many rural activities.

Overall management model for Statskog SF

Figure 2. The overall management perspectives for STATSKOG.

Property Management

- Safeguard and maintain State-owned forest and mountain properties
- Have a satisfactory overview of all properties and rights connected to these, as well as activities on State-owned land
- Initiate the exchange, sale and purchase of real estate to improve the configuration of holdings
- Make cooperation with municipalities where the State is a major landowner a priority

Figure 3. Management objectives for the Norwegian State Forest. Photo: Tord Åberg

STATSKOG is today run as a private business shareholder company (where the state is the only shareholder), have sub-divided its activities in the way that also logging and silviculture activities are run as a separate business. “Statskog-Borregard” (SB-Skog) is a shareholder company, where STATSKOG owns 50% of the obligations. SB Skog can take enterprises on forestry and the logging operations also at other land than state-land. Their activities are carefully handled with an environmental focus and all activities certified according to the “Living Forest Standards” (Figure 4).

As a large landowner STATSKOG is also involved in nature protection and creation of forest reserves. They have their own staff of nature ecologists, also run as a separate company at national level, who can be used as advisors on ecological challenges. These days STATSKOG is deeply involved in processes of creating new forest reserves on a voluntarily basis.

Forestry

- Forestry provides a significant contribution to Statskog's finances
- Reduced felling in recent years as a result of ongoing surveys on further protection of Statskog's forest properties
- Forestry activities at Statskog are environmentally certified to ISO-14001. Felling is carried out according to the Living Forest standard

Figure 3. The main objectives to Statskog activities within forestry. Photo: Tord Åberg

Figure 4. SB-Skog is operating along the chain of custody of timber products, including silvi-culture. Its activities are all certified according to ISO 1400 Standards and the Standards of Living Forests.

STATSKOG is also responsible for outdoor recreation activities as hunting and fishing on its land. The hunting and fishing is mainly administered through local (municipal) elected boards, with a permanent staff also run like a private company. These so-called "Fjellstyrene" get its

income from its own activities and play its important role in local nature management and business (Figure 5).

Preparing moose-hunters for the coming hunt.

Cultivation of freshwater fish populations

Grouse census prior to hunting season

Moose freight from a hunt in remote areas

Figure 5. Pictures from different activities and local responsibilities of the “Fjellstyrene” in Norway. Photo: Tord Åberg

Referencer

Norwegian State Forests – STATSKOG:
www.statskog.no

Statskog-Borregaard – SB Skog:
www.sbskog.no
Fjellstyrene: www.fjellstyra.no

24. Comments from “The Workshop on targets and tools for the maintenance of ecological and socio-cultural values of large intact forest areas in Russia”

Linda Berglund²⁵ & Ole J. Sørensen¹

As a final summarization of the workshop, a plenary discussion was held on central questions for the maintenance of ecological and socio-cultural values of large intact forests in Russia. The participants were asked in advance to prepare their own thoughts and reflections on 5 questions, which then were discussed in a plenary session. This session also included some presentations on how the Norwegian State Forests and the Nord-Trøndelag County administration play a role in regional development and the change of strategies for local living conditions, as a result of the implementation of national nature conservation efforts in this community. A brief transcript summary of the discussion on each question:

1. What are the most important values of the Dvinskoye Forest?

The upper part of the Pinega river area has a long history of settlement – dated back to the time before Moscow was established. The tribe known as the “Tsjudes” have once colonised the area. Traditional villages still exist in the area as well as the old Monasteries of Verkolsky and Sursky, the place of the holy St. Johan Kronshtadsky, and Verkola – the hometown of the Russian author Fjodor Abramov. You can here find old countryside/taiga settlement Russian culture, and there is still a local dialect in use.

Here has never been private properties – and the culture of a freedom loving people with strong free will is still existing. Ecologically and environmentally the area is of high importance due to its existing large massive of intact taiga forest with its own, mainly intact natural ecosystem processes, but its biodiversity is still almost unexplored. This uniqueness is of a quality that could be regarded as a “world heritage site” as an example of western boreal taiga.

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2. What are the main challenges in the Dvinskoye Forest Area?

A main challenge is that 70% of the remaining intact forests are leased to logging companies for a period of the next 49 years. They have invested for being operative in the area for at least this period, and forestry activities is a main source of income for most people living in these areas, and its infrastructure and the societies functioning at all. As such – upcoming strong restrictions on forestry for the future as protection of large part of the remaining old-growth forest, will create tremendous negative effects on local communities economically, social welfare and culturally.

The dying out of the spruce as we have observed the last years is a challenge for forestry and income possibilities for the timber. Its causes might be ecologically natural and as such not an ecological catastrophe, but a challenge for a productive, healthy forest for good quality timber production. It is a challenge to find proper use of the dead timber from the areas being logged.

As for the forest management being done over the last 60 years of the Karpogorsky Leshoz – the Leshoz director stress management have kept the forest in good conditions and as such never been criticized, and they have kept strict restriction to keep zones of tree stands bordering rivers and streams, at least this aspect of preserving biodiversity have been well managed.

3. What are the solutions for maintaining biodiversity and landscape qualities of this forest area?

Protection of a large as possible part of the remaining intact forest massive is of utmost importance for to save the qualities of the area regarding biodiversity at ecosystem level. This is according to general accepted ecological rules and understanding. So – to create borders for a possible coming reserve is of strong importance. Compromises will have to be done.

Securing of biodiversity at species level can probably be solved within the frames of a combination of smaller reserves with certain stricter rules and advices on forestry logging operations. At landscape level it will be necessary to create rules for coming logging operations as well as creating plans for areas logged in former times and the creation of new forests through silvicultural operations. The young forests today is the key for future possibilities of biodiversity so implementation of plan for area use and forest compositions in the regrowth areas after logging is also an item to be implemented in overall plans for the area.

So – more investment in silviculture of young forests in combination with plans for future biodiversity care and possibilities of these areas would combine economically and socially aspects with reduced use of the old growth.

FSC-certification is a good tool for improving ecological as well as social care, but as they are formed today they will probably not be enough to secure ecological care in a proper way. Ecological standards also have to be included in the general laws so FSC-standards and law-giving are matched.

The creations of a field Research Station in the area to study these forests ecology as well as the areas cultural values are suggested. This would create national as well as international attention to the area, and have a possibility for mankind to learn more about ecological processes in boreal taiga. It would also to some degree improve local income possibilities as well as local employment.

Somehow it is necessary to change the local employment from being dependent on logging activities and handling of timber, to a more complex labour market, within forestry as well as other activities. The local social culture and uniqueness of nature qualities should have a possible market for different kinds of eco-tourism aiming in on information on nature as well as local culture, hunting and fishing etc.

4. What kind of national cooperation would you like to see for this areas use and conservation?

At national level the need of cooperation between official administrations, in forestry and environmental as well as, education and scientific research institutes are important together with NGOs, Certification companies/institutes and the timber business industry and local politicians should coordinate their activities. Most of the issues would be at Oblast level, but national levels will also have to be included in overall and strategy processes. Of the timber values taken out from these areas – as much as possible should be ploughed back to regional/local developmental projects etc.

5. What kind of international cooperation would you like to see for this area?

The assembly all agreed upon the need for an international involvement of the issue. Details were not discussed, but as we recognized the international ecological value and importance of the area in question, an international cooperation is also natural to find solutions. The Nordic countries should be most interested as the area in question is also a source for their own existing and coming biodiversity.

25. Sustainable forest management:

– from policy to practice by communication, education and public awareness using landscapes as laboratories in Fennoscandia and NW Russia

Per Angelstam, Robert Axelsson, Johan Törnblom¹³, Marine Elbakidze^{13, 14}, Alexander N. Davydov², Sergey Chumachenko²⁶ & Ole Jakob Sørensen¹.

Abstract

Sustainable development as a continuous process and sustainability as a long-term goal have started to engage new actors and stakeholders in relation to the use of goods, ecosystem services and values in forests and woodlands. A key aspect is to match these resources with the identification and development of products that are desired on different markets. Management and governance in this new situation implies a need to include not only stand and local spatial scales, but also regional as well as national and international levels. However, an important challenge is to build bridges in a geographical area among actors involved with different sustainability dimensions, actors in different sectors and at different societal levels, and different disciplines to facilitate the need for production and exchange of knowledge. Communication, education and public awareness are critically important, together with the need for transparent information about the state and trends of ecological, economic, social and cultural/spiritual dimensions of landscapes as social-ecological systems. The term landscape approach captures this and can be operationalized by applying concepts such as Model Forest, Biosphere Reserve, and traditional village systems. In this paper we advocate an approach that supports communication, education and public awareness and that relies on landscapes as laboratories for learning and knowledge production. We stress that to implement policies about sustainable development and sustainability, the context of landscapes in terms of environmental history, biophysical conditions, cultural heritage and modes for government and governance in the landscape need to be considered. We illustrate this idea by reviewing the challenges in Sweden and NW Russia using two urban-rural gradients (Bergslagen and Moscow regions) and two large northern river catchments (Ångermanälven and Pinega). Finally, we discuss the

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challenge of applied interdisciplinary knowledge production where practice, education and research are integrated to address and solve real world problems.

Introduction

According to a wide range of international and national policies Sustainable Forest Management (SFM) aims at satisfying ecological, economic, social and cultural dimensions of development based on forest resources (Higman et al. 2004). This requires integration of policy, governance and management by continuous evaluation (Mayers & Bass 2004). While sustained yield thinking in principle has a long history in forestry, the sustainable development concept that appeared in the 1980's meant that also ecological, social and cultural dimensions should be satisfied (e.g., Innes & Hoen 2005).

With regard to forest and woodland landscapes sustainable development as a process and sustainability as a long-term goal have thus started to engage new actors and stakeholders concerning the use of goods, ecosystem services and values, and the identification and development of products from these natural resources. To implement SFM it is necessary to continue with efficient wood production, and at the same time expand beyond the traditional forest sector to include also other sectors involved with for example rural development and biodiversity conservation. This implies a need to plan and manage not only at stand and local spatial scales, but also at regional as well as national and even international levels. A key challenge is thus to build bridges in a geographical area among actors involved with different SFM dimensions, actors in different sectors at different societal levels, and different disciplines to facilitate knowledge production and mutual exchange of experiences (e.g., Barbour et al. 2004, Borrini-Feyerabend et al. 2004, Blagovidov et al. 2006). Communication, education and public awareness are therefore important to support implementation of SFM, as is the case for its different criteria including ecological (e.g., Convention on Biological Diversity) and socio-cultural ones (e.g., European Landscape Convention) and spiritual ones (e.g., the IUCN/WCPA "Delos Initiative"). The term landscape approach captures this integrated approach to learning for sustainable development and sustainability (e.g., Dudley et al. 2006, Singer 2008).

A paramount challenge is to translate to practice the landscape approach as a tool to implement the principles of SFM via policy level criteria and indicators to management practices in actual landscapes on the one hand, and how innovations that appear locally and regionally can be extracted and affect policy on the other. There are two important challenges that actors and stakeholders at multiple levels (local forest management unit (FMU), regional, national and global) are faced with. First, there must be transparent information about both states and trends or

different sustainability criteria (economic, ecological, social, cultural and spiritual) based on suites of indicators that make it possible to operationalise the SFM principle within a management unit. To assure sustainability as defined in official and company policies performance targets for indicators often need to be formulated for different forest and societal contexts (e.g., Angelstam et al. 2004, Villard & Jonsson 2009). Second, tools for adaptive governance and spatial planning are needed at multiple spatial and temporal scales in a geographical area (e.g., forest management unit, geographical landscape, administrative unit, catchment of 100,000 to 1,000,000 ha in size) with multiple actors and stakeholders representing private, public and the civil sectors of society.

In this paper we propose an approach supporting communication, education and public awareness (cf. www.cepatookit.org). To implement SFM policies the context in terms of environmental history, biophysical conditions and models for government and governance in the landscape need to be considered (Angelstam & Törnblom 2004). To make this approach concrete we summarize the main challenges in terms of knowledge about the state and trends of different sustainability dimensions, and the development of platforms for local and regional governance. We then describe the contents of our ongoing co-operation between the Swedish and Russian forest sectors and education units about how to translate SFM policies to practice by mutual learning (see also Angelstam & Elbakidze 2007, Angelstam et al. 2007a). We focus on how problem-based learning approaches in education and vocational training can be developed using landscapes in northern and central Europe from Fennoscandia in the West to the Ural Mountains in the East as laboratories for local capacity building, knowledge production and collaborative learning. Thus, ultimately, through the students at universities and vocational training bodies in Europe's West and East, the intended learning audiences for public awareness are private, public, and civil sector actors at multiple levels. However, this requires the need to bridge existing gaps between practice, policy, education and research in human and natural sciences, which is the topic of the discussion.

From policy to practice, and back again

SFM, criteria & indicators (C&I), and performance targets

SFM is a principle that needs to be broken down into broad topics (criteria) and variables (indicators) to be operationalised in actual forest management units (e.g., Higman et al. 2004). Defining, measuring and evaluating what sustainable forest management actually is in practice is not easy, but in the last decade there has been considerable effort to do that by numerous international, national, regional and business initiatives that use criteria and indicators as a way of operationalising the SFM principle (Mayers & Bass 2004). Policies (both official and private) not only define

criteria and indicators, but also formulate goals (or performance targets) to be reached to achieve sustainability for a given indicator over a specified time frame. These targets can be short-term and voluntarily negotiated such as forest certification standards (e.g., PEFC and FSC) and politically negotiated environmental quality objectives to be reached within a certain time frame (Higman et al. 2004). The targets can also be long-term and mirror policy statements about sustainability, such as the amount of habitat to maintain viable population of all species (e.g., Villard & Jonsson 2004). From a sustained wood yield perspective the introduction of ecological, social and cultural dimensions of SFM sometimes leads to conflicts among actors involved with governance, planning and management of different dimensions of SFM. Indicators therefore have to be SMART (Specific, Measurable, Attributable, Relevant and Realistic, Time-bound and Targeted), and should reflect all SFM criteria. The four most commonly used criteria are economic, ecological, social and cultural. For each of these a number of indicators and target values have been proposed in international forest policies, national forest programmes, voluntary forest certification schemes and company policies.

Government and governance of forest landscapes

The Russian Federation as well as the Fennoscandian countries is in a transition from government-based decision-making to multi-level governance. Given transparent knowledge about the state and trends of all dimensions of SFM, forest landscape managers in different sectors have to balance the different SFM dimensions by making sure the desirable performance targets are reached without resulting conflicts. There are several examples of conflicts between economic and ecological dimensions. Additionally, emigration of the human population from economically remote areas is a vital problem, which has to be solved in Nordic Countries as well as in the Russian Federation (e.g., Lehtinen 2006). This means that SFM also includes how to deal with social issues. As a consequence, forest landscape managers must be able to communicate with a wide range of users and stakeholders involved with goods, ecosystem services and values in forest landscapes, as well as different markets. There is extensive empirical experience to support that when actors and stakeholders in a governance system in forest landscapes represent multiple sectors (public, private and civil) and levels of organization (local, regional, national, international), then sustainable development and sustainability will be easier to achieve (e.g., Borrini-Feyerabend et al. 2004).

Several concepts have appeared during the last decades that aim at sustainability on the ground based on the idea of a landscape approach, such as a Model Forest, EU Leader and Biosphere Reserve (Axelsson & Angelstam 2006, Axelsson et al. 2009). Common goals are to accommodate and integrate the production of multiple goods, ecosystem services and values in a landscape through new systems of adaptive governance.

Given a long history of strong economic focus in Sweden there are problems with ecological (e.g., loss of biodiversity) and socio-cultural dimensions (e.g., rural development) of SFM. This is evident from the motives behind the development of Biosphere Reserves and Model Forests, respectively, in Sweden as initiatives towards implementation of sustainable development and sustainability on the ground. The Russian Federation is a very large and diverse country. The forest landscapes have different ecological and economic histories, and potential for economic and socio-cultural development. Therefore the driving forces towards SFM are different in different regions. For example, in the Komi Model Forest ecological dimensions were the initial driving forces, while in Pskov Model Forest the driving forces were mainly economic (Elbakidze & Angelstam 2008). Given these differences, SFM is best developed and realized by drawing upon place-based experiences from landscapes as social-ecological systems that represent (1) different histories of forest landscape use, and (2) different societal contexts ranging from top-down state government to multi-stakeholder governance.

It is also vital to draw upon experiences from traditional knowledge and village systems (e.g., Elbakidze & Angelstam 2007). The traditional village system can be described both as a model of local governance, and as a human habitat including not only a settlement with fields and pastures, but also all the natural-cultural landscape including territories of traditional forest use for logging of wood for traditional building and heating, hunting areas (hunting huts and trap-lines), areas where peoples traditionally collect berries and mushrooms and gather materials (wood, birch bark) for folk crafts. Also sacred groves and forest chapels are typical features of the symbolical landscape, which is important for cultural identity of local people (Davydov 2004, 2008).

Linking C&I to SFM by planning in space and time

The two previous sections are consistent with Lee's (1993) mental picture about state and trends of sustainability dimensions as a "compass", and governance as a "gyroscope". Planning processes are an important link between these two dimensions. One approach to link criteria and indicators to forest landscape planning is to focus on the spatial and temporal dimensions of planning that links governance and management within a management unit at multiple scales. Ideally, both bottom-up collaborative and communicative, and top-down regional approaches should be combined (Blicharska 2009).

As an example we focus on a fictive geographical area that delivers 2,000,000 m³ of timber and pulpwood to sawmills and, pulp and paper industries every year. Assuming a growth rate of 4 m³ per year the size of the forest management unit would be about 500,000 ha. However, from biodiversity conservation and regional planning perspectives the entire landscape needs to be included and not only productive forest land. Thus,

assuming that forest cover in this region is 50%, excluding bogs and wetlands, cities and settlements, agricultural and other land covers, this would be equivalent to an administrative region or catchment of about 1,000,000 ha, i.e. equivalent to one or more local administrative units such as municipalities. In NW Russia, i.e. without the wood supply provided through 2–3 commercial thinnings per forest rotation in Sweden, the annual allowable cut would be about 2 cubic meter per ha, and the management unit thus twice as large (Table 1).

But how large is a landscape from the perspective of an ecological dimension such as population viability of species? Using specialized bird species listed in the EU Birds Directive, Angelstam et al. (2004) estimated the average size of an area hosting 100 females of several specialized boreal forest bird species over a long time with ideal habitat to be ca 40,000 ha. However, also the dynamics of habitat patches in the landscape has to be estimated. As an example, a species using a 20-year period in a succession of 100 years needs an area at least five times as large and well planned for its long-term presence compared with being present in the short term. Using the minimum occurrence thresholds at the home-range and landscape scales it was estimated that the average minimum area needed for 100 females of the same suite of bird species was approximately 250,000 ha for a dynamic managed landscape. However, we do not know how many such local landscapes are needed to maintain a viable population. Assuming that viable populations would need to encompass an effective population of 500 females, the area needed for viable populations would thus exceed 1,000,000 ha for the birds in the example above. Ecological integrity is a higher level of ambition for biodiversity conservation. This means that populations of species should be able to interact with each other through different natural ecological processes. The woodland reindeer in Arkhangelsk oblast in NW Russia is an example of a species that most likely, as is the case in Canada, indicate that the interactions between forest dynamics, the reindeer as a prey and the large predators. Similar arguments can be put forward for aquatic systems with salmon as an example. For species with large area requirements such as raptors as well as large herbivores and large carnivores this means the appropriate management unit would be equivalent to the scales of one large or several smaller European countries. Thus, to maintain ecological processes and adaptive capacity several such large landscape units need to be maintained (Linnell et al. 2005) (see Table 1).

To satisfy and take into account socio-cultural dimensions of SFM is also more area-demanding than satisfying sustained yield wood production. The countryside in forest regions is dominated by production of renewable resources. Use of forest goods, services and values provide monetary incomes and sense of place. Wood harvesting and production is the base for large scale value-added industrial production that provides income to the national level. However, the local benefits depend on land

ownership and use rights. In Fennoscandia landscapes with family farms provide diversified local income, while landscapes owned by large companies have by and large been abandoned during the past 30 yrs of mechanized forestry (e.g., Lehtinen 2006). With the appearance of markets for “post-modern” products rural regions has potential for further production services, assets and values, such as recreation, outdoor activities and ecosystem services. The natural and cultural heritage is also an attractive living environment that could give rise to new economic activities that are associated with traditional land use in a region. It is also important to be aware of regional differences within countries with respect to social capital towards long-term planning, business culture and small-scale business entrepreneurship. Finally, the use of different forest certification systems is an example of cultural differences among markets with respect to their awareness about and interest in ecological, social and cultural dimensions of SFM (Table 1).

Education based on problem-based learning

Reality is not disciplinary. There is thus a need for novel courses (=syllabi) and updated education materials, didactic approaches based on the principles of problem-based learning, and good understanding about where in the present education programmes (=curricula) this can be fitted in (e.g., Hosny El-Lakany 2004, Farley et al. 2005, Hammer & Söderqvist 2001). A detailed background regarding the challenges of learning for sustainable forest management in the Russian Federation's NW can be found in Angelstam & Elbakidze (2007). The components of the development of a formal education program include:

- Curriculum development (program)
- Syllabi development (courses)
- Competence development (building capacity lecturers)
- Teaching material development (lectures, textbooks)
- Training of students and lectures (landscape laboratories for demonstration/practice)
- External facilities for teaching and learning (demonstration/practice)

Table 1. Outline of how different planning dimensions can be framed using planning horizons

	Short term (1–5 years)	Medium term (10–20 years)	Long term (50–100 years)
Macro-scale (scale 1:1,000 K; region/oblast, forest company)	Wood supply	Wood supply; tree development Public transport infrastructure (e.g., road network and logistics)	Wood supply, strategic forest management unit plan, choice of forest management system. Assign protected areas (based on regional gap analysis) Regional planning (e.g., infrastructure)
Meso-scale (scale 1:200–50K) (district/lesnichestvo, forest management unit)	Road building	Large scale logistics; Tactical management plan, long-term SFM plan (cf. lesprojekt); Habitat network functionality: adapt silvicultural systems to natural disturbance regimes; secure key habitats, habitat corridors (spatial modeling of habitat suitability) Municipal planning and rural development (e.g., local capacity building, encourage entrepreneurship)	Habitat network func- tionality: adapt silvicultural systems to natural disturbance regimes; secure key habitats, habitat corridors (spatial modeling of habitat suitability) Provision of ecosystem services
Micro-scale (scale 1:25–10 K) (stand/vydel, opera- tional management)	Road building; Opera- tional plan General stand scale considerations (management for biodiversity) Plan sites for use of non-wood products	Large scale logistics Social considerations (e.g., village forests; fire-wood)	Integrated logging- silvicultural operations

To link SFM principles to practices in the management unit it can be viewed as a landscape consisting of an ecological system that interacts with society to generate economic, ecological and socio-cultural benefits. The transition from the sustained yield of wood as the only paradigm to SFM requires communication among different sectors at multiple scales in time and space. We outline of how different planning dimensions can be framed using planning horizons (short-term to long-term) across multiple spatial scales for (a) dealing with wood supply – roads – logging – silviculture, (b) securing ecological dimensions such as biodiversity conservation including ecosystem services, and (c) satisfying socio-cultural dimensions.

Lectures

Implementing policies about SFM is a challenge for actors at local to global levels. Communication, education and public awareness about ecological, economic and socio-cultural dimensions as well as different governance approaches are critically important components. Focusing on higher education the current Swedish-Russian co-operation as an example we produce a course plan based on reaching learning outcomes by a combination of (1) *lectures*, (2) *seminars and practical studies* based on the ideas of problem-based learning, and (3) *individual work*, as well as the use of the local landscapes for learning and knowledge production. The course on SFM from principle to practice, and back again, has been prepared to satisfy the official requirements by universities in the Russian

Federation, Sweden and Ukraine. The SFM course syllabus is planned for one semester and is based on eighteen two-hour lectures, which are grouped into six themes:

- Introduction of the SFM principle and sustainable development based on natural resources in terms of goods, ecosystem services and values in forest landscapes by evaluation of policy, assessment, management and governance (1 lecture)
- Policy, politics and legislation, and C&I in general + performance target (2 lectures)
- Knowledge about ecological, economic and socio-cultural criteria (6 lectures)
- How practical management in different countries is made and planned to affect local indicators in different biophysical, historical and governance settings (6 lectures)
- Governance of landscapes as social-ecological systems under different societal contexts (2 lectures)
- Synthesis (1 lecture)

Exercises and seminars based on problem-based learning

Problem-based learning (PBL) is an approach to learning, in which students collaboratively solve problems and reflect based on their experiences and search for new knowledge. Some characteristics of PBL are that learning is driven by challenging, open-ended problems where students are encouraged to work in small collaborative groups, and that teachers are facilitators of learning. Thus, students are encouraged to be responsible for and organize the learning process with support from the facilitator. Given the multi-sector and multi-scale endeavor of sustainable forest management seminars and practical studies are based on learning from experiences in concrete landscapes (social-ecological systems) as laboratories. To invite forest landscape actors and stakeholders to interact and discuss with students is one approach that has proven effective.

Writing own projects

The most common way of searching for information is to read texts. These can be shorter as on the internet and in newspapers or longer as in reports, journals and books. As a consequence we write to communicate new knowledge, ideas, opinions or instructions. Writing a report should be an integrated part of designing and planning a project.

It is thus essential to learn and practice the craft of designing a project and writing a text that reports this project. In other words what the learner did, why it was done, how it was done and what was learned from it. The final product envisioned is a short fact sheet, a research paper or a longer report. *IMRAD* is a commonly used acronym for the logic of short or long

reports that are standardized to answer the following questions (e.g., Day 1998):

- What is the question (problem) studied? (Introduction)
- How was the problem studied? (Methods)
- What were the findings? (Results and Analysis)
- What do these findings mean? (Discussion)

To design a study and write a report the following steps and tools work well to divide the craft of preparation and writing into different stages, which allows the learner to plan the work and be ready in time:

- Formulate what you want to do in 2–3 sentences, and write the title. Learn from others by reading and talking to people with valuable experience. Make a short presentation for your co-workers/ colleagues using black board, overhead projector or a computer.
- Design the study: how to collect, analyze and present your data. Make dummy graphs, tables or sketch illustrations for analysis and presentation of data. Make a data file to store the data for analyses. Make a presentation.
- Write outline with headings based on the previous step, write introduction and methods. Let your team members read the outline.
- Collect data. Analyze, present and discuss them according to IMRAD.
- Invite colleagues to review the report. Revise.
- Finalize the report with text, data and illustrations.

Landscapes as social-ecological laboratories: Four examples

The landscape approach to translating SFM policies to practices on the ground, and for practices on the ground to affect SFM policies, is based on geographers' frameworks to describing parts of or entire social-ecological systems with their biophysical, anthropogenic and perceived dimensions. The key to this innovative approach is to focus on contrasting environmental histories and different legacies of decision-making in societies (Angelstam et al. 2007b). The European boreal eco-region from the Atlantic Ocean to the Ural Mountains is a good example. Here we illustrate the landscape laboratory approach by reviewing the challenges in four regions in Sweden and NW Russia (Table 2).

Table 2. Four forest landscapes in Sweden and NW Russia are classified based on their environmental history and legacies of decision-making.

	Mostly multi-level governance, many land owners	Mostly top-down government, state owns in principle all land
Long history of land use, steep urban-rural gradient	Bergslagen region	Moscow region
Shorter history of land use, large catchments	Ångermanälven catchment	Pinega river catchment

Bergslagen region

Bergslagen is an informal region in south-central Sweden with an ancient history of use of natural resources as a means of developing human welfare and quality of life (Seebass 1928). Minerals, wood and streams were for very long the base for economic wealth for the entire Sweden. Local small-scale iron production started more than 2000 years ago. Germans saw the opportunity of industrial mining in the early Medieval, and Vallonians from Belgium of steel production in the 17th century. While agricultural development on good soils started thousands of years ago, Finns introduced slash-and-burn agriculture on poor conifer forest land soils in the 16th century. Another side of the coin of the long history of industrial production became low levels of entrepreneurship and education of people.

This trend is, however, now partly changing. Natural resources continue to form the basis for innovative value-added production based on wood, metals and water. However, in addition non-tangible values are becoming important for development. The nature and culture of Bergslagen is attractive to a new wave of immigrants seeking recreation and quality of life. Some move in permanently from densely populated regions in Europe, and others split their week and year with recreation and work from a distance in Bergslagen on the one hand, and in the Stockholm area and other cities in Central Sweden. Bergslagen thus remains being a Swedish trade-mark and heartland. Change has been and is still thus the rule. Society needs to continue to adapt to new situations. A current challenge recognized by many actors and stakeholders is to develop a governance model for intensified use of an increased range of goods, services and values of entire landscapes in Bergslagen as social-ecological system, or simply landscape, which is based on transparent information about the state and trends of sustainability dimensions (Andersson & Angelstam 2009). The region is employing several different approaches for rural development including EU Leader, Model Forest, World Heritage, and Biosphere Reserve (Axelsson et al. 2009).

Ångermanälven catchment

The catchment of Ångermanälven from the Baltic Sea to the Scandinavian mountain range is a typical example of the regional colonization and economic history in north Sweden's boreal forest eco-region. The use of natural resources in the Ångermanälven catchment has evolved as "frontiers" of change that have, usually, started at the coast of the Baltic Sea. "Ånger" is derived from the Norwegian word "Anger", which translates into "deep bay" and refers to the estuary. The catchment covers 31,860 km², and encompasses 14 municipalities of which five cover most of the catchment. An important result of this gradual colonization of less and less biologically productive landscapes is a clear gradient in land ownership pattern with family farms along coast to forest companies in the inland, and state owned land in the mountains.

The historical review and the results from interviews in the municipalities Vilhelmina, Dorotea and Åsele in the westernmost part of the catchment show that the range of natural resources used and the intensity of use are increasing. Additionally, external national, European and global factors have been added cumulatively as driving forces. At present there are both opportunities for collaboration and risks for conflicts between different resource users. To accommodate an increasing range of actors' needs, demands and desires for natural resources, traditional sectoral approaches need to be replaced by a landscape approach that includes both ecological and social systems. To ensure adaptive governance, transparent information about the state and trends of different sustainability dimensions as well as strategic steering and coordinating activities are necessary. Traditional village systems, Sami village organizations and other participatory approaches are discussed as tools on the road to sustainable landscapes. Also in this region there are several landscape approach initiatives (EU Leader, landscape strategy, Model Forest, World Heritage Site).

Pinega River catchment

The Arkhangelsk region hosts the majority of Europe's very last intact forest areas which are not unproductive mountain forests or forest tundra, i.e. vital for satisfying international policies about biodiversity conservation in the European boreal forest from the Atlantic Ocean to the Ural Mountains (e.g., Dobrynin & Stolpovskiy 2008). The forest management challenges are large and diverse (Figure 1). Social policy linked to the necessity to decrease the migration of the population from the Northern areas also has to be taken into consideration. The entire Pinega river catchment, the basin of which covers 42,600 km², and the surrounding areas of large intact forests is a focal landscape for the challenge of implementing SFM.

An agreement between the Federal Agency of Forestry and Administration of Arkhangelsk Oblast signed in April 2007 could be a good platform for positive changes in the forest sector in Arkhangelsk Oblast. According to this agreement, the Federal Agency supports the development of a Model Forest²⁷ initiative called "White Sea Taiga". The aim is to elaborate and introduce new approaches and rules to the forest management in the intact forests, secondary forests and in the forests in the former agricultural lands. Climate change issues should be also studied. The area between Dvina and Pinega rivers will be included to the area of a

²⁷ According to the Model Forest development guide, a MF should satisfy six attributes (IMFNS 2008). These are (1) a landscape large enough to address an area's diverse forest uses and values, (2) an inclusive and representative partnership, (3) a commitment to sustainability, (4) a governance system that is representative, transparent, and accountable, (5) a program of activities reflects the values, needs and management challenges among the partners, in the local community and on regional to national levels, (6) a commitment to knowledge sharing, capacity building and networking, from local to international levels.

MF. The development of research and education of forest specialists are also two main points of the agreement. The idea of organizing of an international unit for knowledge production in the Ura village (Yula River basin) is also discussed.

Figure 1. Satellite image showing the forest harvesting gradient south of Karpogory in the Pinega catchment with four strata; (1) young un-managed forests (without harvesting or silviculture, and with potential for development of sustained yield forestry in the future if cleaning and bioenergy harvesting is commenced), (2) harvested areas with corridors along streams according to previous rules (thinning is now allowed in previous set-asides), (3) partly harvested areas in chequer-board pattern outside large intact forest areas, and (4) not harvested areas inside large intact forest areas. The white line is 10 km.

Moscow region

After the appearance of the 2007 Forest Code, clear-felling is no longer allowed in the Moscow region. This is related to the perception that social and protective functions of forests are more important than wood supply. There is a need to develop a new strategy for forest governance and management for rural development based also on socio-cultural and ecological values of forests. In addition the Moscow region hosts numerous concrete discussions about forest management systems (Table 3). As experiences of existing Russian MFs show, the MF approach is a good platform to facilitate transparent discussions among different forest actors and stakeholders concerning new approaches towards SFM (Elbakidze & Angelstam 2008). The Moscow MF could extend from the linden tree at St Basil's church near the Kremlin to the forests between Pushkino and Sergiev Posad NE of Moscow. A main issue is how to select and design

forest and woodland management systems to develop economic, ecological and socio-cultural criteria (Table 3). Interesting case studies are formed by the MSFU Shchelkovo forest and the Ismailov Park (Merzlenko & Melnik 2000, 2001), the Abramtsevo cultural reserve, the natural park Moose Island and city parks. Easy access for students and stakeholders is essential. Most of the sites mentioned can be reached by metro and local trains.

Table 3. Forest and woodland management systems

Criteria	Objective	Forest and woodland management system		
		Cohort	Even-aged	Uneven-aged
Economic	Wood yield		Effective economic production	
Ecological	Dry site biodiversity	Light, large trees, dead wood	Successional stages from young to old	
	Mesic site biodiversity			
	Wet site biodiversity			Gap phase dynamic
Socio-cultural	Recreation and health	Open forest with large trees	not compatible	Continuous dense forest cover
	Cultural landscape	Grazed forests, wooded grasslands	not compatible	
	City park	Open forest, lawns	not compatible	

An important challenge is to evaluate the extent to which different forest and woodland management systems can satisfy economic, ecological (Angelstam & Kuuluvainen 2004) and socio-cultural criteria of sustainable forest management.

Communication and public awareness

Being a complex challenge, the implementation of policies about sustainable development and sustainability requires public awareness about both state and trends and decision-making processes. This requires the combination of the abilities of content providers (scientists, researchers and stakeholders) and communicators (journalists, radio and TV producers) in several countries. To support this approach we have taken the first steps to set up a web site in English and Russian (www.euroscapes.org). The focus is on people, places and practices. The site will be used as a tool to attract attention and disseminate information among scientists, researchers, policy-makers and practitioners interested in how to realize the vision of sustainable landscapes. The maintenance of high level, relevant up-to-date scientific content is important as a quality guarantee for users of the site. The existence of the site will be made known through a series of activities (press conferences, meetings with scientists, professionals, politicians and other stakeholders) during the first year after setting up the web-site. The second step is to use the material gathered at the site in condensed form as educational or informational projects, edited and

packaged with a more specific target audience, i.e. students, professionals or other communicators. In this step the Euroscapes society can also help arrange seminars or gatherings that will serve to discuss specific topics within the wider context of landscape sustainability.

Discussion

Knowledge production for adaptive management and governance

Because reality is both uncertain (Table 4) and not disciplinary there is an urgent need for holistic knowledge production (Farley et al. 2005). By knowledge production we refer both to the creation of new knowledge, and the process of communication between users and producers of knowledge to ensure that results are communicated to the surrounding community (e.g., Lee 1993, Gibbons et al. 1994).

Table 4. Illustration of the need to learn how to learn and adapt, rather than to learn rules.

		Social system	
		Predictable	Unpredictable

Ecological system	Predictable Unpredictable	Traditional forestry Adaptive management	Adaptive governance New production of knowledge

To realize the vision of sustainability a “societal learning process” (Lee 1993, Gibbons et al. 1994) needs to be developed by exploring different existing approaches to integration and communication, as well as testing them in actual rural landscapes. To be successful this requires (1) new types of knowledge production (quality assured with scientific methods), (2) successful dissemination of information, and (3) action. We argue for the need to develop and use (i) an accounting system as a “map and a compass” that informs natural resource managers, policy-makers, media, authorities exercising governance, students and the general public about the state and trends of natural resources (goods, services and values), (ii) ways of establishing societal platforms for local and regional adaptive governance and spatial planning as a “gyroscope” (Lee 1993), (iii) including the role of entrepreneurs as initiators of social platforms and partnerships (Folke et al. 2005). This would contribute to make informed decisions based on knowledge. Societal systems would thus both get information from and inform social stakeholders, and should have a role in a wide range of arenas, regardless of scale and ecosystem context. According to Gibbons et al. (1994) this trans-disciplinary approach has four features that separate it from traditionally disciplinary sciences: (1) It develops an evolving framework to guide problem-solving efforts, which focuses on achieving holistic understanding; (2) It develops research methods and modes of practice, based on the input from different disci-

plines; (3) Unlike the disciplinary sciences where results are communicated through organizations and education, results of transdisciplinary knowledge production are communicated by scientists and practitioners who participated in the work; (4) It is about problem solving on the move and socially robust knowledge (Gibbons 1999). Thus, communication in ever-new configurations is crucial.

Daniels & Walker (2001) describes 5 distinct phases in a collaborative learning process; 1) assessment – where an evaluation of the context and the potential for collaboration takes place, 2) training – where stakeholders build an appreciation for collaboration and learn some specific techniques of collaborative learning, 3) design – development of a context specific strategy for involving stakeholders in a meaningful process, 4) Implementation/facilitation – to conduct project activities and decision making, 5) Evaluation – data gathering and reflection to learn from participating stakeholders what was most and least effective approaches to be able to adapt the project or learn for future projects. This knowledge production concept includes humanities, social and natural science disciplines, and close collaboration between academic and non-academic actors, i.e. a transdisciplinary approach (Table 5).

Table 5. Transdisciplinary knowledge production is located at the interface between research and management and requires close collaboration between different types of actors.

Academic actors			Non-academic actors	
Basic research	Applied research	Education	Extension	Implementation
Disciplinary	<i>Transdisciplinary knowledge production</i>		Management	

Learning by development requires quality assurance and continuous documentation. Nonaka & Takeuchi (1995) use the terms tacit knowledge as subjective knowledge and explicit knowledge as objective knowledge. Tacit knowledge is implicit and personal. Hence the knowledge is not directly accessible to others and it is impossible to assess its significance in relation to existing knowledge. In contrast, explicit knowledge is accessible to others. Explicit knowledge is mostly tangible; it is fixed on some kind of medium such as a book, scientific journal, CD, video or a web site. As a consequence, it is brought into the wider context of the public domain. This process allows us to judge results in relation to existing beliefs and commonly held attitudes (Table 6). Scientific documentation and exposure to peer review could act as an important quality assurance system for all kinds of knowledge production systems.

Table 6. Characteristics of tacit and explicit knowledge (after Tress et al. 2006).

Tacit knowledge	Explicit knowledge
Implicit	Expressed in language
Personally bound	Not bound to an individual
Not accessible for others	Available on a medium and accessible for all
Not put in context of other knowledge	Seen in the context of existing knowledge

Towards a network of landscape approach efforts

To bridge gaps among academia, private and public sectors, as well as non-governmental organizations, for developing governance and management, as well as to integrate academic disciplines, towards sustainable development and sustainability is a challenge. Our solution is that a interdisciplinary team of researchers and practitioners should focus on being a hub for real-world actors and academia (to reach the aim of transdisciplinary knowledge production) based on the following principles:

- Base the transdisciplinary knowledge production on a suite of landscape level case studies in a gradient from centers to peripheries of economic development, and with different governance systems and in collaboration with local stakeholders. This multiple case study approach (i) allows both depth and overview, (ii) includes different types of resource use and trajectories of development, and (iii) different systems of governance (i.e. top-down and bottom-up). International co-operation is a necessity.
- The social-ecological system (=landscape) should have a platform for collaboration, negotiation and implementation of the combined results from practice, ongoing development efforts and transdisciplinary knowledge production. Forest landscapes with different biophysical characteristics, histories and systems of governance in Europe's East and West thus form a suite of excellent and unique "laboratories" for producing knowledge to solve contemporary and future challenges.
- The case studies should represent both designed initiatives to move towards sustainability objectives (e.g., EU Leader and InterReg projects, Model Forests, Biosphere Reserve, the Canadian Forest Communities programme etc.), and "randomly" selected areas without special efforts in this direction.
- The production of knowledge should not be centered solely at one major organization, authority or university, the reason being that easy access and thus more regular exposure to case study landscapes should be prioritized. By involving researchers and other key-persons from several centers and countries, transdisciplinary knowledge production and a "researcher-governor-practitioner" interface will be developed.

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Summary and closing statement

I Introduction

The safeguarding of large forested areas in order to reduce the loss of biodiversity and the vision of sustainability based on wise use of renewable natural resources is highly recognized by international fora like the European Union (EU), The Barents Council (BEAC), the Convention on Biological Diversity (CBD) and the Ministerial Conference on the Protection of Forests in Europe (MCPFE).

On December 4–7, 2007 in Steinkjer/Lierne, Norway, a conference and workshop focusing on this important theme took place with specialists from forest management, forest industry, environmental management, researchers and non-governmental organizations from Finland, Norway, Sweden, Ukraine and Russia.

The aim of the conference was to let people with ecological, economic, social and cultural interests in the large intact forests of North-West Russia meet and discuss the challenges connected to protection and sustainable use of these areas.

The participants of the conference represented a uniquely broad representation of actors and stakeholders representing all dimension of sustainable forest landscape management. The conference's focus was on balancing the conservation and use of natural resources in the large forest areas in the Russian Federation's NW, including goods, services and values

The conference was organised by the University College of North Trøndelag (HiNT), Norway, the Norwegian Directorate for Nature Management (DN), Archangelsk State Technical University (ASTU), the Swedish University of Agricultural Sciences (SLU), Finnish Environment Institute (SYKE), Tampere College, Kuru Institute of Forestry and WWF. The meeting was hosted by HiNT and DN with main financial support from the Nordic Council of Ministers.

II Background

Nordic institutions like HiNT, DN, SYKE, SLU, and WWF have had close cooperation with North-West Russian institutions for several years on protection and sustainable use of forest.

Finland, Norway, Russia and Sweden are committed to the MCPFE and Montreal processes on sustainable forest management, European Landscape Convention and the Millennium Development Goals of significantly reducing the loss of biodiversity by 2010.

Forest landscapes provide goods, services and natural and cultural values. Balancing the use and conservation of these dimensions involves quite different challenges in the Nordic countries compared with North-West Russia. However, a common desire is to strike a balance and implement conservation and sustainability policies of different kinds.

Biodiversity is a common challenge. A considerable proportion of the World's biodiversity is connected to intact forest. In total 25 percent of the world's forests are in Europe. More than 80 percent of this forest is in the European part of the Russian Federation. About 74 percent of Europe's total forests are today classified as semi-natural or plantations.

The remaining large intact forested areas however are located in the northern part of Europe only, and mainly in the Russian part of the Barents Region. These forests make up about 14 percent of the total forest area of European Russia, and the vast majority of these large forests are located in the most remote areas and often on unproductive sites.

As of today, less than 5 percent of Europe's forests are protected with the main objective to conserve biodiversity. Most of these protected areas are small. The aim of these protected forest areas is to contribute to securing global biodiversity values for future generations. The extent and functionality of these protected area networks are, however, recognized as being far less than the amount needed to achieve this goal.

In a European context conservation of large intact forests in North-West Russia, and in Komi and Arkhangelsk in particular, is recognized as an efficient way to sustain biodiversity in terms of species, habitat and ecosystem functions. The reduction in forests available for harvesting may, however, be significantly reduced for local timber enterprises.

III Topics

During the conference the experts paid attention to the following topics:

- The need and possibility to secure global biodiversity values by designation of forest protected areas for the future.
- Ways to develop sustainable use and management of diverse resources and values including:
 - Implementation of sustainable forest management as well as genuine economic, social and cultural progress at national and regional level in Russia and the Nordic countries.
 - Forest legislation and forest certification as tools for sustainable forest management on local and regional levels.
 - Social platforms for local and regional governance
 - Transdisciplinary knowledge production including education and vocational training, and applied research.

IV Main findings

The content of presentations and discussions allow some main conclusions to be drawn:

The large intact forests in North-West Russia are important (1) for biodiversity, (2) as a source of timber to the regional forest industry and (3) for non-timber forest products for local people. The dilemmas discussed during the conference concerned how to combine these interests in different forested areas in the Barents Region.

There was a general agreement that preferably some of the large forested areas should be left intact. Several presentations looked into different possibilities of making a network of protected areas (green belts, green meridians, world heritage sites etc) in order to fulfil the obligations taken on by signing the Convention on Biological Diversity. A more intense use of secondary forest was discussed in order to mitigate the economical consequences of leaving some of the last old growth forests intact.

The conference participants also agreed upon the importance of implementing sustainable forest management (SFM) in regions with large intact forests. SFM has to take into account all actors and stakeholders at all levels. This means the whole range from local and regional level (eg timber industry, local people, tourists) to international conventions and agreements (CBD, MCPFE, FSC, Barents Cooperation (BEAC) etc).

Implementation of sustainable forest management (SFM) in regions with large intact forests has to take into consideration the different outcomes from the forest such as ecological, economic, social and cultural. The implementation of SFM also has to take into account systems of governance that are representative of resource users, inclusive and participatory and that take into account the entire landscape and include all sectors. The experiences from the existing arenas aimed at achieving sustainable forest landscapes (like Model Forests and Biosphere reserves) were presented and evaluated.

The ongoing radical changes in forest sector and organisation in the Russian Federation, new demands of the forest market and new challenges in the forestry in the Western European countries require a change in the educational system. Ecological and socio-cultural dimensions of sustainable forest management are not well reflected in the present education system. The number and types of desired professionals in the forest sector are changing dramatically. New professionals with a wider range of skills at all levels are needed.

The forest health in North-West Russia (especially in the Arkhangelsk region) and the amount of dead and dying trees were addressed. The participants discussed the causes of this death in the context of natural ageing, extreme weather events, climatic change, beetle attack, and changed hydrology and human impact.

The certification of the Russian forest (FSC, PFS), inventories of forests biological and economical values and the evaluation of the forest biodiversity were also important issues at the conference.

The importance of the old sacred groves, trees and other cultural elements of the forest are already recognised by international organisations (eg the Delos Initiative of IUCN/WCPA) and were highlighted at the conference. These elements are mainly found in connection to former and present settlements.

The economic return from the forest is important for the region as a whole and not necessarily for local people living close to the forest massifs. Measures taken towards safeguarding these large intact forest areas for the future has to take this into account.

The Dvinskoy, one of the largest forests still intact in the Arkhangelsk region, was addressed especially at a workshop following the conference, and the participants discussed several problems and possibilities in maintaining this area intact for future generations.

V Recommendations

The conference participants expressed the need to follow up on these important issues and agreed upon the following recommendations:

- *Forest protection and sustainable forestry*
The remaining large intact forests of North West Russia are unique both on Global, European and Russian scales. All stakeholders and actors representing different sectors and levels of governance need to join efforts to find solutions for conservation and sustainable use of these forests. The large intact forests should also be taken into account in international agreements both within biodiversity and climate.
- *Ecosystem Service Assessment*
An Ecosystem Service Assessment (ESA) for the last intact forests of North-West Russia should be recognized as an important tool for assessing the total value of these forest systems on local, regional, national and international scale. Being a global heritage and responsibility, ESAs for these forests could preferably be initiated and supported financially in collaboration with international bodies (UN, CBD, and EU).
- *Knowledge exchange*
Exchange of knowledge between the Nordic countries and the North-West Russia is crucial in order to implement policies on protection and sustainable forest management in local landscapes.
- *Cross boundary cooperation*
Cross boundary cooperation should be initiated both within the North-West Russia, and between the countries in the Barents Region. Representatives from Arkhangelsk Region suggest initiating cooperation

with the Komi Republic for protection and sustainable use of large intact forests on the border between Arkhangelsk Region and Komi Republic. It would also be valuable to support transboundary Norwegian-Swedish, Russian-Finnish and Norwegian-Russian initiatives.

- *Climate*
The possibility of establishing a system of climate quota in accordance with the Kyoto Protocol should also be addressed. A suggestion is to offer the international society the possibility to compensate logging companies that have originally leased land in the intact forest areas in order leave the areas unlogged.
- *Industry and rural development*
The future perspectives of the forest industry activities and rural development connected to intact forest areas need to be addressed including measures to secure the health of the forest.
- *Use of secondary forest*
Specialists underline the great values that lie in more effective use of the secondary forest outside the old growth forest areas.
- *Education*
Systems for education, vocational training and social learning that are adapted to the ongoing changes in forest management need to be developed. There is an urgent need to create of modern education materials for policy makers, the general public, planners, managers and technicians, and academic studies.
- *Social and cultural consequences*
The social and cultural consequences of leaving the large forest areas intact vs. logging them should be assessed on local, regional and international levels. The experiences from the existing arenas aimed at achieving sustainable forest landscapes (like Model Forests, Biosphere Reserves) should be further evaluated, and results should be disseminated among interested partners.
- *Model forest – Arkhangelsk*
To solve existing challenges in management of the intact forests, a Model Forest in Arkhangelsk region should be developed as an arena for implementing the best national and international experience with participation of all stakeholders.
- There should be 2 main concepts for the Model Forest:
 - Development of intensive forestry in secondary forests (the southern part of the region)
 - Protection and sustainable use of forest and non-forest resources in the watershed of Northern Dvina and Pinega River (Dvinskoy).
- *Investigation of last large intact forest*
The protection and use of last large intact forest massifs in Arkhangelsk and Komi, such as the Dvinskoy Forest, needs to be addressed especially both nationally and possibly through an international ad hoc task force.

VI Final remarks

The different organisations present at the conference expressed the need to find possibilities for future cooperation and expressed their interest in joint projects concerning conservation and sustainable use of the last intact forests of North-West Russia.

The participants also recommend through the Barents Council, to investigate how the international society could contribute to safeguarding Europe's last old growth forests, located in NW Russia.

The conference participants strongly expressed the importance to provide the messages from this conference to the Federal Agency of Forestry of the Russian Federation, The Barents Council (BEAC), The EU, CBD, MCPFE, IUCN, WCPA and other relevant organisations and institutions.

The Norwegian Directorate for Nature Management will in agreement with the other organisers of the conference take the responsibility to distribute this summary and closing statement.

Lierne, Norway, 7th December 2007

КРАТКИЙ ОТЧЕТ И РЕЗУЛЬТАТЫ

I Вступление

Необходимость охраны обширных лесных массивов с целью сокращения потерь и устойчивое развитие, базирующееся на рациональном использовании возобновляемых природных ресурсов, особо подчеркивается такими международными организациями и консилиумами, как Европейский Союз (EU), Совет Баренц-Евроарктического Региона (BEAR), Конвенция о биологическом разнообразии (CBD) и Конференция по вопросам защиты лесов Европы на уровне министров (MCPFE).

Специалисты в области лесопользования, лесной промышленности, управления природоохранной деятельности, ученые и неправительственные организации из Финляндии, Норвегии, Швеции, Украины и России встретились 4–7 декабря 2007 г. в норвежском г. Стейнчер/Лиерне для участия в конференции и семинаре по важным вопросам лесопользования.

Целью конференции стало объединение специалистов, чья деятельность связана с экологическим, экономическим, социальным и культурным аспектом малонарушенных лесных массивов Северо-Запада России, для обсуждения важных вопросов охраны и устойчивого лесопользования на данной территории. Участники конференции представляли широкий круг заинтересованных сторон, вовлеченных в устойчивое использования лесных ландшафтов. Основное внимание было уделено поиску баланса между сохранением и использованием природных ресурсов в лесных массивах на Северо-Западе России.

Организаторами конференции стали Университетский колледж Сев. Тронделага (HiNT), Норвежское управление природопользования (DN), Архангельский государственный технический университет (ASTU), Шведский университет сельского хозяйства (SLU), Финский институт окружающей среды (SYKE), Колледж Тампере, Институт лесного хозяйства Куру и WWF. Мероприятие было проведено HiNT и DN при финансовой поддержке Совета министров Северных стран.

II Опыт сотрудничества и общая информация

На протяжении нескольких лет организации из Скандинавии, такие как HiNT, DN, SYKE, SLU, а также WWF сотрудничают с организациями Северо-Запада России в направлении охраны лесов и устойчивого лесопользования.

Финляндия, Норвегия, Россия и Швеция участвовали в разработке и принятии решений MCPFE и Монреальского процесса в области устойчивого лесопользования, Европейской конвенции о защите ландшафта и Целей развития на рубеже тысячелетия по значительному снижению потерь биоразнообразия к 2010 г.

Лесные ландшафты являются источником продукции, услуг, а также хранителем природных и культурных ценностей. Поиск баланса между сохранением и использованием данных факторов подразумевает на Северо-Западе России решение проблем совсем иного рода, чем в скандинавских странах. Общей инициативой, однако, является установление баланса с применением различных практик охраны и устойчивого пользования.

Сохранение биоразнообразия – проблема, стоящая перед всеми. Значительная часть имеющегося в мире биоразнообразия напрямую связана с малонарушенными лесами.

25% мировых лесов сосредоточены в Европе, а 80% этого фонда – на Европейской части Российской Федерации. Около 74% имеющегося в Европе леса сегодня классифицированы как вторичные леса или плантации.

Единственным местом, где сохранены крупные массивы малонарушенных лесов, является северная часть Европы – главным образом, российская территория Баренц-региона. Такие леса составляют около 14% общей лесной площади европейской части России, при этом большая их часть расположена в самых отдаленных уголках, часто на непродуктивных площадях.

На сегодняшний день менее 5% европейских лесов охраняются, главным образом, в целях сохранения биоразнообразия. Площадь большинства из подобных охраняемых территорий небольшая. Цель их создания – это способствовать сохранению ценностей мирового биоразнообразия для будущих поколений. Однако, площадь и эффективность подобных лесных площадей признаются намного ниже тех, которые требуются для достижения обозначенной цели.

В контексте Европы сохранение крупных массивов малонарушенных лесов Северо-Запада России, особенно в Республике Коми и Архангельской области, является эффективным способом поддержания биоразнообразия, а именно сохранения видов, среды их обитания и функций экосистемы. С другой стороны, следствием применения подобной практики может стать значительное снижение ресурсов для местных лесопромышленных предприятий.

III Тематика

В ходе конференции экспертами отмечена важность следующих вопросов:

- Необходимость и возможность сохранения ценностей мирового биоразнообразия путем выделения охраняемых ценных лесных участков.
- Способы развития устойчивого использования различных ресурсов и их практической ценности, а именно:
 - Внедрение устойчивого лесопользования, а также стимулирование эффективного экономического, социального и культурного прогресса на национальном и региональном уровнях в России и скандинавских странах
 - Лесное законодательство и лесная сертификация как механизмы устойчивого лесопользования на местном и региональном уровнях.
 - Социальная платформа для местного и регионального управления
 - Производство междисциплинарного знания, включая образование и профессиональное обучение, а также прикладные исследования.

IV Основные результаты

Содержание докладов и обсуждений позволило сделать следующие основные выводы:

Крупные массивы малонарушенных лесов на Северо-Западе России имеют важность 1) для сохранения биоразнообразия, 2) как источник древесины для региональной лесопромышленности, 3) для получения недревесной лесной продукции, необходимой местному населению. Обсуждаемые в ходе конференции спорные вопросы касались того, как объединить эти интересы на различных лесных территориях Баренц-региона.

Принято основное соглашение о том, что крупные массивы преимущественно должны сохранить статус малонарушенных. В ряде докладов рассматривались возможности создания сети охраняемых территорий (зеленые зоны, зеленые меридианы, районы с объектами мирового наследия, т.д) с целью исполнения принятых обязательств Конвенции о биологическом разнообразии. В целях снижения негативных экономических последствий вследствие запрета на эксплуатацию старовозрастных малонарушенных лесов обсуждалась возможность более интенсивной эксплуатации вторичных лесов.

Участники конференции также оказались едины во мнении о важности внедрения устойчивого лесопользования (УЛП) в регионах, на территории которых имеются крупные массивы малонарушенных лесов. УЛП подразумевает учет мнения всех участников

лесных отношений на всех уровнях, т.е. от местного и регионального (например, лесные промышленники, местное население, туристы) до международных конвенций и соглашений (CBD, MCPFE, FSC, Баренц-Сотрудничество (BEAC), т.д).

При внедрении устойчивого лесопользования (УЛП) в регионах, на территории которых имеются крупные массивы малонарушенных лесов, необходимо принять в расчет различные ценности леса, такие как экологические, экономические, социальные и культурные. На конференции был представлен и оценен имеющийся опыт достижения устойчивого лесопользования (такие как Модельные леса и охраняемые территории).

Радикальные изменения, происходящие в Российской Федерации в лесном секторе и на организационном уровне, а также новые требования к рынку лесной продукции и возникновение новых проблем лесного хозяйства в западно-европейских странах требуют изменения системы проф.обучения и образования. Сегодня в системе образования не отражены экологический и социально-культурный факторы. Количество специалистов в лесной отрасли и их специализации претерпели значительные изменения. На всех уровнях требуются специалисты более высокой квалификации и широкой специализации.

Также обсуждалось состояние здоровья лесов северо-запада России (особенно актуально для Архангельской области) и объемы сухостойной древесины. Участники обсудили возможные причины процесса усыхания, такие как естественная возрастная структура, погодные катаклизмы, климатические изменения, активность насекомых-вредителей, изменение гидрологического режима и антропогенное воздействие.

Лесная сертификация в России (FSC, PEFC), инвентаризации биологических и экономических ценностей леса и оценка биологического разнообразия также стали важными вопросами в ходе конференции.

На конференции также подчеркивалась значимость святых рощ, священных деревьев и иных объектов культурного значения, что ранее было отмечено международными организациями (например, Делос инициатива МСОП/МСРА). Данные объекты имеются, главным образом, на территории бывших и действующих селений и деревень.

Экономическая отдача от леса важна не только для населения, проживающего в непосредственной близости от лесных массивов, но и для всего региона в целом. Необходим подсчет экономических затрат по сохранению крупных малонарушенных массивов от рубки.

Особое внимание на семинаре, проведенном после конференции, было уделено одному из крупных малонарушенных массивов на территории Архангельской области в междуречье Северной Двины и Пинеги (Двинской массив). Участники обсудили возможности и

ряд проблем, связанных с поддержанием для будущих поколений статуса этой территории как малонарушенной лесной территории.

V Рекомендации

В качестве приоритетных для разработки рекомендаций участники конференции выбрали следующие вопросы:

- *Сохранени лесов и устойчивое развитие лесного хозяйства*
Сохранившиеся на Северо-Западе России крупные лесные массивы являются уникальными как в российском и европейском, так и в глобальном масштабе. Всем участникам лесных отношений в различных секторах и на различных уровнях управления необходимо объединить усилия по выработке решений для сохранения и развития устойчивого использования таких лесов. Важность крупных малонарушенных массивов для сохранения биоразнообразия и поддержания климата должна быть отражена в международных соглашениях.
- *Оценка экосистемных услуг*
Оценка экосистемных услуг (ESA) на территории сохранившихся малонарушенных массивов Северо-Запада России должна быть признана действенным механизмом оценки общей ценности таких лесных систем на местном, региональном и международном уровне. Являясь объектом мирового наследия, подлежащего сохранению, такие леса должны оцениваться, причем начало и финансирование деятельности ESA должны осуществляться совместно с международными организациями (UN, CBD, EU).
- *Обмен знаниями*
Обмен опытом и информацией между скандинавскими странами и Северо-Западом России приобретает первостепенную важность при внедрении политики сохранения лесов и устойчивого лесопользования в региональных условиях.
- *Международное сотрудничество*
Международное сотрудничество должно осуществляться как между странами Баренц-региона, так и на территории Северо-Запада России. Представителями Архангельской области было предложено начать сотрудничество с Республикой Коми, нацеленное на сохранение и развитие устойчивого использования крупных малонарушенных массивов на пограничной территории между Архангельской областью и Республикой Коми. Ценным также явится поддержание инициатив сотрудничества между Норвегией и Швецией, Россией и Финляндией и Норвегией и Россией.

- *Климат*

Обсуждалась возможность разработки и внедрения в практику системы климатических квот в рамках реализации механизмов Киотского протокола. Для предотвращения рубок в малонарушенных лесных массивах предложено обратиться к международному сообществу с предложением о предоставлении лесозаготовительным компаниям и администрациям регионов компенсации за сохранение лесов от рубки. Такие компенсации могут быть получены в результате реализации Проектов совместного осуществления в рамках Киотского протокола.

- *Промышленность и развитие сельских районов*

Необходимо принять во внимание перспективы лесной промышленности и сельского развития, связанные с эксплуатацией малонарушенных лесных территорий, а также меры по обеспечению нормального санитарного состояния лесов.

- *Использование вторичных лесов*

Специалисты подчеркивают большую ценность более эффективного использования вторичных лесов за пределами малонарушенных лесных массивов.

- *Образование*

Необходимо разработать системы образования, профессионального и социального обучения, адаптированные к происходящим в лесном управлении изменениям. Особо необходимым является создание учебных курсов и современных учебных материалов для политиков, широких кругов общественности, разработчиков лесной политики, управленцев и инженеров.

- *Социальные и культурные последствия*

Социальные и культурные последствия сохранения малонарушенных лесных массивов и предотвращения каких-либо заготовительных работ на их территории необходимо оценить на местном, региональном и международном уровне. Необходима также дальнейшая оценка имеющихся практик в развитии устойчивого лесопользования (Модельные леса и охраняемые территории), результаты практик должны адресованы заинтересованным участникам лесных отношений.

- *Модельный лес – Архангельск*

При участии заинтересованных сторон для решения проблем, имеющихся в области управления малонарушенными лесами, модельный лес Архангельской области должен стать ареной для применения лучшего национального и международного опыта. Концепция Модельного леса должна базироваться на 2 основных моментах:

- Интенсификация лесного хозяйства во вторичных лесах (в южной части области).

- Сохранение и устойчивое использование древесных и недревесных ресурсов на водоразделе рек Северная Двина и Пинега (Двинской массив).
- *Исследование сохранившихся крупных массивов малонарушенных лесов*
Вопросы о сохранении и эксплуатации крупных массивов малонарушенных лесов в Архангельске области и Республике Коми, таких как Двинской массив, необходимо обсуждать на национальном уровне с привлечением специальной международной рабочей группы.

VI Заключительные замечания

Участвующие в конференции представители различных организаций выразили желание начать сотрудничество, а также интерес в совместных проектах, направленных на сохранение и развитие устойчивого использования малонарушенных лесов Северо-Запада России.

Участники также порекомендовали с помощью Совет Баренц-региона оценить каким образом международное сообщество могло бы оказать содействие в сохранении Европейских малонарушенных лесов, расположенных на Северо-Западе России.

Участники конференции подчеркнули важность предоставления результатов и заявлений конференции Федеральному агентству лесного хозяйства Российской Федерации, Совету Баренц-региона (BEAC), ЕС, CBD, MCPFE, IUCN, WCPA и иным организациям и учреждениям.

Норвежское Управление природопользования (The Norwegian Directorate for Nature Management) согласно договоренности со всеми организаторами конференции обязуется обеспечить распространение данной резолюции.

Лиерне, Норвегия, 7 декабря 2007.

Sammendrag

Menneskets bruk av skogene er i vår tid mer kompleks enn tidligere siden de skal tilfredsstille mange formål både i forhold til tradisjonell bruk til tømmer og papirindustri, brensel, jakt, fiske, bær- og sopphøsting og friluftsførmål. I dag skal de også ivareta biodiversitet, og rurale og nasjonale samfunnsverdier. Bruk som tradisjonelt har blitt ivaretatt lokalt, blir nå pålagt å følge regler vedtatt nasjonalt og internasjonalt. Endringer i lokalt klima grunnet indirekte og direkte effekter av global oppvarming må også vurderes, samtidig som skogene i seg sjøl utgjør en viktig komponent i karbonets syklus som binder av CO₂ på kort og lang sikt. Bruk av skogene vil dermed både gi positive så vel som negative effekter økonomisk, økologisk og i samfunnsstruktur og kultur uten at vi ser alle aspekter umiddelbart.

Bare i den nordre delen av Europa, og hovedsakelig innenfor den russiske delen av Barentsregionen finner vi i dag store og intakte naturlige utviklede skoger, men disse områdene krymper og vil dermed kunne gå tapt som de naturbankene de utgjør i dag.

Det er de siste mulighetene for å ivareta disse store og intakte, naturlige barskog-økosystemer, unike siden de representerer områder som ikke er sterkt påvirket av menneskelige påvirkning eller store hogstoperasjoner. Både internasjonale konvensjoner (CBD og Bern) og organisasjoner som IUCN, Greenpeace og WWF har fokusert på behovet for vern av mange av disse områdene. Betydningen av et vern er forstått, men vern vil også medføre store utfordringer for skogbruk og samfunnslivet i samme region. I tillegg vil rurale samfunn bli økonomisk lidende dersom skogbruket er en viktig inntektskilde for innboerne og en ikke samtidig utvikler annen lokal næringsvirksomhet.

Denne kompleksiteten er forstått både i skogforvaltningen, skogindustrien og miljøforvaltningen innen Barentsregionen så vel som forskjellige private aktører (NGOs). Formålet med denne konferansen og påfølgende Workshop har vært å belyse både kunnskap og erfaringer om bevaringsutfordringene og knytte disse opp til hvordan en best kan løse de mangesidige samfunnsutfordringene knyttet til eventuelt vern av de siste store, urørte gammelskogområdene i Nordvest Russland.

Presentasjonene som her publiseres fra konferanse og workshop begynner med en gjennomgang av kulturelle så vel som religiøse/åndelige verdier knyttet til taigaskogene i Nordvest Russland. En får oversikt over både vernede så vel som gjenværende urørte områder og metoder for registrering av både tap av områder samt metoder for å finne/vurdere verdifulle biotoper. Mens noen artikler tar for seg generell landskapsøkologisk teori og anvendbarhet i biodiversitetsbevaring, tar andre for seg

eksempler på registrering av suksessjonsutforminger av gammel skog og sammenligning av fuglefauna mellom fragmenterte gammeskoghabitater i Norge med de store ufragmenterte kompleksene i Yula-elvas nedslagsfelt i midtre Arkhangelsk. Skogdødsituasjonen presenteres sammen med en innsikt i områdets skoghistorikk.

Det gis eksempler på hvorledes skogvernet utformes i Norge, og hvorledes mer miljøvennlig skogbruk og fokus på beskyttelse av biodiversitet implementeres både i Norge og i Russland, dels gjennom innføring av «Miljøsertifisering av skogbruk». Konsekvenser for rurale samfunn i både Norge og Russland når vern av natur iverksettes er belyst, og med noen eksempler fra hvorledes en – spesielt i Norge bruker offentlige og private midler til å kompensere for negative effekter av vern ved å utvikle andre typer næringsvirksomhet. Det er også fokusert på hvorledes et mangesidig, bærekraftig skogbruk kan utvikles med eksempler fra «Modell Forest» – begrepet. Fra Russiske myndigheter får vi innsikt i hvorledes den nye skoglovgiving nå åpner for mer miljø- og biodiversitetshensyn. Utdanning på et bredt grunnlag vil være en nøkkelfaktor for å nå nye målsettinger, og det skisseres både erfaringer og metoder for hvorledes dette kan utvikles i samarbeid på internasjonalt nivå.

Konferansens *Summary and Closing Statements* gir mange retningslinjer for hvorledes en bør arbeide framover og erkjenner at internasjonal medvirkning er ønsket og nødvendig dersom eventuelle mål om bevaring av store skogområder av biodiversitetshensyn skal kunne balanseres i forhold til bevaring av lokalsamfunn samt regional samfunnsutvikling.