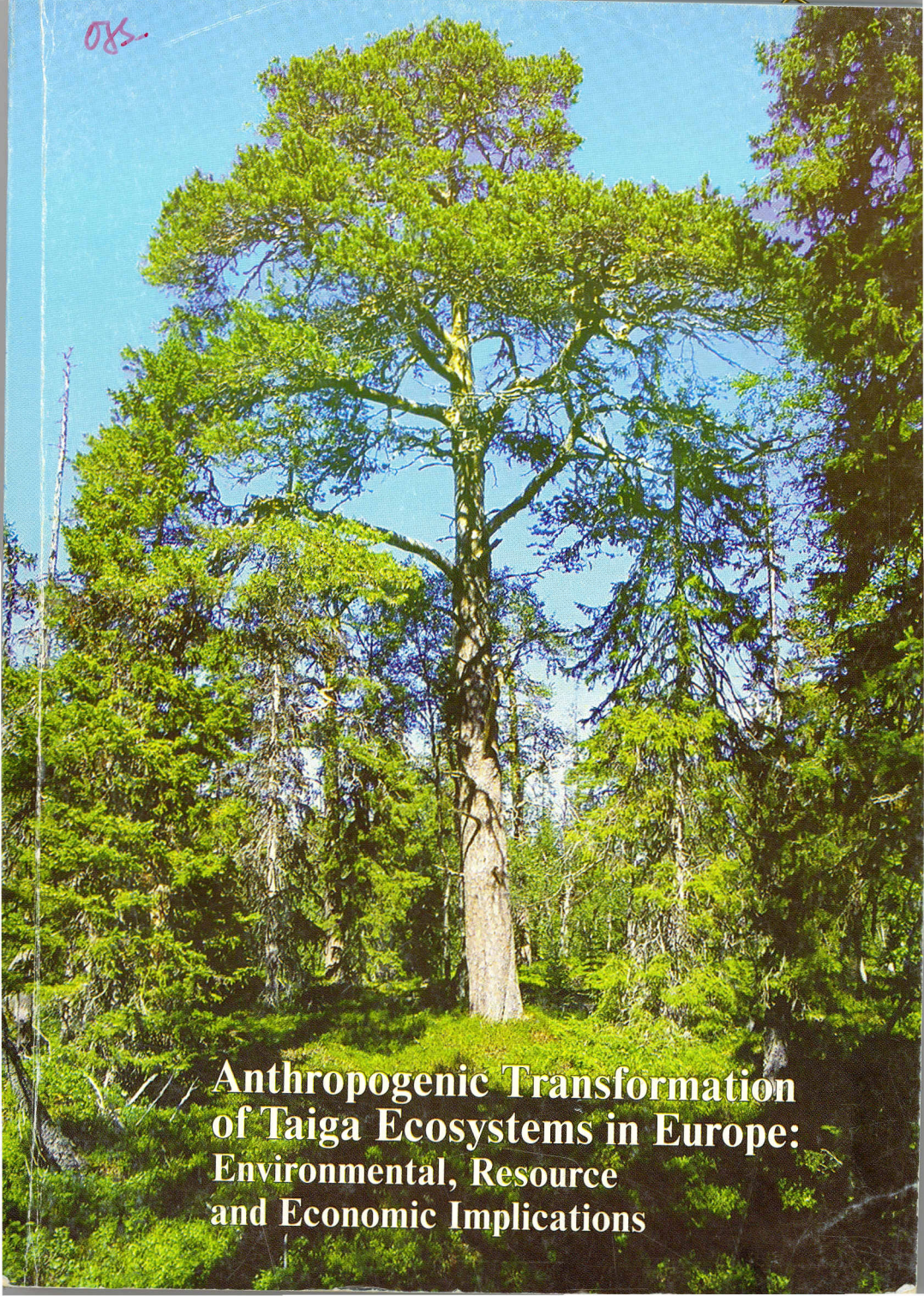

Anthropogenic Transformation of Taiga Ecosystems in Europe: Environmental, Resource and Economic Implications

Russian Academy of Sciences

Scientific Council for Forest Problems

Forest Research Institute, Karelian Research Centre, RAS

SYKE Finnish Environmental Institute

nordcn Nordic Council of Ministers

Proceedings of International Conference

Anthropogenic Transformation of Taiga Ecosystems in Europe: Environmental, Resource and Economic Implications

Petrozavodsk
23-25 November 2004 r.

Organizing Committee

Isaev A.S., Russian Academy of Science, Academician, of Organizing Committee Chairman (Russia)
Volkov A.D., Forest Research Institute of Karelian Research Centre of RAS, PhD (Russia)
Gromtsev A.N., Forest Research Institute of Karelian Research Centre of RAS, DSc (Russia)
Krutov V.I., Forest Research Institute of Karelian Research Centre of RAS, DSc (Russia)
Linden H., Institute of Game and Fisheries, Prof. (Finland)
Lindholm T., Institute of Environmental, DSc (Finland)
Predtechenkaya O.O., Forest Research Institute of Karelian Research Centre of RAS, PhD (Russia)
Sorensen O.J., Nord-Trondelag University College, Faculty of Social Science and Natural Resources, Prof. (Norway)

Eds.
A.D. Volkov, PhD
A.N. Gromtsev, DSc

ISBN 5-9274-0156-2

THE ANTHROPOGENIC EFFECT OF BIRD COMMUNITIES OF THE TAIGA ECOSYSTEM WITH SPECIAL REFERENCE TO THE EFFECT OF FORESTRY

Sørensen O. J.

Nord-Trondelag University College,
Faculty of Social Sciences and Natural Resources.
Box 2501. N-7729 Steinkjer. Norway.
ole.j.sorensen@hint.no

Introduction

Birds of the Taiga ecosystems have over time evolved their habitat requirements and niche specialization in a way that makes the population viable over long periods. These adaptations reflect the vegetation and forests formed by natural succession systems and landscape patterns formed by these systems.

Birds are well-studied species, and we have excellent knowledge about the habitat adaptations, niche use and differentiation of grouse birds, passerine birds, woodpeckers, owls and raptors, partly also their population biology and statistics of abundance (Helle 1985a & b, Boström 1988, Helle & Mönkkönen 1990, Edenius & Sjöberg 1997). As a group they can tell as about their reaction to mans transformation of the taiga ecosystems from a natural regime to a man-used and man-planned and manipulated ecosystem (Järvinen et al. 1977). Birds can be used as monitors of changes in the environment (Furness & Greenwood 1993), and their reaction of habitat changes and fragmentation are studied (Ahlen & Nilsson 1982, Jokimäki 1996, Thingstad 1997, Thingstad et al. 2003, Hågvar et al. 2004).

As birds can be used as indicators for the natural functionality of ecosystems, we can also, because of our generally good knowledge about their habitat needs — also use birds as advisors for forest to reduce both short and long term negative effects of forestry activities.

This text will give you examples from different kinds of birds to show threat and possibilities as we now teach and advise in Norway, but cannot cover every aspect.

Grouse birds *(Tetraonidea)*

Formozows work (1946) introduced me to the winter ecology of the Taigas fauna, and the adaptation of grouse birds to winter conditions. Semjonov-Tjan-Sankijs (1960) work on grouse birds was the work I read that opened my eyes for the landscape scale effects of the forests succession stage at the population level of different grouse species. His work has later been followed up by habitat studies in Finland (Seiskari 1962, Uusvaara 1963) as well as Norway

and Sweden (Børseth & Kraftt 1973, Sorensen 1979, Myrberget 1984, Wegge et al. 1985, Rolstad & Wegge 1989, Rolstad et al. 1991, Swenson & Angelstam 1993). Population studies have mainly been done in Finland (Rajala 1974, Linden & Rajala 1981), also in Russia (Semenov-Tjan-Sanskij 1970), but few data from Russia are available for western countries. Several authors have presented data on their food choice in both summer and winter (Pynnönen 1954, Kaasa 1959, Seiskari 1962, Pulliainen 1970, Salo 1971, Sørensen 1979, Linden 1981, Spidsø et al. 1984).

Out of the cited literature we can understand that the habitat and niche specialization and separation in these birds are excellent understood (Fig 1). The Willow Grouse *(Lagopus lagopus)* and Black Grouse *(Tetrao tetrix)* are adapted to young seral stages of the forests, and a rather open habitat where leave trees are abundant and leave buds and catkins of different kinds are a key winter food. The Capercaille *(Tetrao urogallus)* are a climax-adapted species, and needles of pine *(Pinus silvestris*), but also Spruce *(Picea abies),* and in parts of Sibiria, also Larch *(Larix sp)* is the key winter food. The Hazel grouse show an intermediate habitat adaptation, with preferences for both young and dense treed stands of mixed leave (preferably alder *(Alnus sp))* species and spruce forests, with either alder or birch catkins as preferred winter food. Elements of the same vegetation are often found in old growth climax forests, often near to streams and rivers, and edges of bogs and swamps, with alder trees mixed with a dense, multilayered coniferous forest.

It is easy to recognize the niche separation between this nearly related species and their niche specialization adapted to different seral stages in a natural taiga landscape. The difference is clearest during winter and more overlapping at summertime. Most overlap in habitat use seems to occur during the early chicken period, when at least all species have a preference for old, wet forest, bog edges and similar forest types, where all species seems to use caterpillars and other digestible insects as a main food. But also this habitat occurs regularly in a natural landscape dominated by young forest as they represent patches of fire-refugees and even corridor-like structures in a burned landscape — the most long-lasting, stable elements of the Taiga.

Forestry, by it's different activities can considerably influence populations of grouse birds locally as well as on landscape level. Large clear-cuts will almost exclude Capercaillie populations for a long period, as well as the Hazel Grouses use of climax forest. For the capercaillie, with individual home-ranges of 50 — 100 Ha, use of fragmented old growth forests add a strong stress for the populations, maybe more in Fennoscandia than in Russia.

Large clear-cuts will though promote populations of firstly, the Willow Grouse, and later the Black Grouse and then Hazel Grouse. Small clear-cuts will have less effect on Capercaillie populations, but if the old growth habitats

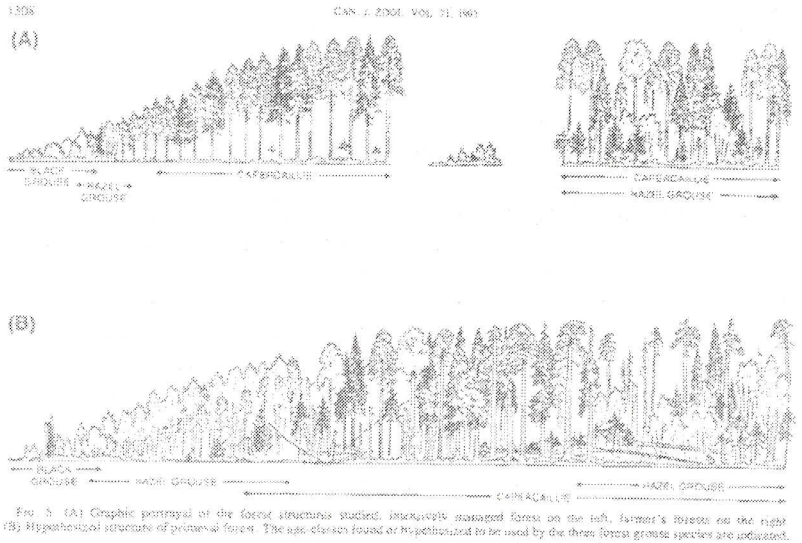

Fig. 1. Niche separation of grouse birds in the Taiga with adaptation to different succession stages (Swenson & Angelstam 1993)

become fragmented, populations suffer and might become more vulnerable to predation — a system of meta-populations and *Source- and Sink-habitats*. Small clear-cuts will hardly promote the Willow Grouse, but the more flexible Black Grouse might react positively, but again is there a risk of greater vulnerability to predation. A population of Hazel Grouse might possibly function well in either landscapes, due to their social organization and rather small territories, as long as their need of an abundance of leave forest are met.

Large, as well as small clear cuts will, at different periods of early succession, produce a lot of winter food for the three smallest grouse species, and a vast, open landscape created in this way will be almost as prolific for the Willow Grouse and Black Grouse as the burned areas will do. But — here the practice of silviculture for young forest has a possible detrimental, negative impact, induced by the forestry's strong selection for valuable species (spruce, pine and larch), and thereby the early destruction of leave-tree species in the pre-commercial thinning. The long time effects here are considerable as the important winter food resources for the three smallest grouse species, probably

a main factor in an areas carrying capacity for this birds, are impacted, and also strengthened by the fact that the production of catkins of these trees varies greatly between years. Attitudes in Fennoscandia have though changed over the last years to let more leave trees be left, but will it be enough?

A third important forestry operation with possible long-lasting, local as well as landscape level influence on all grouse birds, are the draining of swampy forest as well as draining of bogs. These operations reduce the amount of the best habitats for chickens, and later possible logging of the same areas will enhance this effect. Draining of bogs, especially the smaller bogs, also have impact on the amount of the bog cotton grass *(Eriophorum sp.)* shown to be a key nutrition before and during the egg-laying period for all the taigas grouse species.

We know little how predation on grouse is affected by change in grouse habitats, but must assume that the grouse birds still prefer to stay in biotopes similar to their primary adaptations. Different predators have different habitat requirements too, and sometimes habitats distribution might give certain predators a pre. As an example I would like to mention that a landscape dominated by several smaller clear-cut/openings partly makes it easier to locate possible prey both for a raptor like the Goshawk *(Accipiter gentilis)* as well as for a four-footed predator like the marten *(Martes martes)*. Studies by Beshkarev et al. (1994) have shown how one–layered old, but managed spruce forests might function as sink-habitats for hazel grouse. Hjeljord et al. (2004) have shown that predation on capercaillie broods are lower in managed forests done in natural old growth forests in the Pinega region of Archangelsk, but could not identify reasons for this unexpected difference.

A landscape dominated by drained bogs will likely also stress grouse hens with chickens to the wetter habitats left — also making it more easy for predators to hunt selectively in habitats spots in the landscape.

More examples could be presented, but I will here conclude that we for the habitat and general ecology knowledge of the grouse birds to a great extent can both predict the fate of these birds in a forestry dominated landscape, but we also know how negative effects probably can be greatly reduced if forestry adapt the suggestions given by biologists.

Woodpeckers *(Picidae)*

Angelstam & Mikusinski (1994) has given an overview on woodpeckers in natural and managed boreal and hemi-boreal forests. The seven species of woodpeckers have a key function in the Taiga ecosystem. They are all more or less dependent on dead wood and dying trees as their source for food. They all make new nesting cavities in standing dying or dead trees (Fig. 2). The species of tree selected for nesting, the trees degree of degrading and tree size also show that these species have their main adaptation and nice-separation to different seral stages of the taigas forest succession (Hågvar et al. 1990). The

niche separation regarding food habits are shown in Table 1, based on Haftorns (1971) data on these species food-choice, but thorough studies are few. Studies of these birds home-range use also show intra-specific niche-separation in the way that breeding pairs seems to use different parts of a common home range as their feeding ground (Hogstad 1976, Hogstad & Stenberg 1994, Stenberg & Hogstad 1995).

Based on their choice of nesting trees, we can clearly see an adaptation that shifts from the younger seral stages for the Lesser Spotted Woodpecker (*Dendrocopus minor)*, when sub-dominate, partly suppressed leave trees starts dying off in the leave-tree succession. The seral stage when older and dominating leave-trees starts dying at the end of the leave –tree succession is the habitat for the White-backed Woodpecker. Hogstad and Stenberg (1994) have nicely shown that this species need at least 150 — 200 dead, standing trees pr Ha. in the territory to make successful breeding. These two species are both specialists of finding their food as larvae's, mainly from beetles in dead wood. Overskaug & Sørensen (2002) have used this information actively advising forestry operations in habitat used by the White-Backed Woodpecker. The Green Woodpecker (*Picus viridis*) use older and more open forest, but prefers old, big aspen trees as nesting tree and will most often seek food in the Taigas anthill nests (*Formica sp*). Such ant nests need time of decades to build up.

Table 1

Food-niche separation by Taiga woodpecker species (After Haftorn 1971).
w = Winter food s = Summer food
Number of stars indicate importance

Food item	BWp	GWp	GHWp	GSWp	WBWp	TTWp	LSWp
Formica and other ants	S**	**S**** **W*****	S* W?	S**	S*	S*	S*
Carpenter ants	**S***** **W****						
Bark beetles and other beetles at dead and rotten wood				W** S**		**S**** **W*****	
Larvae in wood — often dead and rotten wood	S* W**	S*	**W*****	W* S**	**S**** **W*****	S** W**	**W*****
Spiders			**S****				
Insects in general	S*	S*	**S*****	S*	S*		S** W**
Louse sp. on leaves *(Aphidoidea)*				S**			**S*****
Scavenger				W*			
Predator bird chickens				S*			
Seed from spruce and pine				**W*****			
Berries often *Sorbus* sp.	S*	S**	S**	S*	S*	S*	
Sap-sucking				S*		**S****	

The Great Spotted Woodpecker (*Dendrocopus major*), similar in size to the White-backed Woodpecker; is a kind of generalist species as its food source also includes carrion and meat after predation of nests, seeds of spruce and pine during winter, and might have a kind of "tramp-strategy" to migrate randomly around to find spots that for the year has an abundant seed-production.

The Grey-headed Woodpecker (*Picus canus*), almost of the size of the Green Woodpecker, is the least known species. Its nesting habitat seems to be the use of older and more deteriorated, but still living aspen trees, than its near relative. As far as we know its nutrition requirements, larva of beetles and other insects in dead, coniferous wood is more important, often using wide territories and old-growth forests at wintertime, certainly an adaptation that puts this species into old successions where the species optimum might include old wood of large dimensions, well rotten and in abundance.

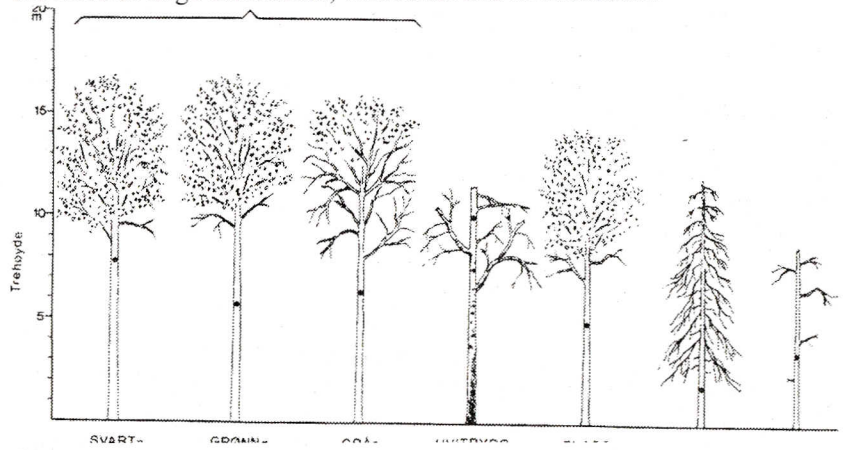

Fig. 2. The nest tree selection by different kinds of woodpeckers. A: Black Woodpecker, B: Green Woodpecker, C: Grey-headed Woodpecker, D: White-backed Woodpecker, E: Geat Spotted Woodpecker, F: Three-toed Woodpecker, G. Lesser Spotted Woodpecker. After: Hågvar et al. (1990)

The Black Woodpecker (*Dryocopus martius*) require trees of big dimensions to nest, often 10 m. above the ground. As many other woodpeckers it prefers the soft wood of aspen trees for nesting, but do also use birch and spruce, and more often the pine as a nesting tree. Its staple food is the big carpenter ants *(Camponotus sp.),* which it picks out of tree stumps and logs during the whole year. These ants will be very common in dead wood after forest fires, but also live in the lower parts of living, old and big trees. It is evident that its habitat is

somewhat flexible, but fits very well into a fire dominated landscape with surplus of dead trees, where nesting sites can be either in living or dead trees out in the burned areas, or in suitable trees in parts of the forest that fire have passed more or less unharmed, — "the fire-refugees" of the forest.

The small, Three-Toed Woodpeckers niche seems to be the use of old-growth coniferous forest, where sap-suckling of old trees is one part of its food-niche at summertime in addition to the use of bark-living beetles and larva. The species nests in medium-sized, dead and well rotten coniferous trees, often near the ground. The nesting trees have often been sub-dominates in the forests development. The species seems to prefer to use large, continuous forests, and avoiding the crossing of open areas (Amcoff and Angelstam 1996).

The woodpecker's role as key species in the taiga is most evident as they are the active nest builders for a guild of second home users. Hågvar and Sørensen (1976) have put up a table (Table 2) that show at least 23 other bird species are very dependent of old woodpecker nests. This dependency is even more important as Sonerud (1985) has shown that predation, mainly by martens, but also by weasel increases considerably two years after they are made (Sørensen et al. 1990). Combined will these facts clearly show that forestry, as it reduces the areas of natural succession in forest, cleaning up and not letting trees grow old and die at the spot, have considerably and cumulative impact on the population levels of hole-nesting birds in the taiga.

Areas actively, and over time used or/and clear-cut by forestry, can probably never really imitate natural conditions regarding the need for dying and dead trees for woodpeckers and their second hand users. But forestry can help out greatly by leaving such trees on clear-cuts with the purpose to become new nesting and feeding trees for woodpeckers and the guild of hole-, cavity- and stub-nesting birds.

Passerine Birds

Several authors have presented studies that mainly focus on Passerine birds, their habitat choice in forest succession and consequences of landscape change by forestry (Järvinen et al. 1977, Ahlen & Nilsson 1982, Helle 1985 a & b, , Väisenen et al. 1986, Virkkala, 1987, 1991, Boström 1988, Helle & Mökkönen 1990, Angelstam 1992, Jokimäki & Huhta 1996, Willson & Comet 1996, Edenius & Sjöberg 1997, Thingstad 1997, Thingstad et al. 2003, Hågvar et al. 2004). The different passerine birds (*Passeriformes*) will as the grouse birds show preferences to different succession stages of the taiga. Finnish researchers have nicely shown that passerine bird populations have changed greatly since the period of clear-cutting became common, with an increase of species being either generalists or adapted to young forests, and a decrease in populations adapted to the old forests (Järvinen et al. 1977). This effect is also most marked for species that lives the whole year in old forests — the species that are truly taiga species as tits (*Parus sp.*) and Crossbills and Gross beak

(*Loxia sp. and Pinicola enculeator*). Species like the Siberian Jay (*Perisoreus infautus*) and the Pine Grossbeak also prefers rather large areas of old growth forests suffer the most. Fragmentation of old growth forest is shown to be detrimental for many of the species that winter in the Taiga (Jokimäki and Huhta 1996). The other species, and especially the ones that use very young and partly open habitats are most often migratory at wintertime and still make a good living at summertime in the Taiga.

Table 2

List of woodpeckers and their second-hand user of tree-holes and other cavity-like structures in trees.

Species of Hole-user	*Latin name*	Tree-stumps, cavities	Holes made by fungi	Black Wood-pecker	Green Wood-pecker	Grey-Headed & White-Backed Wood-pecker	Three-toed & Great Spotted Wood-pecker	Lesser Spotted Wood-pecker
Goldeneye	*Bucephala clangula*		*	*				
Goosander	*Mergus merganser*		*	*				
Smew	*Mergellus albellus*	*	*	*				
Mallard	*Anas plathyrynchos*	*						
Kestrel	*Falco tinninculus*	*	*	*				
Stock pigeon	*Columba oenas*		*	*				
Hawk Owl	*Surnia ulula*	*	*	*				
Tawny Owl	*Strix aluco*		*	*				
Ural Owl	*Strix uralensis*	*						
Tengmalm's Owl	*Aegolius funereus*		*	*	*			
Pygmy Owl	*Glaucidium passerinum*					*	**	
Jackdaw	*Corvus monedula*	**	**	**				
Starling	*Sturnus vulgaris*		*	*	**	**	**	
Swift	*Apus apus*	*	*	*	*	*	*	
Wryneck	*Jynx torquilla*				*	**	**	*
Great Tit	*Parus major*		*	*	*	**	**	*
Blue Tit	*P. careulus*				*	*	*	**
Siberian Tit	*P. cinctus*						**	**
Crested Tit	*P. cristatus*						**	**
Marsh Tit	*P. palustris*							**
Coal Tit	*P. ater*							**
Wood nut-hatch	*Sitta europea*				*	**	**	
Tree-creeper	*Certhia familiaris*							*
Redstart	*Phoenicurus phoenicurus*	*	**	**	**	**	**	*

Species of Hole-user	*Latin name*	Tree-stumps, cavities	Holes made by fungi	Black Wood-pecker	Green Wood-pecker	Grey-Headed & White-Backed Wood-pecker	Three-toed & Great Spotted Wood-pecker	Lesser Spotted Wood-pecker
Pied Fly-catcher	*Ficedula hypoleuca*					*	**	**
Spotted Flycatcher	*Muscicapa striata*	*	*					
Thrushes sp.	*Turdus sp.*	*	*					
Green sand-piper	*Tringa ochropus*	*	*					

One species that might be specially adapted to newly burned areas, The Ortolan Bunting *(Emberiza hortulana)*, might also suffer in Fennoscandian forests as forest fires are rather effectively suppressed, but might not be so affected in the Russian taiga where forest fires are more common, but also with effective suppression. Prescribed burning for the purpose of helping species specialized to newly burned areas, (ecological man-made burns), will probably help this species, but areas might be to small and patchy to really have any population effect.

We also have to put focus on the guild of hole-nesting passerines (Table 1). Most of them are dependent on the woodpeckers for creating the nest place as second home users (Hågvar & Sørensen 1976, Zarnowitz & Manuwal 1985, Angelstam & Widen 1987, Newton 1994) and the effect from forestry is considerable. A study in Norway have nicely shown that densities can be improved from almost zero to 100 — 700 pairs pr. Km2 (Hågvar et al. 1990), a strong evidence to the fact that even old natural, but over time managed and selectively logged forests loose their hole-nesting bird fauna if not handled with that purpose in mind.

For the passerine birds are corridors with old forests combining larger areas of the same habitat crucial for the population of wintering birds. The width of corridors have recently been studied by Hågvar et al. (2004). The result show that corridors along rivers and bogs should be at least 30 m. broad to give a kind of optimal function as breeding habitats, but they also conclude that even broader strips must be parts of the system.

Birds of prey — Raptors (Falciformes***) and Owls (***Strigiformes***)***

Solheim (1978) has given an overview of nesting and hunting strategies of raptors and owls in our Taiga ecosystems. The two guilds (day- and night-active) of raptors preying on birds and mammals of the taiga also show adaptations to use different stages of forest successions. They also show both inter- and intra-specific niche-separation according to prey and hunting areas. The effect of forestry might be both positive and negative at the species levels.

Species like the Hen Harrier (*Circus cyaneus*) and Short-Eared Owl *(Asio flammeus)* both hunt and nest at the ground in large patches of open habitats, most likely to be found either on large marshes or at large burns, or on large clear-cuts. These species and others using this habitat are very little affected by forestry, but the Norwegian policy of keeping clear-cuts small (< 5 ha) does not promote these species.

Species like the Kestrel (*Falco tinnunculus*) and Hawk Owl (*Surnia ulula*) also use open habitat as their main hunting ground, but are representatives of species that sits on tree-tops watching for prey as their main hunting strategy. They also nest in cavities or holes in trees. We see that these species must suffer from forestry on both small and large clear-cuts as sitting posts are taken away during logging operations and thereby minimizing the species hunting possibilities. Trees for nesting are also reduced to a minimum, making these guilds very sensitive to logging, compared with how their original, burned habitats would look like.

The Goshawk *(Accipiter gentilis)* studied by Widen (1989), Marcström et al. (1990), Tømmerås (1993) and Selås (1997) and the Great Grey Owl *(Strix uralensis)* are representatives for guilds hunting mainly inside mature forests, most often using ambush strategies from sitting post and nesting in old trees in quite huge nests. The Great Grey Owl also represents both night- and day-active raptors dependent on other species (often other kind of raptors) for nests — they are second-hand nest-users. These species might react negatively if forests are kept in unsuitable young succession stages and lack of suitable nesting trees. They probably are vulnerable to how their habitats are distributed at landscape level, but their vulnerability is not well understood. We can — as an example, regard the Goshawk who in Fennoscandia is believed to suffer from the clear-cut forestry as both hunting habitat and nesting places are affected, but we also see that the species are thriving, nesting and reproducing in a very patchy forested landscape of the fjords of South-western Norway (Sorensen Unpublished).

Some other raptors as the buzzards *(Buteo sp.)* often nest in large trees, and mostly hunt in open habitats, are probably very tolerant to clear-cutting forestry, but there are a need to leave either enough trees for nesting and sitting posts, on clear-cuts or in none- or selective logged areas spread around.

The Golden Eagle (Tjernberg 1983) (*Aquila chrysaetos*), as well as the White Tailed Sea Eagle (*Haliaetus albicilla*) and the Osprey (*Pandion haliaetus*) all nest in quite large and thereby old trees. Age of Golden eagles nesting tree are often between 250 — 350 years — indicating a strategy to use stable elements in the Taiga as trees that either grow in fire refugees or trees surviving fires — anyhow elements that easily become scares in a forestry driven landscape

Summarizing I would stress that the need of the large, nesting trees for some species might be crucial over time — and that the species that have their adaptation to hunt in old forests are of greatest concern. This also includes concern for some species that are dependent on other raptors for nests.

Forestry and Landscape change.

The taiga ecosystems will always naturally change at landscape level in a system driven by forest fires of small and large scales, wind-felling of small and medium-sized areas, and internal stand small scale processes and renewal induced by insect and fungi. Areas with very old forests — are mainly small and located at special topographic given areas, riversides and edges of bogs. The clear-cutting of forests does not necessarily change the amount of young forests so much at a large scale view, but the habitats that are logged often differs from what nature creates (Solheim 1987, Angelstam 1992). Forestry change landscape patterns in another direction that nature would do, and do deliver a shortage of dead wood, either standing or laying on the ground, to be used by cavity-nesting birds and food for species living on insects of dead wood.

Forestry's consequences on bird populations

To summarize we can conclude that forestry, with its clear-cutting and cultivation procedures have the possibility to make great impact on population levels of many different bird species. The impacts can be positive for some species, but also very negative and for other species with long-term effects. But there are many possibilities to adjust activities positively to birds needs:

1: Forestry could plan their activities on a landscape and long-term level using the habitat adaptation of grouse birds as a model that would secure both the needs for young succession adapted species as the Willow Grouse and the Black Grouse, and the needs of older succession adapted species of the Hazel grouse and the Capercaillie, to create as landscape model taking care of leave trees and areas of old growth forests.

2: Forestry should be very careful to improve the needs for the guild of woodpeckers, that use dying and dead trees of different size categories as nesting trees, and often insects in dead wood as a main food source at wintertime. Being key species for the guild of 20 — 25 different second-nest hole-users, they represent important indicators for well functioning ecosystems.

3: Forestry should also pay attention to the special needs of the very old and large nesting trees for different kind of big raptors as Goshawk, Buzzards and Eagles. The first one primarily in larger patches of old-growth forests, the buzzards more flexible, but large trees in small groups left after logging might function well. These species of nest-builders are also important for many other raptors and owls that take these old nests in use.

4: Combined these efforts would give a possibility to keep taiga bird populations viable at a landscape level, but would also be very useful to improve and secure taiga biodiversity at a plural species level as they secure habitats in a, maybe, simplified natural landscape, with the most important ingredients at different succession stages.

A functional bird fauna also indicates that biodiversity at large might be doing well. We know that many red-listed species of the Taiga often are the species with niches in the very old forests — where the amount of large, living trees, decaying wood in surplus and large areas of mature forests are key factors. As aspen is also a tree species of great important for woodpeckers, they also have a lot of specialized species of the detritus food chain bounded knit to this tree species.

5: It is possible to do these suggested adjustments in forestry's activities, also combined with effective and machine-planned forestry. We have many of the important ecological answers and can make proper advices for a multiple sustainable management and use of forests. But it needs to be more actively taken in use in every country with a active forestry using the Taiga.

Several authors have published papers on forest history and landscape changes created by nature itself or by man. This information is over time in Norway presented as guidelines for forestry in Norway as Multiple use forestry (Aasaaren 1990, Solbraa 1996), Biodiversity Management in Forestry (Anderaa et al. 1996) and last; the Standards for Sustainable Forestry (Environmental Certification Processes) (Levende Skog 1999). In Finland Haila (1994) and Haila et al. (1994) have discussed the same items. The ideas are partly implemented, and certification of forestry is now in function in Fennoscandia. But I allow myself to doubt that practice is sufficient according to natures need, because I do not see any landscape management plans that includes the ideas on a broad scale, only small adaptations to the ideas.

In Norway we implement this knowledge in the study program for new forestry and nature management students, and run program in continuous education for old foresters, forest owners and others interested in nature management, hopefully changing understanding and attitudes to a new kind of forestry planning and implementation.

It is my conclusion that this important aspect of modern forestry versus wildlife and biodiversity management can only be implemented using robust economical models that care for both the traditional timber-industry; the wildlife and general care for biodiversity resources. We now have much of the tools according to knowledge about the forestry's possible effect on wildlife the next step is to figure out long-term sustainable forestry practice including the biodiversity dimension at landscape level.

References:

Aasaaren, Ø (Ed.) 1990. Rikere skog — 90-årenes kunnskap om skogbehandling og skogøkologi. — Landbruksforlaget. 132 p. (In Norwegian).

Ahlén, J. & S. G. Nilsson 1982. Samband mellan fågelfauna och biotopareal på öer med naturskog i Mälaren och Hjälmaren. — Vår Fågelvärld 41: 161-184. (In Swedish).

Amcoff, M. & Eriksson, P. 1996. Occurrence of three-toed woodpecker (Picoides tridactylus) at the scales of forest stand and landscape. — Ornis Svecica 6: 107-119. (In Swedish with English summary).

Anderaa, R., Rolstad, J. & Søgnen, S. M. 1996. Biologisk mangfold i skog. — Norges Skogeierforbund & Landbruksforlaget. 112 s. (In Norwegian)

Angelstam, P. 1992. Conservation of communities — the importance of edges, surroundings and landscape mosaic structure. Pp. 9-70 in: Hansson, L. (ed.) Ecological principles of nature conservation. — Elsevier Appl. Sci., London.

Angelstam, P. & Mikusinski, G. 1994. Woodpecker assemblages in natural and managed boreal and hemiboreal forest — a review. — Ann. Zool. Fennici 31: 157-172.

Angelstam, P. & Widén, P. 1987. Hänsynsregler i skogbruket — skogbrukets inverkan på livsbetingelserna för hålhäckande fåglar och rovfåglar. — Viltnytt 24: 48-51.

Beshkarev, A.B., Swenson, J.E., Angelstam, P., Andrén, H. & Blagovidov, A.B. 1994. Long-term dynamics of hazel grouse populations in source- and sink-dominated pristine taiga landscapes. — Oikos 71: 375-380.

Boström, U. 1988. Fågelfaunan i olika åldersstadier av naturskog och kulturskog i norra Sverige. — Vår Fågelvärld 47: 68-76. (In Swedish).

Børseth, E. & Krafft, A. 1973. Black grouse and capercaillie brood habitats in a Norwegian spruce forest. — Oikos 24: 1-7.

Edenius, L. & Sjöberg, K. 1997. Distribution of birds in natural landscape mosaics of old-growth forests in northern Sweden: relations to habitat area and landscape context. — Ecography 20: 425-431.

Formozov, A. N. 1946. Snow cover as an integral factor of the environment and its importance in the ecology of mammals and birds. — Materials for fauna and Flora of the USSR; New Series, Zoology, 5: 1 –152. Moscow Society of Naturalist, Moscow; Russia. — Translation into English by: University of Alberta, Boreal Inst. for Northern Studies. Occasional Publication Nr. 1. (1964).

Furness, R.W. & Greenwood, J.J.D. 1993. Birds as monitors of environmental change. — Chapman & Hall, London.

Haftorn, S. 1971. Norges fugler. Universitetsforlaget, Oslo. (In Norwegian).

Haila, Y. 1994. Preserving ecological diversity in boreal forests: ecological background, research, and management. — Ann. Zool. Fennici 31: 203-217.

Haila, Y., Hanski, I.K., Niemelä, J., Punttila, P., Raivio, S. & Tukia, H. 1994. Forestry and boreal fauna: matching management with natural forest dynamics. — Ann. Zool. Fennici 31: 187-202.

Helle, P. 1985a. Effects of forest fragmentation on bird densities in northern boreal forests. — Ornis Fennica 62: 35-41.

Helle, P. 1985b. Habitat selection of breeding birds in relation to forest succession in Northeastern Finland. — Ornis Fennica 62: 113-123.

Helle, P. & Mönkkönen, M. 1990. Forest succession and bird communities: theoretical aspects and practical implications. In: — Keast, A. (ed.) Biogeography and ecology of forest bird communities. — SPB Acad. Publ., Haag. Pp. 299-318

Bortchtchevski, V.G., Hjelord, O., Weggwe, P. & Sivkov, A.V. 2003. Does fragmentation by logging reduce groise reproductive success in boreal forests? — Wildl. Biol. 9 275 — 282.

Hogstad, O. & Stenberg, I. 1994. Habitat selection of a viable population of White-Backed Woodpeckers Dendrocopus leucotos. — Fauna norv. Ser. C. Cinclus 17: 75 — 94.

Hågvar, S., Hågvar, G. and Mønnes, E. 1990. Nest site selection in Norwegian woodpeckers. — Holarctic Ecology 13: 156 — 165.

Hågvar, S., Nygaard, P. and Bækken, B. T. 2004. Retention of Forest Strips for Bird-life adjacent to Water and Bogs in Norway: Effect of Different Widths and Habitat Variables. — Scand. J. For. Res. 19: 1-14.

Hågvar, S. og Sørensen, O. J. 1976. Vi kan gjøre noe for hullrugerne. — Norsk Skogbruk 9 — 4 pp. (In Norwegian).

Hågvar, S., Sørensen, O. J. and Lund, E. 1990. Nest-box studies on hole-nesting passerines in spruce forest. I. Effect of nest hole availability on population density. — Fauna norv. Ser. C, Cinclus 13: 33 — 41.

Järvinen, O., Kuusela, K. & Väisänen, R.A. 1977. Effects of modern forestry on the number of breeding birds in Finland in 1945-1975. — Silva Fennica 11: 284-294. (In Finnish with English summary).

Jokimäki, J. & Huhta, E. 1996. Effects of landscape matrix and habitat structure on a bird community in northern Finland: a multi-scale approach. — Ornis Fennica 73: 97-113.

Kaasa, J. 1959. En undersøkelse over næringen hos orrfugl (Lyrurus tetrix (L)) i Norge. — Meddr. Stat. Vilt. 2. serie — Hefte 4. 122 s. (In Norwegian).

Levende skog 1999. Standarder for et bærekraftig norsk skogbruk. — Landbruksforlaget. 87 s. (In Norwegian).

Linden, H. 1981. Growth rate and early energy requirements of captive juvenile capercaillie Tetrao urogallus. — Finn. Game. Res. 39: 53 — 67.

Linden, H. & Rajala, P. 1981. Fluctuations and longterm trends in the relative densities of tetraonid populations in Finalnd, 1964-1977. Finnsih Game Res. 39: 13-34.

Marcström, V., Kenward, R. & Karlbom, M. 1990. Duvhöken och dess plats i naturen. — ISBN 91-630-0008-3. 96 s. (In Swedish).

Myrberget S. 1984 (Edt.) Skogsfuglprosjektet 1980 — 1984. — Viltrapport 36: 1 — 103. (in Norwegian).

Newton, I. 1994. The role of nest sites in limiting the numbers of hole-nesting birds: a review. — Biol. Conserv. 70: 265-276.

Overskaug, K. & Sørensen, O. J. 2002. Hogstforslag for et hekkeområde for hvitryggspett Dendrocopos leucotos i Surnadal kommune, Møre & Romsdal. — HiNT — Arbeidsnotat 137: 1- 24. (In Norwegian)

Pulliainen, E. 1970. Composition and selection of winter food by the capercaillie (Tetrao urogallus (L)) in north-eastern Finnish Lapland. — Suomen Riista 22: 67-73.

Pynnönen, A. 1954. Beitrage zur Kenntnis der Lebenweise des Hazelhuhns (Tetrastes bonsaisa (L)). — Pap. Game Research 12. 90 s.

Rolstad, J. & Wegge, P. 1989b. Capercaillie Tetrao urogallus populations and modern forestry a case for landscape ecological studies. — Finnish Game Res. 46: 43-52.

Rolstad, J., Wegge, P. & Gjerde, I. 1991. Cumulative impact of habitat fragmentation. Lessons from 12 years of capercaillie research at Varaldskogen, Norway. — Fauna 44: 90-104. (In Norwegian with English summary).

Rajala, P. 1974. The structure and reproduction of Finnish populations of capercaillie Tetrao urogallus and black grouse Lyrurus tetrix on the basis of late summer census data from 1963-66. — Pap. Game Research 35. 51 p.

Salo, L.J. 1971. Autumn and winter diet of the hazel Grouse in north-eastern Finnish Lapland. — Ann. Zool. Fennici 8: 543 — 546.

Seiskari; P. 1962. On the winter ecology of the capercaillie Tetrao urogallus and the black grouse Lyrurus tetrix in Finland. — Pap. Game Research 22. 119 p.

Selås, V. 1997. Polpulation ecology of forest-living hawks in southern Norway. — PhD –thesis; — Agriculturtemuniv. Of Norway, Dept. of Biology and Nature Concervation.

Semenov-Tjan-Sanskij, O. I. 1960. Die Ökologie der Birkhühnvögel (Tetraoniden). — Trudy Laplandskogo Gosudarstwennogo Zapovednika. (Moskwa 1960). — Stat. Nat.-vetenskaplega översätning Nr. 106. 304 s.

Semenov-Tjan-Sanskij, O. I. 1970. Some trends in ecological research on tetraonids in Russian Reserves. — VIII Int. Congr. Game Biol., Finish Game Res. 30: 149-304.

Solbraa, K. 1996. Veien til et bærekraftig skogbruk. — Landbruksforlaget. 183 s. (In Norwegian).

Solheim, R. 1978. Barskogsøkologi og zoologiske verneinteresser — tilpasninger og habitatkrav hos insekter, fugler og pattedyr I et dynamisk økosystem. — Økoforsk Utredning 1987:8: 1 — 120. (In Norwegian).

Sonerud, G. 1985. Nest hole shift in Tengmalm's Owl Aegolius funerus as defence against nest predation involving longterm memory in the predator. — J. Annim. Ecol. 54: 179 — 192.

Spidsø, T, Kastdalen, L., Stuen, O. H. & Wegge, P. 1984. Storfuglkyllingenes ernæring på

Sørlandet og Østlandet. — Viltrapport 36: 60 — 65. (In Norwegian).

Stenberg, I. & Hogstad, O. 1995. Populasjonstetthet og økologi hos hvitryggspett og andre

hakkespetter i Vest-Norge. — Rapp. Skogforsk 10-95: 1- 21. (In Norwegian).

Swenson, J. 1993. The importance of alder to hazel grouse in Fennoscandian boreal forest: evidence from four levels of scale. — Ecography 16: 37 — 46.

Swenson, J. and Angelstam, P. 1993. Habitat separation by sympatric forest grouse in Fennoscandia in relation to boreal forest succession. — Can. J. Zool. 71: 1303 — 1310.

Sørensen, O. J. 1979. Skogsfuglbiotoper og skogbruk. — J. Tidskr. Skogbruk 87 (3): 129 — 141. (In Norwegian).

Sørensen, O. J., Hågvar, S. and Lund, E. 1990. Nest-box studies on hole-nesting passerines in spruce forest. II. Reproduction success in Pied flycatcher Ficedula hypoleuca. — Fauna norv. Ser. C, Cinclus 13: 42 — 46.

Thingstad, P.G. 1997b. Challenges to conservation of biological diversity in boreal forestry landscape; a case study using bird guilds as environmental indicators. — Fauna norv. Ser. C, Cinclus 20: 49-68.

Thingstad, P. G. Skjeggedal, T. & Markhus, G. 2003. Human-induced alteration of two boreal forest landscapes in central Norway, and some possible consequences for avian fauna. — J. Nat. Conserv. 11: 157 — 170.

Tjernberg, M. 1983. Breeding ecology of the golden eagle, Aquila chrysaetos (L.), in Sweden. — Rep. Dep. Wildl. Ecol., Swed. Univ. Agric. Sci. No 10.

Tømmeraas, P.J. 1993. The goshawk Accipiter gentilis in Leksvik — a sacrifice to modern forestry. — Fauna 46: 180-195. (In Norwegian with English summary).

Uusvara; O. 1963. The structure of the habitats of the hazel grouse (Tetrastes bonasia). — Suomen Riista 16: xx- xx.

Väisänen, R.A., Järvinen, O. & Rauhala, P. 1986. How are extensive, human-caused habitat alterations expressed on the scale of local bird populations in boreal forests? — Ornis Scand. 17: 282-292.

Virkala, R. 1987. Efefcts of forest management on birds breeding in northern Finland. — Ann. Zool. Fenn. 24: 281 — 294.

Virkkala, R. 1991. Population trends of forest birds in a Finnish Lapland landscape of large habitat blocks: Consequences of stochastic environmental variation or regional habitat alteration? — Biol. Conserv. 56: 223-240.

Widén, P. 1989. The hunting habitats of goshawks Accipiter gentilis in boreal forests of central Sweden. — Ibis 131: 205-231.

Willson, M.F. & Comet, T.A. 1996. Bird communities of northern forests: Patterns, diversity and abundance. — Condor 98: 337-349.

Zarnowitz, J.E. & Manuwal, D.A. 1985. The effects of forest management on cavity-nesting birds in northwestern Washington (USA). — J. Wildl. Manage. 49: 255-263.

FOREST COVER TRANSFORMATION IN THE EUROPEAN NORTH-EAST (HISTORICAL AND STATISTICAL REPORTING DATA)

Utkin A.I.*/**, Sukhikh V.I.**

* *Institute of forest history, Russian Academy of Science*
Moscow obl., Odintsovo rayon, Uspenskoe village, 143030, Russia
root@ilan.msk.ru
** *Centre for Forest Ecology and Productivity, Russian Academy of Science*
Profsojuznaya st., 84/32, Moskow, 117997, Russia
sukhikh@cepl.rssi.ru

The north of the East European plain is a region of Russia with peculiar nature, history and social characteristics[1]. It constitutes a separate sector of the circumpolar boreal forest belt of Eurasia. The territory stretches from the national border in the West to the Ural mountain foothills in the East, its southern parts covering Northern ridges (~ 62° N), where many large rivers of the White, Barents and Kara Seas, as well as of the Baltic Sea and Volga basins originate.

Until the mid-18th century, when Russia had no direct access to the Black and Baltic Seas, the White Sea coast remained the only sea ground for trade and other contacts between Russia and other countries, first of all England and Holland. The "window on Europe" cut by Peter the Great, establishment of

[1] Until the early 1920s, it comprised Arkhangelsk, Vologda and Olonets provinces and three northern districts of the Perm province, with a total area (lakes and rivers excluded) of 78,659,000, 38,173,000, 11,959,000 ha [8] and 12873,000 ha [11], respectively. Today, these are the territories of Republic of Karelia, Komi Republic, Arkhangelsk, Murmansk and Vologda regions, Komi-Permyak autonomous district. (Old Russian units were converted into the metric system by the authors).