

Forestry and the bird fauna in Sweden

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The development of modern forestry in Sweden has resulted in changes in the quantitative composition of the bird fauna. The geographical distribution of a number of species has also been affected. To about 25 species forestry is thought to be unfavourable. Of these, 8 species have decreased markedly. About 20 species are probably favoured by forestry. Of these, about 6 species have increased markedly. Some species have both benefited and suffered.

The paper deals mainly with the following questions: (1) The fate of the woodpeckers *Dendrocopos medius*, *D. leucotos* and *Picus canus*; the only surviving population of *D. medius* in northern Europe is restricted to a small area in Östergötland, Sweden. (2) Large trees as a limiting factor in the nesting of some large birds of prey. (3) Importance of fruit-bearing trees and shrubs for *Coccothraustes* and *Nucifraga caryocatactes*. (4) The effect of clear-cutting of the natural and virgin forests of the taiga in northern Sweden. (5) The effect of afforestation of former open land (retreat of e.g. *Charadrius apricarius* and *Anthus campestris* in southern Sweden). (6) The fauna of clear-cut areas. In the first years they are colonized by species that are natural inhabitants of alpine heaths and of mires or shores.

Origin of fauna

The fauna is strongly modified by our land use. Forestry, agriculture and other land utilization create habitats and living conditions for the bird species. The native species, originally belonging to the natural ecosystems, or at least the majority of them, have survived until today despite the fact that most ecosystems have more or less been modified by land use. A number of immigrant species originally belonging to steppe, mountain or tundra biomes has also been added to the fauna, species that apparently happen to fit in with the artificial ecological conditions of the man-made landscape (this probably applies to e.g. *Alauda arvensis*, *Phoenicurus ochruros*, *Passer domesticus*, *Ciconia ciconia*).

fauna consists of the particular species, one must consider the conditions that prevailed before the advent of the strong human impact on landscape. However, as shown from palynology, during a long period of time, the ecosystems remained neither stable nor unchanged. Through soil processes, erosion, climate variations, varying frequency of fires and storm fellings, there was probably a persistent change in tree species composition and in many qualitative aspects of the ecosystems. Because of the glaciation periods, the species present today were once members of ecosystems and biomes that repeatedly moved geographically.

Our bird fauna evolved in changing ecosystems long before the human impact on environment, and most of its species have survived through the periods of drastic landscape modification

In order to understand why the bird

caused by varying human land use. The question today is whether or not modern forestry will allow the complete fauna to survive, and which changes in the species composition it may result in.

Research efforts

At my institute a number of pilot studies and research projects have been focused on the causal relationship between land use in forests and the fauna. Special emphasis during the last few years has been given to endangered and highly vulnerable species which require protection or special management of habitats in order to survive. Studies on the nest sites and habitat choice of *Strix uralensis* have already been conducted, as well as investigations on the effects of clear-cutting on the bird fauna in various parts of Sweden. At present, a project on the ecology of endangered woodpeckers is being started, together with a pilot study on the survival of the primeval forest bird fauna of Lapland.

Effects of forestry on fauna

The development of modern forestry in Sweden has resulted in changes in the quantitative composition of the bird fauna. The geographical distribution of a number of species has also been affected, expansion as well as retreat having been recorded. The number of bird species in parts of the country to which, according to a cautious estimate, forestry is unfavourable is about 25. Of these, 8 species have decreased markedly, in all probability due to forestry. The number of species, on the other hand, that are judged to have become favoured by forestry is about 20. Of these, approximately 6 species have increased markedly. These estimates include some hypo-

thetical and far-from-proven causal relations, and also include species that are affected in one way or another — at least in some parts of the country. For this reason some species occur on the lists of both those that have benefited and suffered. There are also cases where forestry can only be regarded as partly responsible for increases or decreases. There are probably also cases where forestry favours one species, which at the same time has suffered from other factors, and vice versa. All these limitations, together with others not mentioned here, should be kept in mind when the impact of forestry on the bird fauna is discussed.

In addition to the listed species, there are probably many common species that have been affected quantitatively, for example, *Ficedula hypoleuca*, *Phylloscopus trochilus*, *Fringilla coelebs*, *Dendrocopos minor* and many others.

In the list, the species suffering and benefiting have been sorted into rough causal groups, primarily in order to demonstrate that clear-cutting is behind many of the positive effects, and that it is often a reduction in the extent of various special habitat qualities that is behind many of the negative effects.

The changes for some of the species or groups will be discussed briefly.

Woodpeckers

All our woodpecker species are indigenous and in prehistoric times they probably occurred in greater abundance than in the present landscapes. Large parts of our forest lands, at least in the northern half of the country, were normally and repeatedly subjected to natural fires, which, at least on better soils, were followed by deciduous forest generation, for example, vast stands of aspen, birch and, on many sites, an

abundance of sallow and willow species. Eventually, in the course of competition, conifers became dominant.

It also seems likely that old mature conifer stands could survive here and there for a couple of centuries. Large parts of our present-day agricultural land in southern and central Sweden may in prehistoric times have consisted of deciduous forests and marshes, and many stands were probably able to reach a great age, with a large percentage of the standing trees weakening and dying off. With this presumption it is very likely, for example, that the three woodpecker species *Dendrocopos medius*, *Dendrocopos leucotos* and *Picus canus* belonged to the most abundant woodpecker species in older times. One of the most interesting tree species, *Populus tremula*, grows quickly to thick dimensions, soon becomes rotten, and harbours an insect fauna which is important to woodpeckers.

Vast stands of aspen intermixed with other deciduous trees were probably characteristic of many burnt areas. Today, really old stands of aspen are extremely rare, and on normal forest land they do not conform to silvicultural principles, despite the fact that the species as such occurs almost everywhere, for example, as shrubs and young trees on clear-cut areas as well as on abandoned fields. It should be easy to create new valuable woodpecker habitats if small areas of aspen and other deciduous trees were preserved in a system of scattered micro-reserves.

The three woodpecker species mentioned have become endangered by the prolonged changes in the forests. For *Dendrocopos medius* the situation is quite critical, the only surviving population in the whole of northern Europe being restricted to a small area in Östergötland, in Sweden. The status of the species has been carefully followed by

ornithologists in the area for many years and in 1974 we started studies on habitat utilization, to be carried out in cooperation with the local ornithologists.

In 1973, *Dendrocopos leucotos* was the subject of a nation-wide survey organized by the Swedish Ornithological Union. The situation in northern Europe as a whole is quite critical but the future can possibly be regarded more optimistically than for *Dendrocopos medius*. The disappearance of the natural habitats is probably to some degree compensated for by new types of deciduous tree stands, as in abandoned pastures, naturally generated and dense shore-line woods and other unmanaged stands, but these habitats are easily destroyed by cutting and also by landscape management for aesthetic and recreational purposes.

In 1975, we are going to start ecological studies on *Dendrocopos leucotos*, aiming at a better understanding of the quality of breeding and food habitats of the species. This is essential to an appropriate management of the existing habitats and also to the creation of new habitats in areas where the species still exists, but is endangered.

Nesting trees as limiting factor

The shortened rotation period and the greater share of forest land subjected to rational silviculture result in a less frequent occurrence of old trees with horizontal branches and forks. At the same time, hollow trees and stumps from old trees will gradually disappear. In the long run, these changes will certainly create problems for some bird species.

The availability of nesting trees for *Pandion haliaëtus*, *Aquila crasaëtus*, *Haliaeetus albicilla* and *Milvus milvus* is to be watched more closely, partly by current investigations, and partly by those

being planned. It seems to be an extremely important question whether these and other species are able to breed within the older succession stages of the rotation period of an intensively managed forest, or whether it is necessary to set aside permanent reserves of natural forests.

Importance of fruit-bearing trees and shrubs

Coccoloba coccoloba and *Nucifraga caryocatactes* are two examples of species that depend on the occurrence of trees and shrubs that bear fruits, berries and nuts. The habitats for these species should be conserved and managed in a manner that will ensure the survival of these species. Many of these habitats, often former pastures or mowed land, are endangered by the transformation of the land to productive forest stands or by landscape management for social purposes.

Species belonging to natural and virgin forests of the taiga

After the clear-cutting of the natural and virgin forest of the boreal taiga in northern Sweden, the new, short rotation stands for industrial purposes create quite new environmental conditions. This results in a rapid reduction of the area of more or less natural vegetation, which raises the question as to whether the species originally belonging to the older and mature stages of the taiga forest types will be able to survive in the quite new types of forests. The silvicultural methods are also constantly changing, which means, for example, that the occurrence of fire as an ecological factor is becoming less common. The tree species composition is influ-

enced drastically by forestry, and in the near future it is possible that the introduction of some new exotic species as well as extensive draining of peat land will also influence the environment. There are apparent risks that the future forest land in northern Sweden will contain less of the habitat types in which our native species have evolved. The aim of our studies is to produce recommendations for the selection of forest reserves and for the management of special types of habitats.

Afforestation of former open land

Many drastic changes in the fauna have taken place as a result of the large afforestation programme of the formerly open heathland of south-west Sweden. From being almost completely devoid of forest, the area has changed to forest land, where remaining fragments of heathland habitats can now only be found in coastal strips and in scattered areas with peat bogs and mountain slopes. The number of bird species inhabiting these areas has probably increased appreciably during this century. True forest species have immigrated and colonized the new forest land e.g. *Tetrao urogallus*. At the same time, some of the few species that occurred in abundance on the old heaths have decreased markedly and one has disappeared completely. In this category there are examples of species that can be regarded as suffering and benefiting at the same time but in different parts of the country, or suffering and benefiting in the same area but in different periods of time.

Charadrius apricarius colonizes large clear-cut areas in northern Sweden today, but in south-west Sweden the afforestation has caused a retreat by and a decrease in the species. *Lyrurus tetrix* is probably being favoured by clear-cut-

ting of former monotonous forests with selective cutting in some northern areas, but in south-western Sweden, however, the afforestation programme has apparently caused a gradual decrease in and retreat by the populations. *Anthus campestris* was a regular inhabitant of the vast heathlands on sandy ground in the inland of southern Skåne, but probably decreased as a result of the afforestations. A quite new phenomenon is its colonization of clear-cut areas, fire breaks and young plantations on former fields in the same areas.

Fauna of the clear-cut areas

As shown in the list, a number of species that can be judged as favoured by forestry are inhabitants of clear-cut areas. The clear-cut areas are sometimes compared to storm fellings and burnt areas, often in connection with explanations of the ecological basis for modern clear-cutting. However, with regard to the fauna, the clear-cut areas differ greatly from both the storm fellings and the burnt areas studied by the author. The clear-cut areas are really bare, and in the first few years these are colonized by species that are natural inhabitants of alpine heaths (e.g. *Lagopus lagopus*, which has expanded geographically toward the south and east on high-elevation cutovers down to the Bothnian Sea), and of mires or shores (e.g. *Numenius phaeopus*, *Charadrius apricarius*, *Lanius excubitor*). An enormous increase seems to have occurred in northern populations of *Motacilla flava*, the most abundant bird species on certain types of clear-cut areas.

A particularly interesting recent change in the fauna is the colonization of cutovers by *Emberiza hortulana*. The species is primarily regarded as being linked with arable land and, for many

decades, there has been a serious withdrawal and total disappearance from many areas. In studies of clear-cut areas, we discovered the species on special types of cut areas all over Norrland and in the upper parts of Dalarna. It was found at all elevations from sea level to timber line in the mountains.

Emberiza citrinella in southernmost Sweden has increased very strongly since the low period in the middle of the 1960's. The increase has mainly occurred by colonization of clear-cut areas with an abundance of shrubs, as well as of conifer plantations on abandoned fields. There are some indications that this increasing sparrow population was partly at least recruited from the continent in the south. The frequency of the bright yellow-head type, the song type and possibly migrational movements are such indications.

Picoides tridactylus was regarded as suffering when old conifer stands were removed. In our studies, however, we have found that the species successfully colonizes clear-cut areas where dead standing trees are left or where the edges contain damaged and dead trees. In parts of the country, the species has recently become characteristic of cutovers.

There are quite a number of bird species that regularly inhabit various stages of cutovers and young forest successions. In no single case, however, is there a species that in Sweden or in parts of the country entirely depends on the cut areas or the younger forest successions. All of these species can exist in other habitats, irrespective of forestry. Therefore, silvicultural exploitation of forest land does not seem to be necessary for the survival of any bird species.

Concluding remarks

The changes in forest land are so exten-

sive and occur so quickly that it is most urgent that we obtain an accurate survey of the situation. We must also carefully watch the trends of the endangered and suffering species. It is also important to follow the quantitative faunal changes

of the more common species in the ordinary types of forest but, in both research and conservation work, we must give priority to the species survival aspect. We cannot afford to lose any members of our natural ecosystems.

Appendix: Bird species probably affected by forestry in Sweden

SUFFERING

CERTAIN QUALITY OF FOREST HABITATS AND CERTAIN HABITAT TYPES LESS COMMON

Tetrastes bonasia
Lyrurus tetrix
Tetrao urogallus
Columba oenas
Bucephala clangula
Mergus merganser
Ciconia nigra
Pandion haliaetus
Haliaeetus albicilla
Milvus milvus
Accipiter gentilis
Aquila chrysaetos
Strix uralensis
Dendrocopos medius
Dendrocopos leucotos
Picus canus
Coccothraustes coccothraustes
Nucifraga caryocatactes
Parus cinctus
Perisoreus infaustus
Aegithalos caudatus

AFFORESTATION OF FORMER OPEN LAND

Lyrurus tetrix
Charadrius apricarius
Turdus torquatus
Anthus campestris
Anthus pratensis

OTHER SECONDARY EFFECTS OF FORESTRY

Bubo bubo

BENEFITING

INTRODUCTION OF CLEAR-CUT AREAS

Lagopus lagopus
Lyrurus tetrix
Charadrius apricarius
Numenius phaeopus
Asio flammeus
Picoides tridactylus
Saxicola rubetra
Oenanthe oenanthe
Lanius collurio
Lanius excubitor
Motacilla alba
Motacilla flava
Anthus pratensis
Anthus campestris
Anthus trivialis
Alauda arvensis
Lullula arborea
Emberiza hortulana
Emberiza citrinella

AFFORESTATION OF FORMER OPEN LAND

Prunella modularis
Tetrao urogallus
Anthus trivialis
etc.