

TRENDS IN THE FORMATION OF NESTING AVIFAUNA OF GRAZED BROAD-LEAVED FORESTS OF SAMARSKAYA LUKA

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National Park «Samara Luka», Zhigulevsk (Russia)

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Annotation. The transforming effects of cattle grazing on nesting birds in the broad-leaved forest on the territory of the Samara Luka National Park were studied. The avifauna parameters for the four stages of forest transformation by grazing were studied. This forest transformation changes the habitat of all nesting bird guilds. As a result, the species composition of nesting birds in grazing areas of the forest changes. The transformation of the forest by grazing causes multidirectional changes in the numbers of nesting birds by different guilds. As the degree of forest change by grazing increases, both the total bird abundance and the number of forest species of nesting birds decreases and the contribution of sparse forest and woodland edges species increases.

Key words: nesting birds, broad-leaved forests, anthropogenic transformation, guilds, species richness, livestock grazing.

Introduction

The grazing of domestic animals in the forest is noticeably transforming the original ecosystem. Cattle grazing destroys the forest species of grass, shrub vegetation and undergrowth of forest-forming tree species. Knocking out the underlay and upper soil horizons compaction leads to a deterioration in the air and water regime of soils. This eventually affects the existence of tree and shrub vegetation negatively and leads to the forest thinning (Polyakova et al., 1985), which causes the increase in the illumination of lower layers and favors the development of meadow vegetation and weeds (Kazanskaya, 1972). Instead of forest types of grasses, meadow grass appears in grazed forests, forming a well-represented turf in the well-lit areas. This obstructs the restoration of original forest vegetation, even after the grazing load on the forest is removed. Thinning can continue up to the point when the original forest ecosystem collapses, leading to the formation of a sparse forest community.

The transformation of vegetation inevitably changes the habitat of forest animals (Bykov, Golovatyuk, 2020). Nesting birds are especially sensitive to changes in living conditions. During the reproductive period, birds are most dependent on protective conditions, and if these conditions do not meet their requirements (within the species stereotype of behavior), they can reduce their abundance in forest areas affected by grazing (Promptov, 1956).

Cattle grazing in the forest can harshly change the nesting conditions not only for individual bird species, but also for entire guilds (Bykov, 2013).

This work is an attempt to conduct a comparative analysis of the changes in the nesting avifauna as the degree of transformation of the initial forest community increases, using the example of broad-leaved forests of the Samara Luka National Park.

Material and methods

The field surveys were performed in the areas of an old deciduous forest. The nesting avifauna of the original forest ecosystem, which was the old bed-straw-hairy-sedge oak forest was studied simultaneously at four stages of grazing transformation, that is, in four areas of this ecosystem, altered by grazing to a different degree.

The first stage, an unchanged by grazing forest, with typical forest herbaceous vegetation, well-developed undergrowth and shrub layer. Herbaceous vegetation is represented by the sweetscented bed-straw *Galium odoratum*, the hairy sedge *Carex pilosa*, Lily of the valley *Convallaria majalis*, Solomon's seal *Polygonatum odoratum*, and the spring vetchling *Lathyrus vernus*. The shrub layer is formed by the common hazel *Corylus avellana*, the Euonymus *Euonymus verrucosus*, and the bird cherry *Prunus padus*. The undergrowth is well developed and is represented by small-leaved linden *Tilia cordata*, Norway maple *Acer platanoides*, common oak *Quercus robur*, European white elm *Ulmus laevis*. Projected cover of the first tier is 70–

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75%.

The second stage, a forest subjected to moderate grazing. The tree layer is sparse; the projected cover is 55–60%. The shrub layer is highly suppressed and is only represented by rare specimens of hazel and single specimens of euonymus. An exceptionally dense carpet of plants that does not grow above the grass layer (maximum height of 15–20 cm) represents the undergrowth, which sometimes completely replaces the grassy vegetation. The herbaceous layer is formed by the sweetscented bedstraw *Galium odoratum*, the spring vetchling *Lathyrus vernus*, the hairy sedge *Carex pilosa* and cereal grass. In some places, both the grass layer and the undergrowth are completely absent. Some areas were with completely destroyed underlay.

The third stage, a forest subjected and intensive grazing for a long periods of time. The tree layer is highly sparse, the projected cover is not more than 30–35%. The shrub layer is absent, with the exception of single specimens of euonymus and volga hawthorn *Crataegus volgensis*. The grass layer is represented mainly by cereal grasses. Forest species are the woodland strawberry *Fragaria vesca*, the spring vetchling *Lathyrus vernus*, the sweetscented bedstraw *Galium odoratum*, and the hairy sedge *Carex pilosa* are found fragmentarily. There are rare sprouts of oak *Quercus robur* and linden *Tilia cordata*.

The fourth stage, a woodland in the place of the original forest ecosystem. The tree layer is represented by freestanding or small groups of trees. Shrub and undergrowth are completely absent. The transition to the fourth stage actually corresponds to

the complete disintegration of the original forest ecosystem.

At each of the sites, nesting birds were counted by voices using a route method (Priednieks et al., 1986). In the course of the accounts, the species composition was identified and the number of both individual species and ecological groups (guilds) of nesting birds was determined.

Grazing areas belonging to one stage of transformation occupy not very large areas. At each of the sections, maximum possible length of the route never exceeded 800 meters. This resulted in poor diversity for the species composition of nesting birds, both in general and in individual guilds, despite the threefold repetition of accounts.

Results and discussion

Grazing transformation of the forest changes the habitat for all nesting bird guilds. For this reason, some species increase while other decrease their count. Some species disappear completely from the transformed forest areas. Other species, on the contrary, appear in areas of the forest changed by grazing. The species composition and numbers for different guilds of nesting birds are changing. The sensitivity of the species composition to changes in nesting conditions is shown in table 1.

There are only three completely eurytopic species of nesting birds which were found on all four sites: *Anthus trivialis*, *Fringilla coelebs*, *Parus major*.

The most representative guild in terms of species composition at all stages of grazing transformation was the guild of birds nesting in hollows.

Table 1

Species composition of nesting birds in forest areas transformed by grazing
Видовой состав гнездящихся птиц участков леса трансформированных выпасом

Species	Presence of the species on a site			
	No grazing	Moderate grazing	Intense grazing	Woodland
<i>Birds nesting openly and predominantly in the lower canopy tiers</i>				
<i>Phylloscopus collybitus</i>	+	–	–	–
<i>Phylloscopus trochilus</i>	–	+	–	–
<i>Phylloscopus sibilatrix</i>	+	+	–	–
<i>Phylloscopus trochiloides</i>	–	+	–	–
<i>Anthus trivialis</i>	+	+	+	+
<i>Motacilla alba</i>	–	–	–	+
<i>Saxicola rubetra</i>	–	–	–	+
<i>Emberiza citrinella</i>	+	+	–	+
<i>Luscinia luscinia</i>	+	+	–	–
<i>Erithacus rubecula</i>	+	–	–	–
<i>Turdus iliacus</i>	+	–	–	–
<i>Sylvia atricapilla</i>	+	+	–	–
<i>Sylvia borin</i>	+	+	–	–
<i>Acrocephalus dumetorum</i>	–	+	–	–
<i>Erythrura erythrura</i>	+	–	–	–

<i>Birds nesting openly and predominantly in the upper and middle canopy tiers</i>				
<i>Fringilla coelebs</i>	+	+	+	+
<i>Hypolais icterina</i>	+	+	-	-
<i>Chloris chloris</i>	+	+	-	-
<i>Coccothraustes coccothraustes</i>	+	-	-	-
<i>Turdus pilaris</i>	+	+	-	-
<i>Turdus philomelos</i>	+	-	-	-
<i>Oriolus oriolus</i>	+	+	-	-
<i>Corvus corone</i>	+	+	-	-
<i>Pica pica</i>	-	+	-	-
<i>Streptopelia turtur</i>	+	-	-	-
<i>Birds nesting in hollows</i>				
<i>Parus major</i>	+	+	+	+
<i>Parus montanus</i>	-	-	+	-
<i>Cyanistes caeruleus</i>	-	+	-	-
<i>Ficedula albicollis</i>	+	+	+	+
<i>Muscicapa striata</i>	+	+	+	-
<i>Ficedula parva</i>	+	-	-	-
<i>Phoenicurus phoenicurus</i>	+	-	+	-
<i>Sitta europaea</i>	+	+	+	-
<i>Jynx torquilla</i>	+	+	-	+
<i>Dendrocopos major</i>	+	+	-	-
<i>Dendrocopos leucotos</i>	+	+	+	-
<i>Picoides minor</i>	-	-	-	+
<i>Picus viridis</i>	-	-	-	+
<i>Passer montanus</i>	+	+	-	+

Analyzing the richness of the species composition of nesting birds in grazing areas by guild, the most resistant to the grazing impact are birds that prefer to nest in shelters, in this case, hollow nesting birds (table 2). On the contrary, the transformation of the forest by grazing greatly impoverishes the species composition of openly nesting birds.

A noticeable change in the species composition

occurs in all guilds as the transformation of the forest ecosystem by grazing intensifies. While at the stage of moderate grazing the proportion of species from the original ecosystem is 80%, then at the stage of woodlands this share falls down to 63,6%. At the stage of woodlands there are species completely uncommon for the forest, such as the white wagtail *Motacilla alba*, whinchat *Saxicola rubetra*.

Table 2

Species richness of nesting birds in forest areas transformed by grazing
Видовое богатство гнездящихся птиц участков леса трансформированных выпасом

Guild of birds	Number of species per site			
	No grazing	Moderate grazing	Intense grazing	Woodland
Birds nesting openly and predominantly in the lower canopy tiers	10	9	1	4
Birds nesting openly and predominantly in the upper and middle canopy tiers	9	7	1	1
Birds nesting in hollows	10	9	7	6
Total	29	25	9	11

The share of forest species in grazing areas decreases, intensifying up to the last stage of transfor-

mation of the forest ecosystem – the stage of woodlands (table 3).

Table 3

Ratio between forest and non-forest species of nesting birds in areas transformed by grazing
Соотношение лесных и нелесных видов гнездящихся птиц участков леса трансформированных
выпасом

Guild of birds	Species ratio, %			
	No grazing	Moderate grazing	Intense grazing	Woodland
Forest species	48,3	43,5	66,3	36,4
Non-forest species	51,7	56,5	33,3	63,6

As a result of grazing, not only the species composition changes, but also the abundance of nesting birds. At the first stages of transformation, it increases across all guilds. On the contrary, the abundance in heavily transformed by grazing forest areas is noticeably lower than on weakly altered and not altered areas (table 4). The contribution of different guilds to the total population also changes. Before

the start of the grazing transformation, their contribution is almost equal. Then, the share of birds nesting in shelters increases, they are especially numerous at the stage of intensive grazing. At the stage of woodlands, the population is contributed mainly by the guild of birds nesting openly in the lower tiers of the forest.

Table 4

Abundance of different guilds of nesting birds in forest areas transformed by grazing
Характеристики численности разных гильдий гнездящихся птиц участков леса, трансформированных
выпасом

Guild of birds	Abundance, pair per 1km ² / abundance contribution, %			
	No grazing	Moderate grazing	Intense grazing	Woodland
Birds nesting openly and predominantly in the lower canopy tiers	158,7/30,6	180/26,1	49,8/17,4	133,3/60,9
Birds nesting openly and predominantly in the upper and middle canopy tiers	200,9/38,8	277,1/40,3	28,6/81,8	19/8,7
Birds nesting in hollows	158,6/30,6	231,3/33,6	54,0/154,7	66,5/30,4

Conclusion

Thus, the grazing transformation of the forest affects the characteristics of the nesting avifauna through the change in nesting conditions. Protective conditions change severely at the last stages of transformation. However, changes in the abundance and species composition of birds begin even with moderate impact of grazing. At the same time, the abundance of nesting birds in the transformed areas can grow both due to an increase in the number of original species and due to the appearance of new species.

The gradual reformation of the original forest bird fauna into the fauna of a semi-open light forest community begins at the stage of moderate grazing. With the transition of the forest area to the sparse forest stage, protective conditions deteriorate harshly for all forest birds nesting openly. However, for non-forest birds that prefer to nest in the lower layers, specifically for species that prefer ground nesting, thinning of the forest and thus improving lighting conditions at the level of the grass layer is a favorable factor. These changes in lighting conditions lead to the intensive development of the grass cover, which forms good protective conditions for non-

forest ground nesting birds. This lighting conditions and the development of meadow herbaceous vegetation is favorable for the sparse-forest and woodland group of birds from the guild of the lower tiers, which prefer to nest on the ground. Forest birds of this guild, for example, such as *Luscinia luscinia*, *Phylloscopus collybitus*, *Phylloscopus sibilatrix*, disappear from sparse forest areas. Only two species of ground nesting birds – the tree pipit *Anthus trivialis* and the yellowhammer *Emberiza citrinella* – are present in the avifauna of both unaffected and heavily grazed areas. Birds nesting openly in the upper and middle layers of the forest do not find suitable protective conditions for nesting in sparse forest areas. Here, only such a eurytopic representative of this guild as *Fringilla coelebs* is found. However, the abundance of this species in sparse forest areas is small.

Birds preferring to nest in shelters (hollow nesters) get some advantages at the beginning of the grazing transformation of the forest. The oppression and subsequent disease of trees initiates the emergence of new hollows, which are used for nesting. In the later stages of grazing transformation, diseased hollow trees die and fall out of the stand. The nest-

ing conditions of hollow nests are deteriorating and their abundance is decreasing.

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ТЕНДЕНЦИИ В ФОРМИРОВАНИИ ГНЕЗДОВОЙ ОРНИТОФАУНЫ ВЫПАСНЫХ ШИРОКОЛИСТВЕННЫХ ЛЕСОВ САМАРСКОЙ ЛУКИ

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Национальный парк «Самарская Лука»

Аннотация. Рассмотрено трансформирующее воздействие выпаса домашних животных на гнездящихся птиц в широколиственном лесу на территории национального парка «Самарская Лука». Параметры орнитофауны изучены для четырех этапов трансформации леса выпасом. Данная трансформация леса меняет условия обитания всех гильдий гнездящихся птиц. Вследствие этого меняется видовой состав гнездящихся птиц выпасных участков леса. Трансформация леса выпасом вызывает разнонаправленные изменения численности различных гильдий гнездящихся птиц. По мере увеличения степени измененности леса выпасом происходит снижение количества и численности лесных видов гнездящихся птиц и увеличение вклада видов опушек и редколесий.

Ключевые слова: гнездящиеся птицы, широколиственные леса, антропогенная трансформация, гильдии, видовое богатство, выпас скота.