THE EFFECT OF HETEROGENEITY LANDSCAPE ON FARMLAND BIRDS

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Abstract: Landscape structure and environmental conditions are very important factors for occurrence and survival of each animal. Traditional farming created suitable conditions for farmland birds. Landscape structure has changed extremely in the second half of the twentieth century in the Czech Republic but remained unchanged in Austria. Farmland birds are currently one of the most endangered species, therefore these birds were studied in the agricultural landscape of the Czech Republic and Austria. Point count methodology was used. The aim of the study was to determine whether the landscape heterogeneity influence on species richness and number of individuals. Homogenous agricultural landscape of the Czech Republic and heterogeneous landscape of Austria were chosen for comparison. According to the results it is evident that the heterogeneity of the landscape has a significant influence on the representation of the birds in the landscape. Heterogeneity of landscape provides for birds sufficient opportunities of shelter, food and nesting sites.

Key Words: Agricultural landscape, heterogeneity, homogeneity, farmland birds

INTRODUCTION

Birds of agricultural landscape are the most endangered species nowadays (Reif et al. 2010, Voříšek et al. 2009, Reif et al. 2006). Traditional farming created for these species favorable conditions by suppressing forests and by creating fields. Intensification of agricultural production negatively affected birds and other animals (Štefanová et al. 2012).

Conversely, major problem is also the abandonment of the landscape and the associated ingrown environment (Voříšek et al. 2009). Skylark, *Alauda arvensis* Linnaeus, 1758 is one of the most important farmland bird species. This species is affected when nesting by vegetation. The height of vegetation affects him the most (Toepfer et al. 2001).

Intensification of agriculture is associated with a reduction in the number of species in the landscape (Bonthoux et al. 2013). A big problem is the transition from traditional farming to intensive farming. Earlier meadows, orchards, cereal cultivation and forests were converted to economic plantation (Varga et al. 2013). Intensive agricultural use of grassland caused a significant decline in nesting species. Whinchat, *Saxicola rubetra* (Linnaeus, 1758) is some of the species, which is dependent on the agricultural landscape. Its decrease is noticeable with the increasing intensification (Müller et al. 2005).

The aim of this study was to compare species richness and number of individuals of farmland birds in agricultural landscape of Czech Republic, which is homogenous with agricultural landscape of Austria, which is heterogeneous.

MATERIAL AND METHODS

We used point count methodology (Bibby et al. 2000, Gregory et al. 2004). Two cross-border areas Austria and Czech Republic were selected, with average temperatures and continental and relatively dry climate. Landscapes of these areas are flat or slightly undulated. Both selected areas are predominantly agriculturally managed.

A substantial part of the territory is composed of intensively exploited vineyards and orchards. The diversity of birds has been observed in both regions in the individual quadrates. Quadrates were

equally distributed in both regions on agricultural landscape with a size of 25 ha. In each country, there were 25 quadrates spatially define (each quadrat was 500 m long and 500 m wide). Individual quadrates were separated a distance of approximately 5 kilometers (Bibby et al. 2000, Gregory et al. 2004).

Birds were monitored for 5 minutes at each point. Observation conducted during the highest activity of singing birds from 5:00 to 10:30. The survey was conducted in good weather that is without rain, fog and strong wind. Birds were designated species and their behavior was investigated, whether they are individuals or couples (Janda, Řepa 1986).

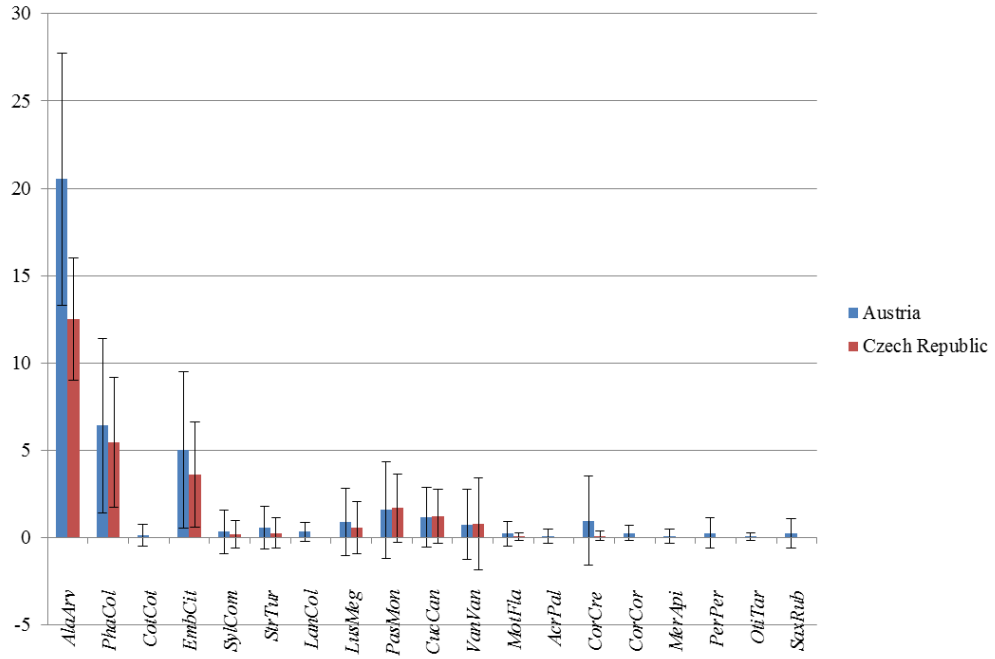
RESULTS AND DISCUSSION

Results

Species richness of farmland birds was higher in Austria. We included to the results species, which are typical of the agricultural landscape. Other species were excluded. There were 47 species of birds observed all together. We recorded 19 species of farmland birds. Other birds belonged to the categories of forest birds and birds of towns and villages.

The following figure (see Figure 1) shows that agricultural landscape of Austria had higher species richness. There were also generally more individuals in Austria. The major differences in number of individuals were observed at Skylark. Great Bustard, *Otis tarda* Linnaeus, 1758 was observed on one quadrate in Austria. This species was not observed on any of the Czech squares. We also did not record typical species such as Quail, *Coturnix coturnix* (Linnaeus, 1758) and Partridge, *Perdix perdix* (Linnaeus, 1758) in the Czech Republic. Tree Sparrow, *Passer montanus* (Linnaeus, 1758) was in balanced numbers on both sides of the border.

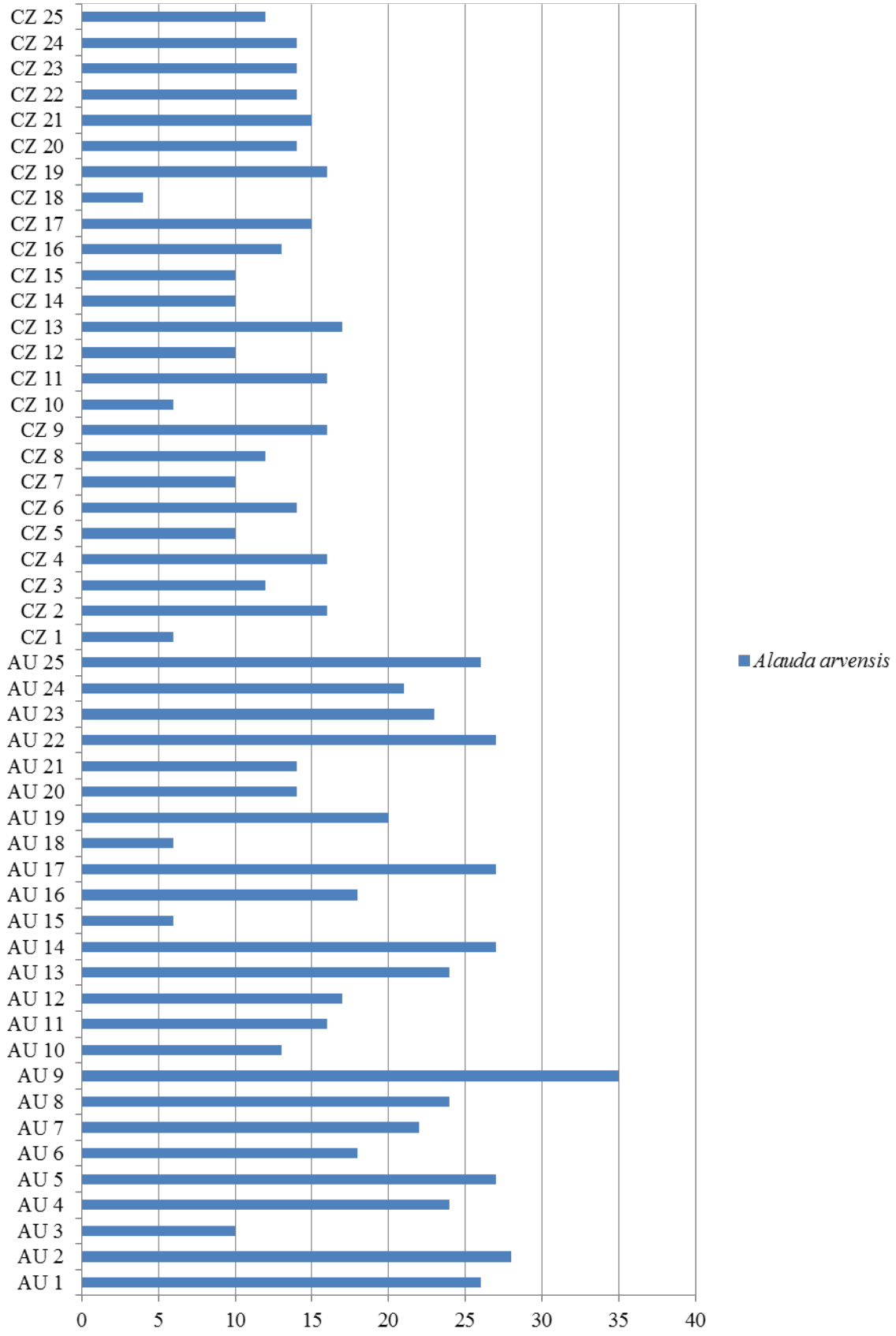
Figure 1 Comparison of the average values of the numbers of farmland birds in Austria and in Czech Republic



Legend: AlaArv – Alauda arvensis, PhaCol – Phasianus colchicus, CotCot – Coturnix coturnix, EmbCit – Emberiza citrinella, SylCom – Sylvia communis, StrTur – Streptopelia turtur, LanCol – Lanius collurio, LusMeg – Luscinia megarhynchos, PasMon – Passer montanus, CucCan – Cuculus canorus, VanVan – Vanellus vanellus, MotFla – Motacilla flava, AcrPal – Acrocephalus palustris, CorCre – Corvus corone, CorCor – Corvus corax, MerApi – Merops apiaster, PerPer – Perdix perdix, OtiTar – Otis tarda, SaxRub – Saxicola rubetra

Skylark was the most widespread species of agricultural landscape in both countries. The differences in the numbers of individuals across squares show how the landscape heterogeneity influences occurrence of this species. Skylark was abundant in Austria. Differences were reflected within a country. Skylark occurred in smaller numbers in the homogenous landscape (see Figure 2).

Figure 2 Number of Skylarks (Alauda arvensis) for all observations on various Czech and Austrian squares



Legend: CZ – Czech Republic, AU – Austria, 1, 2, 3,… - various locations

Discussion

Heterogeneity of landscape influences Skylark, which is typical species of agricultural landscape. This species is a typical representative of farmland birds (Štefanová et al. 2012). Skylark was recorded in higher numbers on the Austrian squares than on the Czech squares.

Lapwing, *Vanellus vanellus* (Linnaeus, 1758) is a species belonging to the waders. These birds are disappearing nowadays, because it is increasingly difficult for them to find a suitable nesting area. Meadows and fields experienced fewer in which they nested (Kubelka et al. 2012). Occurrence of this species was balanced on Czech and Austrian squares. The numbers of individuals were somewhat lower; it corresponds to the loss of this species. Successful breeding was observed on the Austrian side.

Heterogeneity of landscape can positively affect species richness. This is one of the some possible causes of higher species richness in a study comparing the birds in two flooded forests (Koleček et al. 2010). It is an open agricultural landscape in our study, but the results correspond to higher species richness in the heterogeneous landscape than homogenous landscape.

Our study show, how important is research, which is focused on differences in land use of agricultural landscapes and species richness.

It would be necessary to carry out this research during subsequent years. It is important to have more information for determining, which conditions are suitable for the survival of bird's populations. Long term studies of relationships of birds end agricultural landscape are needed (Bonthoux et al. 2013).

CONCLUSION

Landscape heterogeneity influences the composition and abundance of birds. Heterogeneous landscape in Austria, where the agricultural area is divided into small plots, hosts more species and mostly in higher numbers. Conversely homogeneous landscape of the Czech Republic, where the fields are often blended into one huge areas, is species-poor and birds are less numerous.

Influencing of landscape heterogeneity was evident even within the same country. Some localities in the Czech Republic, they are typically just increased heterogeneity, hosted more species and vice versa sites in Austria hosted fewer species with less heterogeneity.

Birds in a heterogeneous landscape have enough shelters, places for foraging and different environments for their nesting. They have a greater chance of resist natural enemies in these areas. The opportunity of shelter from inclement weather lacks often for birds in the homogeneous landscape. Opportunity of shelter from predators lacks also. They have a better overview in this landscape and opportunity of shelter from human activities. Farming is mechanized and birds' nests are destroyed.

Differences in the number of species and individuals were sometimes noticeable and sometimes irrelevant. The influence of heterogeneity is manifested there mainly at birds of field such as the Skylark and the Yellowhammer, *Emberiza citrinella* Linnaeus, 1758. Species such as the Great Bustard or Whinchat, Red-backed Shrike, *Lanius collurio* Linnaeus, 1758, Partridge and Quail occurred only on the Austrian side.

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