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HABITAT SELECTION OF EURASIAN WOODCOCK SCOLOPAX RUSTICOLA DURING THE SPRING MIGRATION PERIOD IN HUNGARY

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Summary: To establish a decent regulation of the hunting of woodcock in Hungary, a monitoring programme started in 2009 at a national scale. More than 900 participating observers collect data of woodcock during synchronized censuses each spring and in autumn to have basic knowledge of woodcock presence and abundance in the country. Data collecting locations were selected by the observers themselves based on their former experiences, which was primarily influenced by the former knowledge about habitat use of woodcock. Their selection of sites could primarily be influenced by the former knowledge about habitat use of woodcock. This situation offers an opportunity to evaluate this choice of habitats. In this study we investigated the habitat selection of woodcock during spring migration and we tested whether the preceding designation of observation points reflects enough knowledge about their habitat preferences.

We used four year spring observation data of the Hungarian woodcock monitoring programme based on synchronized censuses. In order to evaluate the choice of the observers, observation points were buffered with a radius of 874 meters - 2* radius of a 60 ha circle which is known to be used by woodcock individuals in the evening roding period. We intersected the buffers with the Corine Landcover map, and we compared their composition with the composition of buffers of randomly generated points.To evaluate the choice of the birds, correlation between landcover types preferred or avoided by the observers and the detections of woodcock was tested using the nonparametric Spearman correlation. In the case of forests we performed an additional analysis: We classified the buffers using 3 categories of their forest cover rates (0-45% OPEN, 45-77% MID, 77-100% FORESTED). We took 50 random samples of each forest cover rate class per year and we tested the differences among them in the number of woodcock detections and the frequencies of positive sites (where woodcock observation happened).According to our results, the locations of the observation points might not be resulted by random choice. Most landcover types preferred or avoided are also correlated with woodcock abundance. However the correlations we have found were weak. The key element of choice is the presence of forests. The higher rate of broad-leaved forests near the points can raise, the higher rate of discontinuous urban fabric or non-irrigated arable land can lower detection probability.

Key words: landcover, observation, habitat choice, survey, roding

Introduction

In most countries of Europe, Eurasian woodcock is an important small game species. In order to protect and manage the species properly, it is important to collect reliable information of the population. At present, numerous studies of breeding and wintering populations support these activities (Hoodless et al., 2009, Gossmann et al., 2012, Goncalves et al., 2012, Mongin et al., 2012, Fokin et al., 2012). Efforst for gathering knowledge are made also in Hungary, located at the southern part of the breeding area of the species (Hoodles & Saari, 1997, Ferrand & Gossmann, 2009). There are some detections every year which can be related to breeding and wintering birds, but the probability of detecting woodcocks in Hungary is much higher in spring and in autumn than in summer or in winter because many migrating individuals cross the country between their main breeding and wintering sites. Moreover, at those times the probability of sighting is also varying according to time (Schally et al., 2010). Hunting of woodcock is important also in Hungary. The legal hunting season was limited to spring between 1970 and 2008 (Faragó, 2012), but it was banned after that, due to the inconsistency with international legal regulation (79/409/EEC). In order to establish a decent regulation, a monitoring programme started in 2009 in Hungary at a national scale (Schally et al., 2010). More than 900 participating observers collect data of

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woodcock during synchronized censuses 12 times each spring and autumn, in order to have basic knowledge of woodcock presence and abundance in the country. The census method of woodcock is adapted to the cryptic behavior of the species (Ferrand, 1993, Bibby et al., 1997). The most efficient way is to visit fixed observation points during the breeding period at dusk and dawn, when the males perform display, also called roding flights (Ferrand, 1993). The data collecting locations of the Hungarian monitoring programme were selected by the observers themselves based on their former experiences within each game management unit involved in the monitoring. Their selection of sites could primarily be influenced by the former knowledge about habitat use of woodcock. This situation offers an opportunity to evaluate this choice of habitats. In this study we investigated the habitat selection of woodcock during spring migration and we tested whether the preceding designation of observation points reflects enough knowledge about their habitat preferences.

Material and Methods

Study area

Hungary is located in Central-Europe in the Carpathian basin (45–49°N, 15–23°W; Fig. 1). The size of the country is 93028 km2 (320 km N-S, 520 km W-E) (Udvarhelyi, 1973). It has continental climate, the annual average temperature was approximately 10 °C, the annual average rainfall was approximately 600 mm between 2002 and 2011 (KSH, 2013). According to the Corine landcover map (Heymann, 1993, Bossard et al., 2000, Mari & Mattányi, 2002), more than 50% of the country is arable land. The composition of forest species in the country: black locust *Robinia pseudo-acacia* – 24%, pedunculate & sessile oak *Quercus robur & Quercus petraea* -21%, turkey oak *Quercus cerris* -11%, other broad-leaved -11%, pine *Pinus sp.* – 11%, poplar *Populus sp.*- 7%, beech *Fagus sylvatica* – 6%, hornbeam *Carpinus betulus* – 5%, white poplar *Populus alba* – 4%, (MGSZH, 2010; Wisnovszky, 2011). The elevation ranges between 0 and 1000 m, approximately 80% of the country is lowland (Reuter et al., 2007). Hungary is located at the southern part of the breeding area of the species where the woodcocks are known to be breeding only at higher altitudes (Hoodles & Saari, 1997, Ferrand & Gossmann, 2009). According to the results of the ringing activities, woodcocks come from numerous directions to our country (Magyar Madárgyűrűzési Adatbank 2013).

Data collecting

We used four year (between 2009 and 2012) spring observation data of the Hungarian woodcock monitoring programme (Schally et al., 2010) based on synchronized censuses performed 12 times per season from Mid-February to the end of April. This period coincides with the breeding season; however it is shorter, because the migrating birds leave until May. The observers should follow a strict protocol for data collection. Observations were carried out weekly, each Saturday night, after sunset, and lasted 1 hours. The census method is based on roding surveys (Ferrand, 1993) which is widely used to monitor breeding populations across Europe (Saari, 2002, Fokin et al., 2004, Sandakov, 2004, Gossmann et al., 2005, Machado et al., 2008). Roding is a display flight of male woodcock. The birds are flying and calling with a whistling and croaking sound above woodland canopy at twilight in order to find and attract females to mate (Hirons, 1980). Depending on the latitude and altitude, this activity takes place between February and August, and it covers 60 to 100 hectares by a single bird (Ferrand, 1979, Hirons, 1980). One bird can display several times over the same area during the same period, so the survey method is limited to the registration of the number of contacts (woodcocks seen and/or heard). However, positive correlation was found between the number of contacts and the number of individual birds in a given area (Ferrand, 1993, Hoodless et al., 2007 Mulhauser & Zimmermann, 2010). We also analyzed the frequencies of positive sites - where at least one roding bird was detected (Ferrand et al, 2008) – which indicates the length of presence of woodcock at the sites. The data collecting locations (observation points) were selected by the observers based on their former experiences. In order to avoid counting a single bird at multiple places a minimal distance of 1500 meters was kept among the points. Their location remained the same year-by year, however not at all of the observers were able to record data in all seasons (2009: 857, 2010: 922, 2011: 922, 2012: 946 points) and occasions. For this reason we selected only the observation points of continuous 4-year data for this study, and we limited the data to 8 consecutive occasions because of the low number of cases at the early and the late occasions. We used only the data of the points from where they were available at all 8 times.

Data Analysis

In order to evaluate the choice of the observation points (between 2009 and 2012; N=202; 8 consecutive surveys per year) were buffered with a radius of 874 meters - 2* radius of a 60 ha circle which is known to be used by individuals in the evening roding period (Ferrand, 1979). This resulted 238.69 hectare sample areas. We intersected the buffers with the Corine Landcover map. We also intersected the landcover map with buffers of randomly generated points (N=202) to compare their composition with the ones of the observation points. We used chi-squared test of independence and Bonferroni Z-test for their comparison describing the site selection by the observers.

To evaluate the choice of the birds, the effect of landcover composition on detections of woodcock was tested using the nonparametric Spearman correlation. According to the results of the Bonferroni comparisons mentioned above we selected the landcover types with significant preferences and avoidances for analyses. We compared their cover rates with the mean number of contacts (summarized number of contacts per season).

In the case of forests (Corine Land Cover code – 3***) we performed an additional analysis: We classified the buffers with Jenks natural breaks classification method (Jenks, 1967) using categories of their forest cover rates (3 classes: 0-45% OPEN, 45-77% MID, 77-100% FORESTED). We took 50 random samples of each forest cover rate class per year for comparison. We used one-way ANOVA to test the differences in the number of contacts and the frequencies of positive sites in each year. Assumptions were tested with Kolmogorov-Smirnov test of normality and Bartlett test for the equality of SDs.

Spatial processing was performed using ArcGIS (v9.1) and Hawth's Analysis Tools (v3.27), statistical analyses were performed using Microsoft Office Excel 2003, and GraphPad Instat (v3.05).

Results and Discussion

We identified 21 types of land cover categories in the buffers of the observation points. The number of categories per buffers ranged between 1 and 8, the most frequent compositions contained 4 categories per buffer (27.23% of the points). The most frequent landcover types (>30% of the points contained them) of the buffers were broad-leaved forest (98.51%), non-irrigated arable land (74.26%), transitional woodland-shrub (56.93%), pastures (47.52%), and mixed forest (37.13%).

In the buffers of the random points 23 types of land cover categories were identified. The number of categories per buffers ranged between 1 and 8, the most frequent compositions contained 3 categories per buffer (20.3% of the points). The most frequent landcover types (>30% of the points contained them) of the buffers were non-irrigated arable land (86.14%), broad-leaved forest (98.51%), pastures (40.10%), and discontinuous urban fabric (51.98%).

According to the Bonferroni Z-test, the distribution of the categories in the buffers of the observation points differed from the distribution of the randomly placed buffers (Chi^2=93.53 df=20 p<0.001) (Fig. 2.). The frequency was significantly (p<0.05) higher in the case of broad-leaved forest, mixed forest and transitional woodland-shrub, and lower in the case of discontinuous urban fabric, non-irrigated arable land, fruit trees and berry plantations, and inland marshes.

We have found weak correlations between the detections of woodcock and the cover rate of discontinuous urban fabric (r=-0.1946 p<0.01), non-irrigated-arable land (r=-0.1717 p<0.05), and broad-leaved forest (r=0.1983 p<0.01).

We have not found any difference among the forest cover rate categories in the case of the number of contacts or either the frequencies of positive sites in any years.

According to our results, the locations of the observation points might not be resulted by random choice. The availability of most landcover types preferred or avoided are also correlated with woodcock abundance. However the correlations we have found were weak. The areas surrounding the points can be composed of numerous landcover types, although there are only few of higher frequencies.

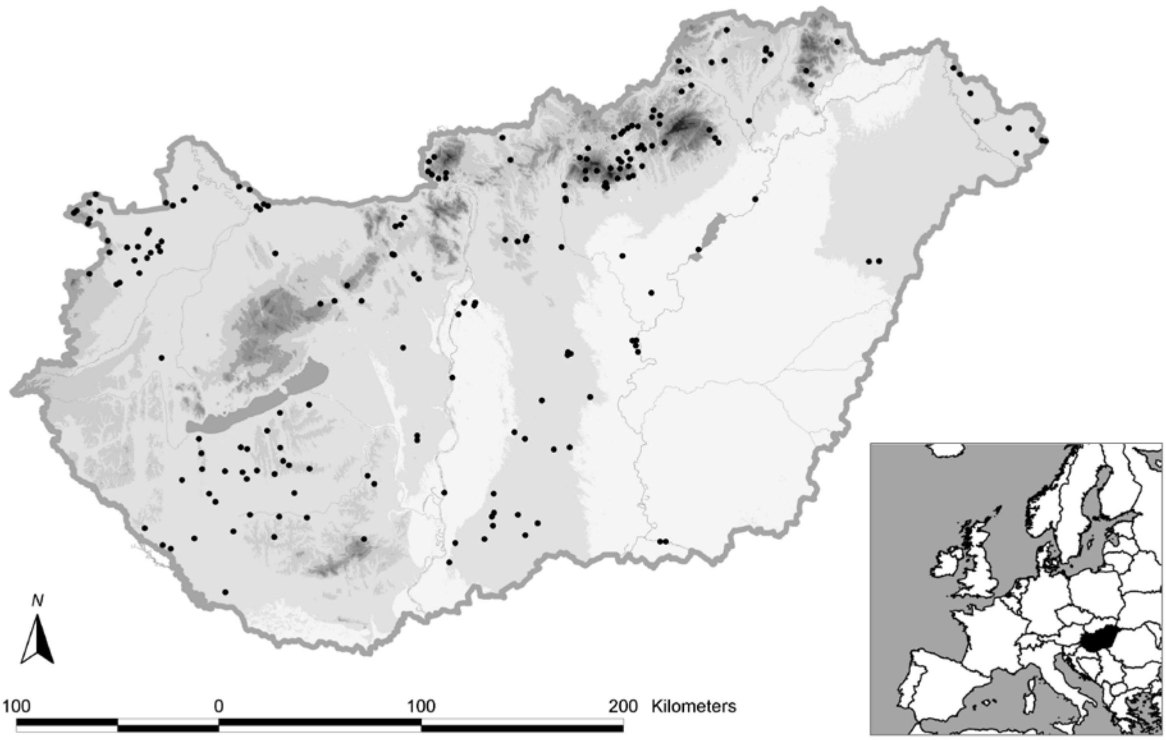

Figure 1. The observation points with continuous four-year data

Preference was detected only in the case of forested land cover types. Broad-leaved forests, mixed forests and transitional woodland-shrubs were present at higher frequencies near the observation points, which indicate higher probability of detection in their presence. Broad-laved forests are present in nearly all buffers, so it might be regarded as a key element of choice. There can be differences also in that type, like tree species or age classes, but the level of detail in the landcover data does not allow such comparisons. The presence of forest is also important in other monitoring programs. The breeding population surveys of woodcock in France (Ferrand et al., 2008) define an observation point as an open area as close as possible to the centre of a randomly chosen 2*2 centigrade (approximately 280 hectare) square in forest habitats. As another example, the sampling units of the British survey of breeding woodcock are all 1 km2 squares in the country containing at least 10% woodland (Hoodless et al., 2009).

The frequency of discontinuous urban fabric near the observation points was significantly lower than near the random points. Detection probability can be affected negatively by noise or by artificial lightning near such places, but the birds may also avoid them due to the high level of disturbance. Although the frequency of non-irrigated arable land is high in the buffers, it is still considered avoided regarding its all-over availability. Although they are easy to approach, the large, open fields may not provide suitable conditions for observation. Even if the probability of detection can be sufficient near fruit trees, berry plantations and inland marshes, their availability is very low, and in most cases they are hard access. Although pastures are known to be important nocturnal feeding sites for the species (Hoodless & Hirons, 2007), their frequency does not differ from the random occurrence. Our results show the preferences and avoidances of the observers primarily. However their choice might be strongly related to the choice of the birds.

Even if they were weak, the correlations that we have found between the number of contacts and some landcover types were significant. The presence of these types may affect not only the choice of the observers, but also the choice of woodcock.

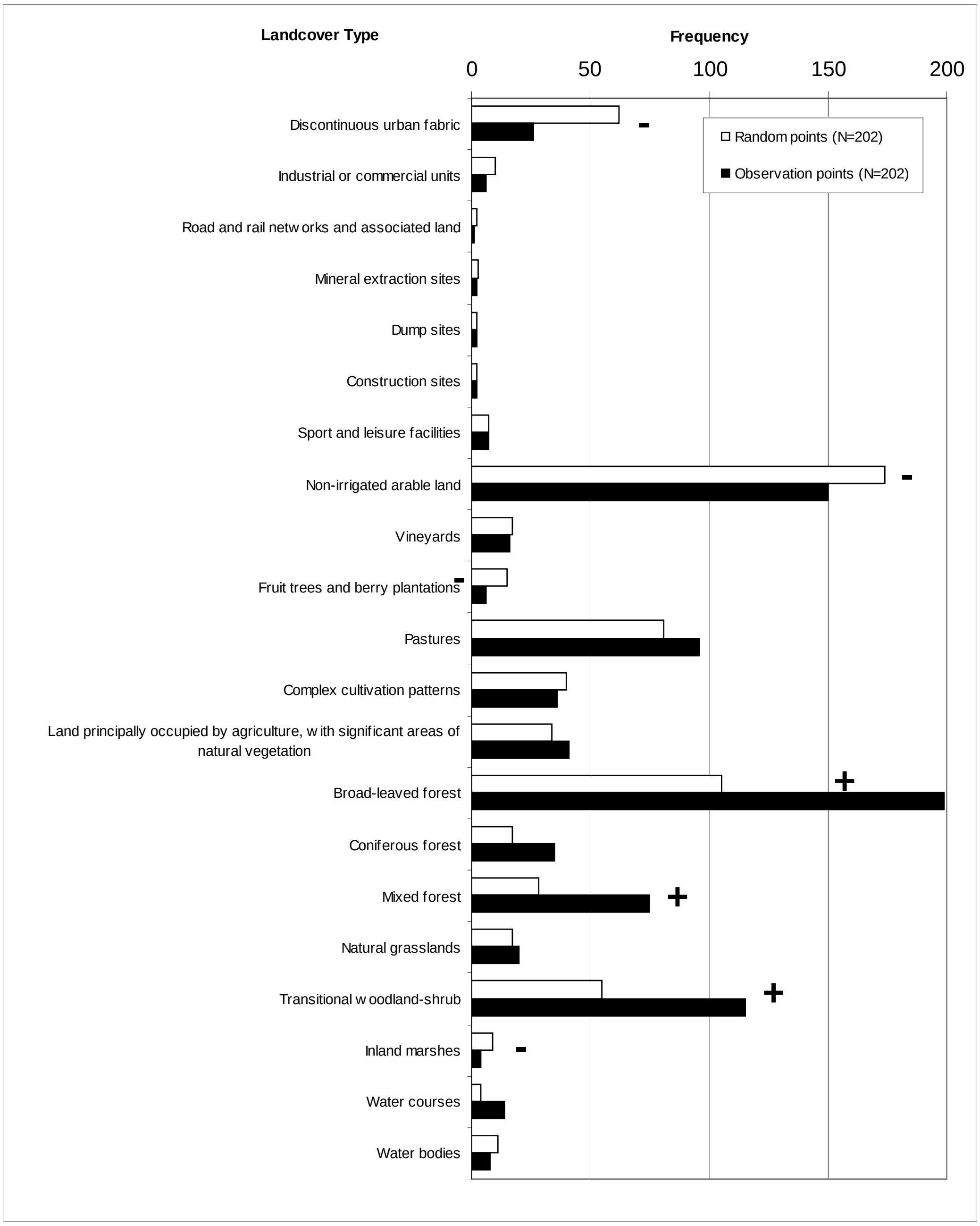

Figure 2. Frequencies of landcover types in the buffers of the observation points compared to the buffers of randomly generated points („+” indicates preference and „–„ indicates avoidance).

As the number of contacts is closely related to woodcock abundance (Ferrand, 1993, Hoodless et al., 2007 Mulhauser & Zimmermann, 2010) we conclude that the cover rate of discontinuous urban fabric and non-irrigated arable land have negative, while the cover rate of broad-leaved forest has positive effect on woodcock abundance in a particular area during spring migration period. These correlations, however, are weak, and the relations might not be casual.

Conclusion

Beside landcover composition, habitat choice of migrating woodcock might be influenced by several other factors, like weather conditions. But it is also possible that except for basic elements, like the stand of trees, no other specific needs are present. Many parts of Hungary may serve as stopover sites for this migrating species, which are very important in replenishment of their reserves by feeding (Newton, 2008). However, as they are used by the birds only for several days, their quality might not need to be as high as the quality of the sites where most chicks are raised. This can also explain the similarity among the forest cover rate categories in the case of the number of contacts or the frequencies of positive sites.

The key element of choice is the presence of forests. The higher rate of broad-leaved forests near the points can raise, the higher rate of discontinuous urban fabric or non-irrigated arable land can lower detection probability. Our results may also support building habitat suitability models for woodcock in Hungary. Although further analyses, like correlations between detections and distances from preferred or avoided sites, need more direct and detailed studies.

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