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The effect of reed burning on the habitat occupancy of passerine species

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Abstract. This paper describes observed patterns of habitat occupancy in breeding passerines in burned and unburned reed-beds during two periods of their reproductive season (May and June). In burned areas only two species, *Acrocephalus palustris* and *Saxicola torquata*, exhibited differences in habitat occupancy between the two study periods. The differences regarding average number of singing males per observation plot were significant only in the case of *Acrocephalus palustris*. In unburned areas, for all species we recorded the same average number of males per observation plot in the two study periods. We also compared the number of singing males of *A. palustris* and of *S. torquata* observed in burned and unburned areas in the second study period. In this period (June) the reed was grown, and the habitats were occupied by both species. The average number of *A. palustris* recorded in the observation plots located in unburned areas was lower than in burned areas, but the difference was not statistically significant. The average number of *S. torquata* males observed in the unburned areas was also lower than in the burned areas, again without statistical significance.

Key words: floodplains, burning of reed, habitat occupancy, passerines.

Introduction

Reed (*Phragmites australis*) is a herbaceous wetland plant, forming characteristic communities and with a wide economical and ecological importance (Haslam 1972). Reed-beds represent an important habitat for plants, invertebrates and vertebrates, including a large variety of birds, many of them endangered and vulnerable species (Valkama et al. 2008). Several studies show that reed management, including burning, has a negative effect on bird species richness (reviewed by Valkama et al. 2008), and/or abundance (Poulin 2002). In undisturbed areas, where the reed is not cut, birds can nest earlier in the breeding season, when predation rates are lower, potentially producing two broods (Graveland 1999). For these passerine species that breed twice during the reproductive season, the maintenance of populations over time depends on successfully raising both broods and therefore ensuring the survival of the maximum number of chicks per season.

Based on these previous findings, and on the need to formulate management plans for the newly designated Natura 2000 sites in Romania according to the national legislation, we wanted to examine the effects of reed burning on passerines in the partially overlapping Sighişoara-Târnava Mare SCI and Podişul Hârtibaciului SPA sites from central Romania.

In this study we aim to show the differences, if any, (1) in the habitat occupancy of passerines in two distinct periods of their breeding season (beginning of May and mid-June) in burned and unburned reed-beds; and (2) in the average number of individuals in burned and unburned areas, for species that had different habitat occupancy in the two study periods.

Materials and methods

The study area, which is entirely included in the two above-mentioned Natura 2000 sites, is located in the middle section of the Târnava Mare basin, characterized by a hilly relief, with altitudes between 420-680 m. The landscape consists of a mosaic of habitats, with deciduous forests especially on the middle and upper sections of the hills, sometimes reaching the floodplain; meadows; grasslands; pastures with varying degrees of shrub and tree-cover, mainly located on the hill slopes. Arable fields are represented only in small areas and are located especially at the bases of gentle hill slopes and in the larger floodplains of the lower watercourses. On the middle and upper sections of the valleys, where the floodplains are more narrow (20-100 m), wet meadow vegetation is present in large areas, and seasonal floods in spring are frequent due to the overflow of the brooks.

The study was conducted in spring 2007, in 17 observation plots. In the field we used point counts (Bibby et al. 2000), the observations being done in the morning, after sunrise and until 11 a.m. on days with dry weather and without strong wind. Six observation plots, each with a 56.5 m radius (1 ha), were established on the Criş Valley on surfaces with unburned reed-beds. Eleven 1 ha plots, located in reed-beds burned at different coverage levels (%) (Mean = 58.27, Median = 60, Min. = 15.00, Max. = 100, SD = 37.40, n = 11 were delimited on a tributary valley. Reed is usually burned in this area in early spring, mainly during March. The first observation period, when we compared burned and unburned plots, took place between 5 and 15 May, when the males of all migrating species were present and the newly grown reed was still short (10-15 cm). The second study period was between 10 and 15 June, when the height of the new reed was at least 1 m. We recorded total number of individual passerine males of each species exhibiting territorial behaviour.

Vegetation was measured between 1 and 10 June. The cover (%) of different vegetation types (see below) was estimated using the methodology described by Cristea et al. (2004). The average herbaceous vegetation cover (%) in this period was slightly higher in the unburned reed plots (Mean = 98.16, Median = 98, Min. = 97.00, Max. = 100, SD = 0.98, n = 6) than in the plots located in burned reed-beds (Mean = 96.00, Median = 95.00, Min. = 90.00, Max. = 100, SD = 3.75, n = 11), but the difference was not statistically significant (Mann-Whitney U test, Z =1.05, P = 0.29). The average shrub cover in the unburned reed plots (Mean = 15.50, Median = 12.50, Min. = 0.00, Max. = 40.00, SD = 13.76, n = 6) was lower than in the plots located in burned reed-beds (Mean = 19.81, Median = 20.00, Min. = 0.00, Max. = 50.00, SD = 15.53, n = 11), but the difference was again not statistically significant (t = -0.56, df = 15, P = 0.57). The average tree cover in the unburned reed plots (Mean = 1.83, Median = 0.50, Min. = 0.00, Max. = 5.00, SD = 2.48, n = 6) was lower than in the plots located in burned reed-beds (Mean = 5.81, Median = 5.00, Min. = 0.00, Max. = 15.00, SD = 4.81, n = 11), and the difference approaches statistical significance (t = -1.87, df = 15, P = 0.08).

For data analysis we used the parametric t test, in the case of normal distribution, and otherwise the non-parametric Mann-Whitney U test. Normality was checked with the Levene test. All analyses were performed with the Statistica 6 package.

We analyzed the habitat occupancy of breeding passerines in the 17 observation plots in the two study periods, in burned and unburned plots, considering the number of singing males for each species. Because the observation plots located in burned reed-beds are close to the forest edge (between 20-80 m), while those in unburned reed-beds are more distant from the forest (between 80-160 m), and because the two habitat types differed in tree cover, which might influence habitat occupancy (Farina 1997; Söderström et al. 2001; Fischer et al. 2005; Bennett et al. 2006), we did not compare the total number of bird species in burned and unburned reed-beds, but considered instead only the species that responded to reed burning (see below).

Results

In the six observation plots located in unburned reed-beds we recorded 11 passerine species (singing males) in total (Table 1). The species richness of these plots remained constant across the two observation periods. In the 11 observation plots located in burned reed-beds we recorded in total 18 passerine species (Table 1). Out of these, only two species, *Acrocephalus palustris* and *Saxicola torquata*, showed differences in habitat occupancy between the two study periods. For *A. palustris* it was a clear increase in site occupancy for burned plots: in the first study period the site occupancy was 18.18%, while in the second period it increased to 81.81%. Differences between the number of singing males in the two periods were also recorded, the number of individuals being significantly larger in June than in May (Mean = 0.27, Median = 0.00, Min. = 0.00, Max. = 2.00, SD = 0.64, n = 11 for May and Mean = 1.36, Median = 1.00, Min. = 0.00, Max. = 3.00, SD =

0.92, n = 11 for June) (t = -3.20, df = 20, P = 0.004). *Saxicola torquata* also increased its occupancy (from 36.36 % in spring to 54.54 % in summer) but showed no significant difference in number of individuals (Mean = 0.45, Median = 0.00, Min. = 0.00, Max. = 2.00, SD = 0.68, n = 11 for May and Mean = 0.63, Median = 1.00, Min. = 0.00, Max. = 2.00, SD = 0.67, n = 11 for June) (t = -0.62, df = 20, P = 0.53).

Table 1. The bird species recorded in burned and unburned areas (1 – present, 0 – absent).

	Burned	Unburned
Lanius collurio	1	1
Lanius excubitor	1	0
Troglodytes troglodytes	1	0
Locustella fluviatilis	1	1
Acrocephalus palustris	1	1
Acrocephalus arundinaceus	1	1
Sylvia communis	1	1
Sylvia curruca	1	0
Phylloscopus collybita	1	0
Saxicola rubetra	1	1
Saxicola torquata	1	1
Luscinia luscinia	1	1
Turdus merula	1	1
Parus palustris	1	1
Parus caeruleus	1	1
Parus major	1	0
Coccothraustes coccothraustes	1	0
Emberiza citrinella	1	0

As a next step, we compared the differences between the number of singing males of *A. palustris* and *S. torquata* observed in burned and unburned areas in the second study period. In this period (June) the reed was grown, and the habitats were occupied by both species. The average number of *A. palustris* recorded in the observation plots located in unburned areas (Mean = 1.33, Median = 2.00, Min. = 0.00, Max. = 2.00, SD = 1.03, n = 6) was lower than in burned areas (Mean = 1.36, Median = 1.00, Min. = 0.00, Max. = 3, SD = 0.92, n = 11), but the difference was not statistically significant (t = -0.06, df = 15, P = 0.95). The average number of *S. torquata* males observed in the unburned areas (Mean = 0.33, Median = 0.00, Min. = 0.00, Max. = 1.00, SD = 0.51, n = 6) was also lower than in the burned areas (Mean = 0.63, Median = 1.00, Min. = 0.00, Max. = 2, SD = 0.67, n = 11), a difference without statistical significance (t = -0.95, df = 15, P = 0.35).

Discussion

In the case of unburned areas, we recorded the same number of territorial males per observation plot between the two study periods. In the burned reed-beds, we found differences in the number of territorial males only in the case of two species (*A. palustris* and *S. torquata*), out of the total 18 species observed; however, differences in habitat occupancy were significant only for *A. palustris*. Contrary to other species, *A. palustris* is dependent on habitats with high vegetation (Lukač & Vujčić-Karlo 2000) like reed-beds, the disturbance of which have a negative effect on the habitat occupancy of this species. Besides nest protection, high vegetation also provides song perches for the territorial males (Lukač & Vujčić-Karlo 2000), and high visibility for females during mate selection (Jilka & Leisler 1974). We believe that after the arrival of the individuals of this species at the beginning of May (Moga pers. obs.), the most competitive males occupy the best territories, which are located in the floodplains with old, unburned reed-beds. Burned reed-beds do not provide such sheltered places, and therefore are not preferred in this period. The low average density per observation plot in unburned areas (but not significantly different from burned areas) could be explained by the fact that these males have

large territories in these areas. Young, less competitive males are pushed towards the edge of optimal habitats, into suboptimal habitats probably in the vegetation stripes with shrubs and trees along the brooks. In June males occupy smaller territories, as a result of the appearance of new, compact reed in the floodplain, which explains the higher abundance of males per observation plot. In the view of Bernstein et al. (2002), there are two major hypotheses regarding the occupation of optimal and suboptimal habitats in the case of forest avifauna in forests and woody vegetation stripes (hedgerows) located at the forest margins, or nearby the forest. According to the first one, the suboptimal habitats (vegetation stripes) are populated by individuals rejected from the large forests (optimal habitats) following intraspecific competition, these birds being obliged to nest in the improper conditions provided by such suboptimal habitats. The second concept states that birds emigrate from these suboptimal habitats to the forests during population declines or when some territories become empty, the stability of bird populations in optimal habitats being therefore dependent on the presence of those in the neighbouring suboptimal habitats. We believe that these concepts are valid also in our study, but in order to gain certainty about this issue, more intensive studies are needed regarding the reproductive success of *A. palustris* in the abovementioned habitat types.

The lack of difference in the habitat occupancy during the two study periods recorded in the case of *S. torquata* in burned areas is due to the particular requirements of this species for vegetation structure. The species prefers high, dense vegetation patches that are suitable observation points for hunting, offering a clear view of insects in the low vegetation (Magee 1965; Johnson 1971; Kinoshita 1997). Considering that not all reed has been burned in all observation plots, and that in the studied areas there are also patches with *Carex sp.* and small *Salix* spp. shrubs, this species finds good habitats even in the first study period (beginning of May), which explains the small difference in the habitat occupancy recorded for the two seasons. The fact that during the second study period we recorded a larger average number of males in the burned reed-beds than in unburned areas can be explained in the same way as for *A. palustris* (see above).

Conclusions and implications for conservation

Reed burning negatively affects the habitat occupancy of only two species in our study: *A. palustris* (statistical significance) and *S. torquata* (no statistical significance). We believe that burned reed-beds were occupied mainly by young, less competitive males that were eliminated as a result of intraspecific competition from the more suitable habitats located in unburned reed-beds.

For these passerine species that breed twice during the reproductive season, the maintenance of populations overtime depends on the success of raising both broods and therefore ensuring the survival of the maximum number of chicks per season. Therefore, in these valleys, the burning of reed should be avoided in the floodplain, and the permanent maintenance of unburned areas should be considered as compulsory in order to ensure the conservation of these species in the future.

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