University of Sopron

Theses of doctoral (Ph.D.) dissertation

Comparative studies on the habitat preferences of Hungarian woodpecker species in willow-poplar alluvial forests, infested by invasive tree species

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1. Introduction

Floodplain forests are at special risk of alien plant invasion because of the constant propagulum supply and the wet, nutrient-rich, disturbed habitats that are very suitable for invasives. Among those invasive arboreal species the green ash (*Fraxinus pennsylvanica*) and boxelder maple (*Acer negundo*) are the most common. Both species are native to bottomland hardwood riparian forests of Eastern North-America. As these species are considered to be mid-successional species, the above mentioned river control managements occurred to be beneficial to them, comparing to the native, early-successional willow and poplar species. Due to their effectively dispersed and abundant seeds, rapid growth, and allelopathic chemicals, that suppress the growth of native tree saplings, they have high influence on the species composition of floodplain forests as they hinder the renewal of native species, and so very few seedlings and saplings of native willow and poplar species can be found in such forests.

Not much is known about these relatively new, recently-formed habitats, but they have already become a widespread problem in riparian forests throughout Central Europe. They affect the processes of the forests, as well as their hole-nesting communities. As the Great-spotted Woodpecker is the most generalist woodpecker species of the Western Palaearctic region, its role is crucial for the cavity-nesting fauna of this transforming habitat. For proper future treatments, it is important to study the habitat preferences of this well-known species.

The thesis tries to enlight on the habitat utilization of different woodpecker species in willow-poplar riparian forests, infested by invasive tree species, with the special interest on the role of invasive

tree species in the habitat use of woodpeckers. The main lines of the studies were the foraging habitat segregation of different woodpecker species and the nest site, nest tree use of the Great Spotted Woodpecker, a generalist species.

Aims and questions of the research

- What are the used and preferred foraging microhabitats, used by the different woodpecker species?
- Are there any differences between the foraging distributions of the different woodpecker species and between the different study sites?
- Are there any intersexual differences int the foraging habitat use of the Great Spotted Woodpecker?
- Is the degree of the intersexual segregation of Great Spotted Woodpeckers differs between the study sites?
- What are the main vegetational characteristics of the nest sites of Great Spotted Woodpeckers in terms of tree species, condition, height and diameter at breast height?
- What are the differences of the vegetational characteristics of nest site use in Great Spotted Woodpeckers between study sites?
- Which vegetational variables and characteristics are the predictors of nest site choice of Great Spotted Woodpeckers?
- What characteristics do nest trees have?
- Are these traits differ between the study sites?

2. Matherial and methods

Census methods

Microhabitat use of different woodpecker species

Observations were made regularly on foraging microhabitat use of different woodpecker species in three study sites from 2012. Based on the protocols of similar studies, the following 9 variables were registered in each position of the foraging specimens where they occurred for at least a 5 minute observation period: tree species used, tree condition, diameter at breast height, tree height, foraging height, relative distance from trunk, branch thickness, foraging technique and substrate condition.

Tree species were classified into the following categories: willow species, black poplar and its hybrids, white poplar and its hybrids, green ash, boxelder, white mulberry and common hackberry. Tree condition was classified as living, decaying and dead trees. Diameter at breast height was registered in 10 cm intervals. Tree height was sorted by 5 m intervals. Foraging height was defined as five equal height regions in the trees and another five equal sections according to the length of the branch to register the relative distance of the given bird from the trunk. In this foraging dimension, the occurrence on the trunk was also registered. The thickness of the utilized branch was classified into 10 cm intervals. Condition of the used substrate was registered in two categories: “Living” and “Dead”. To avoid multiple encounters of a given specimen on the same day, we only registered data of birds of the same sex that occurred at least 200 m apart from each other.

Species, height, condition and diameter at breast height were recorded in 0.05 ha circular plots (12.62 m radius) marked in a 100 m by 100 m grid all over the study area during vegetation period prior to bird censuses, in the above mentioned categories.

Nest site and nest tree use of Great Spotted Woodpecker

Great-spotted woodpecker nest trees were mapped in the breeding seasons of 2014 and 2015 in two study area, as we followed the chirping begging calls of the nestlings. 8 and 12 cavity trees were mapped in one, and 10-10 nest trees were mapped in the other study site.

Characteristics of habitat were measured in 12.62 m radius circular plots (0.05 ha) centred on 20 active woodpecker nest trees and on 20 points, randomly selected from 32 semi-random plots on a 100 m by 100 m grid. Tree species, DBH (diameter at breast height), tree height and condition of each tree were recorded in every plot.

Vegetation parameters were recorded according to the above-mentioned categories.

According to the nest tree, the following variables were recorded: tree species, condition, diameter at breast height, tree height, diameter at nest height, nest height in 2 m intervals, cavity entrance orientation in 45^{o} intervals, age of the nest (new cavity or older), and substrate condition (living or dead).

Diameter at breast height distributions were made for native and invasive species.

Continuous variables were generated as follows for each nest site and random plot: stem density/ha, native tree density/ha, invasive tree density/ha, living, decaying and dead tree density/ha, density of trees

thicker than 50 cm/ha, ratio of native trees to the sum of native and invasive trees, tree species-, condition-, diameter at breast height- and tree height diversity (Shannon).

Data analysis

Microhabitat use of different woodpecker species

Distributions of each foraging dimensions were compared with Chi-square tests between the observed woodpecker species (Great Spotted, Lesser Spotted, Middle spotted and Syrian Woodpecker) in one site, in connection with Great Spotted Woodpecker, between sexes and between sites comparisons were made as well. In terms of tree species, condition, height and diameter at breast height, Jacobs selectivity indices were calculated and their distributions were compared with Chi-square tests as well.

Nest site and nest tree use of Great Spotted Woodpecker

Chi-square tests were made to compare the distributions of tree species, condition, tree height and diameter at breast height in terms of study sites and cavity trees. Sites were compared between nest sites, between random sites, and between nest and random sites of the same forest. Cavity trees were compared between the two study areas.

For cavity trees, Jacobs selectivity indices were calculated for all four above-mentioned variables in terms of the two study areas. Those indices were compared with Chi-square tests as well.

Continuous variables were compared with two-sample t tests in the above-mentioned pairs of sites.

Principal Component Analysis was used to determine the most important factors, predicting the nest sites of the Great Spotted Woodpecker in both study areas. Factor loading were calculated as well for the first three principal components, to see the correlation of the component with each continuous variable. Between-groups principal component was calculated a well, to determine the main difference between the nest sites of the two, different forest areas.

Distributions for diameter at breast height were calculated in the case of native and invasive trees for all sites. Distributions were compared with Chi-square tests in the above-mentioned pairs, and between native and invasive trees in the same site as well.

PAST 2.17c (Hammer et al. 2001) and Microsoft Office Excel 2007 softwares were used for the calculations.

3. Summary of scientific results, theses

According to the field observations, the author determined the followings:

1. The studied Great, Lesser, Middle Spotted and Syrian woodpeckers preferred the crack and white willow and black poplar hybrid trees, and avoided to forage on invasive tree species, even in the area, where the invasive trees are older as well.
2. The hybrid wild grape has high importance in the foraging habitat preference of Lesser Spotted Woodpeckers, as the species preferred this arboreal plant the most.

3. The habitat utilization of male and female Great Spotted Woodpeckers highly overlapped in terms of tree species, diameter at breast height, tree condition, foraging height, tree height, relative distance from trunk, branch thickness and substrate condition. Males used diameter at breast height, tree and substrate condition, foraging and tree height in a wider variety.
4. The tree species preference of Great Spotted Woodpecker sexes showed great difference in the case of native trees. Males avoided the smooth-barked white poplar hybrid trees (which could contain less prey items than the rough-barked black poplar hybrids), and females preferred them. This could be due to the social dominance of males over females (in unison with other studies).

According to the nest site and nest tree studies, the author determined the followings:

5. According to the Principal Component Analyses, the most important traits for the nest site choice of the Great Spotted Woodpecker were the high density of native and living trees, in contrast with the high density of invasive trees.
6. According to the Principal Component Analyses, the nest site choice of the generalist Great Spotted Woodpecker was highly influenced by the characteristics of the habitat. The nest site utilization was skewed to the higher densities of decaying and invasive trees in study area of suboptimal species composition.
7. According to the nest site survey, the Great Spotted Woodpecker used nest trees thicker than 30 cm, decaying willow or white poplar hybrid trees, with the diameter at nest height of 20-30 cm, in living substrates.

8. According to the arboreal vegetation survey, the native poplar and willow trees regenerate in an insignificant proportion in the study sites. The invasive tree species regenerate well in the study sites. This could influence the habitat preferences of the studied woodpecker species.

9. The proportion of the different diameter at breast height categories of green ash and boxelder is increasing towards the lesser diameter types.

4. Bibliography of personal publications

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