Habitat Use and Activity of Roe Deer (*Capreolus capreolus* L.) in Eastern Croatia

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Summary

The activity of roe deer was surveyed in five habitats in the Haljevo Forest (Baranja Region, Eastern Croatia), during the 1965/1966 hunting season. The aim was to compare the habitat preferences and to determine differences in the number of animals observed in the study period, by taking into account: period of the year, height of understory layer in forest stands and weight of fat deposit around kidney. The animals caught by net were marked and their activities have been observed. A total of 532 sightings of individuals were noted on all five habitats, and the abundance of roe deer was 228 individuals. During the fawning period in the spring, the highest number of animals (n=55) was recorded in black locust stand, followed by oak stands with thick understory layer (n=61) and hornbeam stands with oak (n=51). Regarding the quality of habitat as a food source, the highest number (n=196) was in the hornbeam stand with oak, compared to black locust stand (n=59) and oak stand with thick understory layer (n=20). Fitness of roe deer is estimated by measuring kidney fat from 96 culled individuals. Mean weight of kidney fat was significantly higher in the oak stand with thick understory layer (104.71 g) than in young oak stand (55.83 g). In comparison to black locust stand (81 g) and hornbeam stand with oak (96.46 g), the value was higher but not significantly higher, indicating the importance of the oak acorn in roe deer diet.

Key words

roe deer, activity, habitat, shelter, kidney fat

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Received: March 30, 2011 | Accepted: July 11, 2011

ACKNOWLEDGEMENTS
Special thanks to Mr. Đuro Nikolandić, B.Sc. of Forestry, for providing data from personal archives and for the professional help.

Aim

The ability of animals to find nutritious food and digest it in undisturbed, quiet shelter is a basic precondition for a healthy status and physiological and reproductive state of the population. The spatial distribution of individuals within the population at selected habitat determines movements for searching the suitable living places, or the abandonment of present unfavourable conditions. Roe deer (*Capreolus capreolus* L.) is a territorial species, so the population density, combined with age and sex structure, has the crucial influence on spatial distribution. Under the lower population density, groups of individuals and families are distributed at optimal habitat areas with a certain spatial distance between them. Specific distance between two individuals lies between asocial and aggressive distance. This rule also applies between different groups within a roe deer population (Nikolandić, 1971). When population density increases, distance between individuals and groups is reduced to a certain limit, after which the socially weaker individuals or groups are moving into less favourable parts of the habitat or settle the new area (Hennig, 1961; Hennig, 1962; Sägesser et al., 1966; Nikolandić, 1971; Strandgaard, 1972; Robin, 1975; Linnell et al., 1998). However, Focardi et al. (2002) stated that this is not a strict rule and in some roe deer population the abandonment of territory does not happened. The aim of the survey is to compare the preference by roe deer of five habitats in the study area, and to determine differences in the number of animals observed in the study period, taking into account the following parameters: period of the year, height of understory layer in forest stands and weight of fat deposit around kidney.

Material and methods

The survey was carried out in the Haljevo forest (Baranja Region, Eastern Croatia; GPS data: N 45^{0}43'49.21" E 18^{0}37'08.47") during the 1965/1966 hunting season. The following stands of forest vegetation were selected: black locust (*Robinia pseudoacacia*) stand; young pedunculate oak (*Quercus robur*) stand; black walnut (*Juglans nigra*) stand; pedunculate oak stand (*Quercus robur*) with thick understory layer, and common hornbeam (*Carpinus betulus*) stand with pedunculate oak (*Quercus robur*). After the net catching (Figure 1), the individuals caught were marked by neck collars (Figure 2) and released. Observations were carried out by chariots or from high seats, depending on visibility, vegetation density and path network within forest. The game was not scared, so the identification of marked animals was possible from distance of 50 – 80 meters. During the research, 532 sightings of individuals were noted on all five habitats. Abundance was calculated using the formula of Lincoln index (1930): "G = m x b/a", where: G - total number; m - total number of marked animals (86 individuals); b - number of seen animals marked and unmarked (61 individuals); a - number of seen marked animals (23 individuals).

Data on number, gender, age classes and activities of animal were recorded in the field forms, for each habitat separately. Height of understory layer in forest stands was measured on random plots for each habitat and each season. According to mean height of understory layer, the vegetation was classified into three classes: up to 40 cm, 40 – 80 cm, and above 80 cm.

Figure 1. Nets for catching roe deer

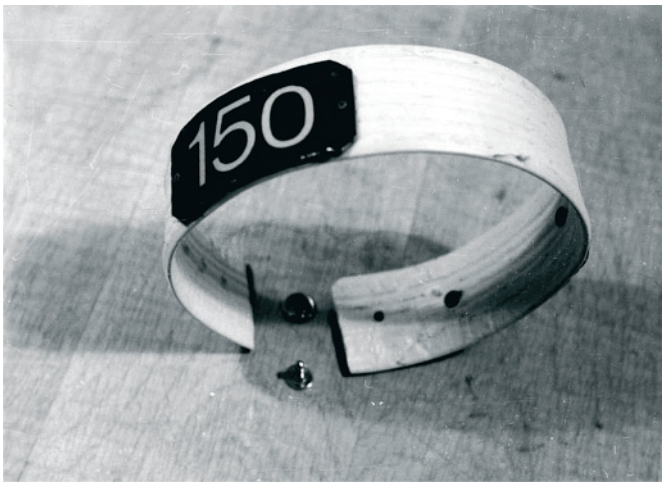

Figure 2. Neck collars used for marking caught roe deer

From a total of 96 individuals culled during the research, kidney fat was removed and measured with a scale (in grams), for each habitat separately. In black walnut stand there were no culls, so the measurement of kidney weight could not be done

Results and discussion

Related to size of the habitat required for reaching the biological needs, the wildlife species are distinguished as "territorial species" that use small, exclusive areas and "migratory species" that use large-size areas (Bolen et al., 2003).

Roe deer is a territorial species with ability for spreading and expanding its areal of dispersion continuously (Linnell et al., 1998, Hufthammer et al., 1998). The abundance of roe deer in Haljevo forest area, calculated using the Lincoln index, was 228 individuals, while the population growth rate in the study period was 1.13 to total number of seen females (Nikolandić et al., 2007). Figure 3 shows the number of roe deer seen at selected habitats

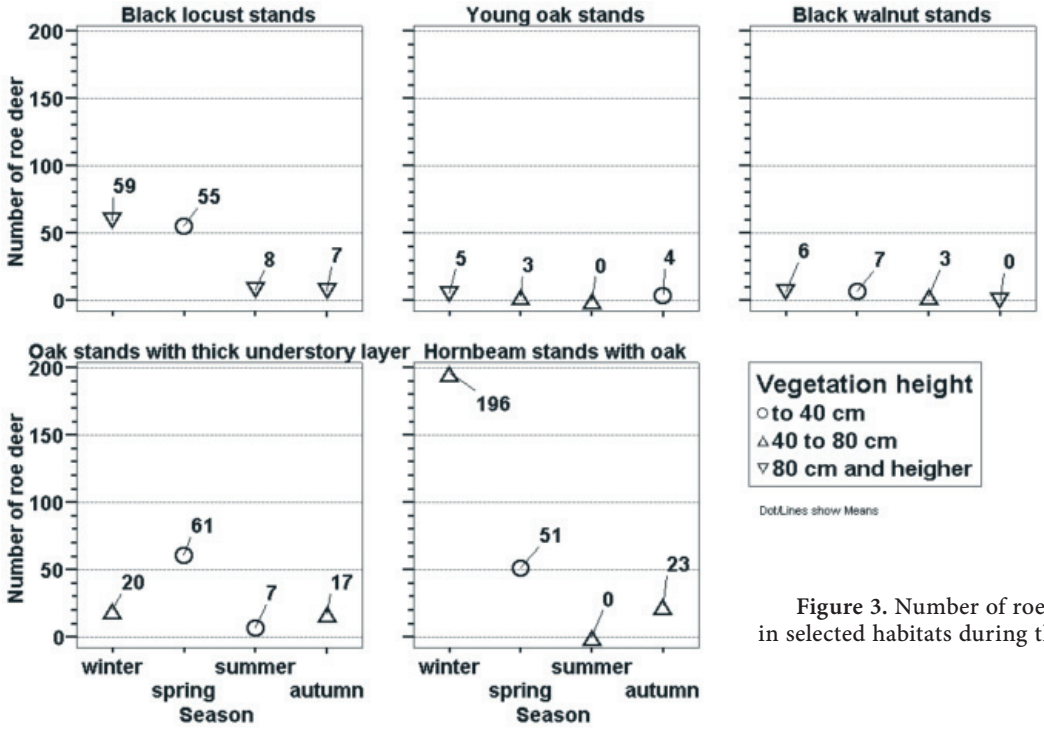

Figure 3. Number of roe deer seen in selected habitats during the seasons

during the seasons through the year. The selection of fawning place is very important, because newborn fawns stay for about three weeks in this area. Fawning place should be warm, sunny, dry and sufficiently covered with vegetation of 40 – 80 cm high, so it can provide a good shelter (Danilkin, 1996).

Roe deer doe looks for the fawning place in the period of one month before fawning. In the fawning period, which takes place in the spring, the highest number of animals (n=55) was recorded in black locust stand, followed by oak stand with thick understory layer (n=61) and hornbeam stand with oak (n=51). Less animals were recorded in black walnut stand (n=7) and young oak stand (n=3), which can be explained by poor visibility. The mean height of understory layer in black locust stand, oak stand with thick understory layer and in hornbeam stands with oak belonged to the class of vegetation up to 40 cm height. Such height provides direct exposure to sunlight, warmth and dryness for the fawn litter, and this could be the reason why more individuals are seen at such habitats. Having an adequate ground shelter in nature available whole year through is important for the existence of roe deer. To avoid the influences of food (in winter) and after fawning season (in spring), the activity of roe deer individuals connected to use of shelter could be the best observed in time of summer and autumn. Due to its small body size, the roe deer individuals have been seen equally in all habitats and all three classes of understory layer height in the survey area (Figure 3).

The quality of habitat as a food source for wildlife can be evaluated the most reliable during the winter as the severe and unpleasant part of the year. The most of the individuals (n=196) was recorded in the hornbeam stand with oak, compared to black locust stand (n=59) and oak stand with thick understory layer (n=20). The lowest number of seen animals was in black walnut stand (n=6) and young oak stand (n=5). This difference between habitats can be explained by seasonality of oak acorn yield and biomass of green pasture in black locust stand in early spring. In the same period the understory layer is dense and high (above 80 cm) in young oak stand and black walnut stand, making the visibility being reduced.

Table 1. Weight of kidney fat of roe deer from selected habitats

	Number of samples (n)	Weight (g)		
		Min	Max	Mean
Black locust stand	18	15.00	114.00	81.00
Young oak stand	12	10.00	65.00	55.83
Oak stand with thick understory layer	38	43.00	148.00	104.71
Hornbeam stand with oak	28	16.00	215.00	96.46
Total	96	10.00	215.00	91.75

In the wildlife management the general physical condition of animals is evaluated in term of fitness. Fitness of roe deer is estimated by measuring fat deposits around the kidneys, which are important for the survival in the winter and early spring period. If the spring is prolonged for two or three weeks, body functions of roe deer depends on the fat accumulated around the kidneys (Strandgaard, 1972; Stube, 1997). The results obtained on weight of kidney fat are given in Table 1.

Furthermore, a multiple comparison was made among values of mean weight of kidney fat for the selected habitats (Table 2).

Table 2. Multiple comparisons for weight of kidney fat between selected habitats

Habitat (I)	Habitat (J)	Mean difference (I-J)	Standard error	Significance	95% confidence interval	
					Lower bound	Upper bound
Black locust stand	Young oak stand	25.167	22.676	.270	-19.87	70.20
	Oak stand with thick understory layer	-23.711	17.410	.177	-58.29	10.87
	Hornbeam stand with oak	-15.464	18.382	.402	-51.97	21.04
Young oak stand	Young oak stand	-25.167	22.676	.270	-70.20	19.87
	Oak stand with thick understory layer	-48.877*	20.148	.017	-88.89	-8.86
	Hornbeam stand with oak	-40.631	20.994	.056	-82.33	1.06
Oak stand with thick understory layer	Young oak stand	23.711	17.410	.177	-10.87	58.29
	Oak stand with thick understory layer	48.877*	20.148	.017	8.86	88.89
	Hornbeam stand with oak	8.246	15.154	.588	-21.85	38.34
Hornbeam stand with oak	Young oak stand	15.464	18.382	.402	-21.04	51.97
	Oak stand with thick understory layer	40.631	20.994	.056	-1.06	82.33
	Hornbeam stand with oak	-8.246	15.154	.588	-38.34	21.85

*-The mean difference is significant at the .05 level.

Mean weight of kidney fat was significantly higher in oak stand with thick understory layer (104.71 g) than in young oak stand (55.83 g). The value was higher, but not significantly higher in comparison to black locust stand (81 g) and hornbeam stand with oak (96.46 g). Higher mean weight of kidney fat was determined in black locust stand and hornbeam stand with oak, than in young oak stands. Although there are no data available for the seasonal acorn yield in oak stand with thick understory layer and hornbeam stand with oak, as well as for biomass of the pasture in black locust stand, the results suggests that these factors make an advantage to habitats, being more preferable for roe deer.

Conclusions

During the roe deer fawning period in the spring, the highest number of observed animals was recorded in habitats selected in black locust stand, oak stand with thick understory layer and hornbeam stands with oak.

The individuals of roe deer were observed whole year through in their adequate shelter, comprising all selected habitats and all classes of understory layer height in the survey area.

Assessment of habitat as a food source is the most applicable in the winter period, when the living conditions are unpleasant to roe deer. During the winter, the most of the individuals were observed in the hornbeam stand with oak.

Mean weight of kidney fat could be applied as an indicator for fitness of roe deer. It was significantly higher in oak stand with thick understory layer than in young oak stand. In comparison to black locust stand and hornbeam stands with oak, the value was higher but not as significant. The results suggest that seasonal acorn yield and biomass of the early spring pasture makes an advantage to habitats being more preferable for roe deer.

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