DOI: <http://dx.doi.org/10.15679/bjwr.v1i1.4>**HABITAT PREFERENCES OF GAME ANIMALS IN TWO SELECTED HUNTING GROUNDS IN THE SAVA RIVER BASIN IN CROATIA***Ozimec S.,¹ Kovačević J.¹, Kulić A.¹, Florijančić T.¹, Bošković I.¹*

Summary: Composition, distribution and suitability of habitats for managing game species was analyzed and compared for two selected hunting grounds in the Sava River basin floodplain in Croatia. The first is III/28 “Posavina Forests” (surface of 14.071 ha), and the second is XII/107 “Garčin” (7.496 ha). Anthropogenic impact on landscape and biodiversity is stronger in “Garčin” since 65% of habitats belong into class of cultivated land. In “Posavina Forests” the percentage of these habitats is 23%. Comparison of forests habitats showed higher value (57%) in “Posavina Forests” while in “Garčin” it is 28%. Forest habitats comprise mainly deciduous mixed forests of pedunculate oak and common hornbeam; pedunculate oak, black alder and field ash forests. Patchy distribution of open, large agricultural surfaces with grasslands, thickets, forests and channels in “Garčin” hunting ground enables management of roe deer, the European hare and pheasant as the main hunting game. More forested „Posavina Forests“ hunting ground, with lack of open habitats, has good conditions for management of red deer, roe deer and wild boar. Negative impact of flooding is more frequent in the “Posavina Forests”. During some extreme events about 80% of the hunting ground can be flooded, which cause mortality and migration of game. Thus, the appropriate mitigation measures in game management needs to be planned.

Key words: habitat, hunting ground, game, Croatia

Introduction

Game resources are regarded as valuable natural resources. Although the benefits from the existence of game animals are mainly related to hunting activities, it can be a valuable income in the rural economy (Tsiantikoudis et al. 2013). The number of hunting grounds in the Republic of Croatia is 1,060 with total surface of 5,012,905 ha (Florijančić et al. 2010). They are established for breeding, protection and hunting the game, with an aim to protect and preserve natural and ecological balance of the natural habitats, game animals and wild fauna and flora (Anonymous 2005). Characteristics and quality of habitat are most important elements for the management with game animals in each of the hunting grounds. Use of the procedure for solvency scoring and determination of hunting productive surfaces in hunting grounds (Anonymous 2006) requires specific knowledge on real presence of habitat types, their structure, distribution and ratio between natural and artificial habitats. Following this evaluation it is possible to calculate hunting productive surfaces, domicile game stock and capacity of hunting ground for particular game species.

According to Croatian Nature Protection Act (Anonymous 2013), habitat is „unique functional unit of terrestrial or aquatic ecosystem, defined by geographical, abiotic and biotic features; all habitats of a type constitute a single habitat type.” The protection of habitats makes an integral part of the nature protection in the European Union and each member state is obliged to establish national ecological network, identify, describe and map the sites which represent particular habitat type, assess the degree of threat, propose conservation and protection measures and determine other relevant facts. Habitat types are described through the system of habitat classification.

¹Siniša Ozimec, PhD, assistant professor; Josip Kovačević, graduate student; Antonio Kulić, graduate student; Tihomir Florijančić, PhD, full professor; Ivica Bošković, PhD, assistant professor, University Josip Juraj Strossmayer in Osijek, Faculty of Agriculture, Kralja Petra Svačića 1d, HR-31000 Osijek, Croatia

Corresponding author: Siniša Ozimec, PhD, Assistant Professor, Faculty of Agriculture, Kralja Petra Svačića 1d, HR-31000 Osijek, Croatia; E-mail: sinisa.ozimec@pfos.hr

Material and Methods

The Sava River basin covers an area of 97,713 km², of which 25,374 km² or 26% comprises the area of the Republic of Croatia. With total length of 945 km, the Sava River is the longest right-bank tributary of the Danube River and the second longest after the Tisza River. The length of the Sava River course in Croatia is 510 km, and 45.2% of national territory belongs into the Sava River basin (Komatina 2010). Along the Sava River course in Croatia, there were 16 identified sites important for biodiversity, related to species and habitats listed in the EU Birds and Habitats Directives. Their total surface is 1,807 km² or 7% of total area of the Sava River basin in Croatia (Anonymous 2009).

Two hunting grounds located in the Sava River basin floodplain: III/28 “Posavina Forests” and XII/107 “Garčin” (Figure 1) were chosen for analyses and comparison of habitat composition, distribution and suitability for living and breeding of main game animal species. Both of the hunting grounds are characterized with different relief and hydrological conditions, size of the forest complexes and intensity of the human impact on land, habitats and nature.

Figure 1. Geographical locations of the analyzed hunting grounds (1) = hunting ground III/28 “Posavina Forests”; (2) = hunting ground XII/107 “Garčin”

Hunting ground III/28 “Posavina Forests” is located western from the course of the Una River and south of the Sava River, which right bank (from 521 to 574 river km) makes the border. According to relief characteristics it is typical lowland hunting ground, with altitude range from 92 to 105 m above sea level. Total surface of hunting ground is 14,071 ha, of which 11,423 ha (81%) are surfaces suitable for hunting management.

Mean air temperature in the period: 1971-2000 is 11.0 °C, with minimum in January (0.5 °C) and maximum in July (21.2 °C). Annual amount of precipitation is 876 mm; maximum of 95 mm is recorded in June, while minimum (48 mm) occurs in February. Mean number of days with snow cover is 35 days (Zaninović et al. 2008).

Hunting ground XII/109 “Garčin” is located in the eastern part of Brodska Posavina region. This is typical lowland hunting ground with altitudinal range from 84 to 119 m above sea level. Total surface of hunting ground is 7,496 ha, of which 90 % are surfaces suitable for hunting management.

Mean air temperature in the period: 1971-2000 is 10.7 °C, with minimum in January (-0.2 °C) and maximum in July (21.0 °C). Annual amount of precipitation is 748 mm; maximum of 88 mm is recorded in July, while minimum (39 mm) occurs in February. Mean number of days with snow cover is 31 days (Zaninović et al. 2008).

Main sources of data were Hunting Management Plans for both of the analyzed hunting grounds (Crkvenac 2005, Žalac and Abramović 2005) valid for ten year period, from 1 April 2006 to 31 March 2016. These documents contain data, such as: structure of land surfaces; description of vegetation and habitats; assessment of habitat quality and scoring the solvency of the hunting ground for game animals (Anonymous 2006); actual status of the wild animal species, population structure and guidelines for management with game animals. Field observations were carried out in October, 2010 and June, 2013.

National habitat classification of Croatia (Anonymous 2014) defines eleven main habitat classes, each divided into four lower levels of habitat types, as it is presented in Table 1. The first eight classes contain most of the natural and semi-natural types of habitats and ecosystems, while three contain various anthropogenic habitats. Habitat types in the hunting grounds were identified and classified according to division and nomenclature set up in the Guidebook for the National Habitat Classification of the Republic of Croatia (State Institute for Nature Protection 2010).

Table 1. Main habitat classes according to National Habitat Classification of Croatia (Anonymous 2014)

Habitat type code	Name of the main habitat class
A	Inland surface waters and wetlands
B	Unvegetated and sparsely vegetated land surfaces
C	Grassland, bogs and tall herbs
D	Scrubs
E	Forests
F	Sea coast
G	Marine habitats
H	Underground habitats
I	Cultivated non-forested land and habitats with weeds and ruderal vegetation
J	Constructed and industrial habitats
K	Complexes of habitats

Results

Composition of the habitat types and comparison between hunting ground III/28 “Posavina Forest” and XII/107 “Garčin” is presented in Chart 1.

Habitats from the class A, Inland surface waters and wetlands, with total of 97 ha makes 0.85% of hunting productive surfaces in hunting ground “Posavina Forests”. Permanent watercourses are the Sava and the Sunja Rivers, and streams: Jastrelica, Turija, Velika Obreška, Mala Obreška and Rastovica.

Standing water bodies with wetland features are old oxbow lakes: Dražiblato, Dedun and Stara Sava in Crkveni Bok, which are former side-arms of the Sava River. Drainage canals are also present in the hunting ground. In the hunting ground XII/107 “Garčin”, habitats from class A occurs on 97 ha (1.44%), of which 82 ha makes artificial network of drainage canals: Mantek, Glovac, Svržnica, Luganovica, Gardun and Lateralni kanal. Streams: Biđ, Papak and Duboki potok belongs into permanent watercourses.

Chart 1. Composition of main habitat types and comparison between hunting grounds III/28 “Posavina Forests” and XII/107 “Garčin”

Percentage of meadows and pastures (class C) which are semi-natural habitats (Blasi et al. 2009), is more higher (23.79%) in the hunting ground III/28 “Posavina Forests”, compared to 5.42% in the hunting grounds XII/107 “Garčin”. In the first hunting ground, ecological and spatial conditions are more suitable for the lowland hay meadows (alliance *Arrhenatherion elatioris*), present also in the second hunting ground, and moderately humid pastures from the alliance *Cynosurion cristati*.

Regarding the forest habitats (class E), they are dominating in the hunting ground III/28 “Posavina Forests” (8,066 ha or 70% of total hunting productive surface), while in the hunting ground XII/107 “Garčin” forest habitats are present on 1,902 ha or 28.2%.

Reduced forest cover in the second hunting ground indicated long and strong anthropogenic impact on land and extensive exploitation of forests in the past. Rauš et al. (1985) reported that in the north-eastern Croatia forests covered 70% of area in 1750; 60% in 1850; 28% in 1961, and today is about 30%.

The most of the forests belongs into following habitat type classes: E.2 Floodplain forests of pedunculate oak (*Quercus robur*), black alder (*Alnus glutinosa*) and narrow-leaved ash (*Fraxinus angustifolia*); E.3 Forests of deciduous oaks outside the reach of floods, with specific forest of pedunculate oak and common hornbeam (*Carpinus betulus*). Those forests in Croatia grow in lowland areas with relatively high groundwater. In silvicultural terms, these are high regular stands managed in rotations of 140 years (Vukelić 2012).

Cultivated land (class I) is dominant in hunting ground XII/107 “Garčin” with 4,389 ha or 65.2% of total hunting productive surface. It is mainly ploughed land with various crops, such as: maize, wheat, barley, oilseed rape and sugar beet. This habitat class also includes various weed and ruderal vegetation.

Cultivated land is not distributed as large open plots, but it is mixed with small forest stands, thickets and grasslands. Ozimec et al. (2000) surveyed habitat composition in the open hunting grounds in the Baranja region (north-eastern Croatia) and reported 88% of agricultural land, 8% waters and canals and 4% forests. Due to domination of forest habitats, and less human settlements in the hunting ground III/28 “Posavina Forests” cultivated land is present on 549 ha or 4.8%.

Based on available data from the Hunting Management Plans, status of populations of main game species which can be managed in the analyzed hunting grounds is given in Table 2.

Table 2. Status of main game animal populations in the analyzed hunting grounds (Crkvenac 2005; Žalac and Abramović 2005)

Game species	III/28 “Posavina Forest”	XII/107 “Garčin”
	Number of individuals	
Red deer (<i>Cervus elaphus</i>)	100	-
Fallow deer (<i>Dama dama</i>)	60	-
Roe deer (<i>Capreolus capreolus</i>)	180	100
Wild boar (<i>Sus scrofa</i>)	100	6
European hare (<i>Lepus europaeus</i>)	150	160
Common pheasant (<i>Phasianus colchicus</i>)	200	280
Wild ducks (<i>Anas</i> sp.)	300	70

Lowland conditions and dense cover of deciduous forest in the hunting ground III/28 “Posavina Forests” are favorable for breeding big game species, such as: red deer, fallow deer, roe deer and wild boar. Frequent spring and autumn floods have direct negative impact on wildlife within this hunting ground. During extreme events about 80% of the hunting ground can be flooded which cause mortality and migration of game. So, the appropriate mitigation measures need to be planned.

Patchy distribution of open agricultural land with grasslands, thickets, less forests and canals in hunting ground XII/107 “Garčin” enables breeding of roe deer, the European hare and pheasant as the main hunting game. During the summer time, roe deer prefers to stay on cultivated land and it is adapted for living at open field habitats (Tucak et al. 2002).

Conclusion

Characteristics and quality of habitat are most important elements for the efficient management with game animals in the hunting grounds. High habitat diversity is pronounced in the Sava River basin floodplain in Croatia. Habitat preferences of game animals depends on composition and distribution of aquatic, wetland, forest and grassland habitats, as well as on presence of the artificial habitats, created and sustained by the human activities.

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