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short communication

Connection between prey composition and the landscape structure in the hunting area of Barn Owls (*Tyto alba*) in Baranja (Croatia)

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Abstract

Background and purpose: *The assumption that the species composition and the relative abundance of small mammals in pellets of Barn Owls reflects the landscape structure of the hunting area is tested, based on habitat preferences of small mammals identified from pellets collected in the hilly and lowland parts of Baranja county (Croatia).*

Materials and methods: *During 2007 we collected 2395 whole pellets and their fragments in 21 localities, from which 6613 prey remains were identified as belonging to small mammals (99.5%) of 23 species. The correlation between the relative abundance of mammal species and landscape structures (habitat types and landscape features) was tested.*

Results: *There was a significant correlation between the relative abundance of seven small mammal species and the proportion of particular landscape structure classes. The number of small mammal species showed a negative correlation with the area of inland marshes. The evenness of the small mammal fauna grew with the mosaicity of landscape and the length of the borders in the owl's hunting area. In the total prey the Common Vole* (Microtus arvalis) *dominated with more than 62%, which indicates its population outbreak. The diversity and evenness of small mammals in the hilly and lowland regions did not differ.*

Conclusions: *We found significant correlations between the relative abundance of some small mammal species and the landscape structure classes in the owls' hunting area. Our results suggested that the diversity of small mammals increases as the mosaic of the landscape increases, while the degree of population outbreak of the Common Vole decreases. These relationships should be taken into consideration when designing landscapes or changing land use.*

INTRODUCTION

The Barn Owl (*Tyto alba*) is an opportunistic predator with highly variable food composition comprising mainly small mammals *(1)*. The composition and abundance of the small mammal communities of the Barn Owl's hunting area can be influenced by landscape structure *(2)*. By examining the diet of Barn Owls we can make conclusions about the landscape structure of their hunting area, as the abundance of small mammal species from pellets reflects the distribution of their habitats *(2, 3)*. Owl pellet analysis is therefore not only used to better understand the diet of owls, but also as an indirect method for small mammal fauna surveys and more often in ecological studies. Kross et al. *(4)* suggested that in a hunting area with different crop types the ratio of small mammal groups in Barn Owl pellets differs. Milchev et al. *(5)* found that higher predation of wetland mammal species correlated with an increasing size of wetland habitats in the Barn Owl's hunting area. Using such correlation allows making decisions which can help in the protection of the landscape and the small mammal communities living in the area *(6)*.

The aim of our study was to collect as many Barn Owl pellets as possible at its nesting and roosting sites within a single year in Baranja in order to find correlations between the relative abundance of prey species and the distribution of habitat types in the hunting area around the sampling sites. Furthermore, our aim was to examine whether the abundance of preyed small mammal species reflects the differences in landscape structure between the hunting areas of the edge of Bansko Hill and the lowland region of Baranja.

MATERIAL AND METHODS

Baranja is a mostly flat region in the north-eastern part of Croatia (Figure 1), enclosed by the rivers Danube and Drava, covering 1147 km^2 *(7)*. The region is characterised by typical agricultural landscape (48% of Baranja) with remnants of the natural vegetation including oak-hornbeam forests and wooded steppe fragments, as well as with gallery forests along the two big rivers *(8)*, thus about 20% of its area is covered by forests *(7)*. In the northern part of Baranja, Bansko Hill (highest point is 243 m a.s.l.) stretches in an east-west direction, with vineyards on the plateau and in the southern slopes, but in the marginal steep areas there are natural vegetation fragments *(8)*. In the large part of Baranja's lowland region (about 8,000 hectares), melioration works were started more than a century ago, and for that reason 135 km of dams and a network of canals with a total length of 1056 km were built. The climate is temperate continental with significant fluctuations in temperature, thus in January and February the temperature may drop to as low as -29 °C, while in July and August it may exceed 32 °C. Average annual rainfall is low, 640 mm *(7)*.

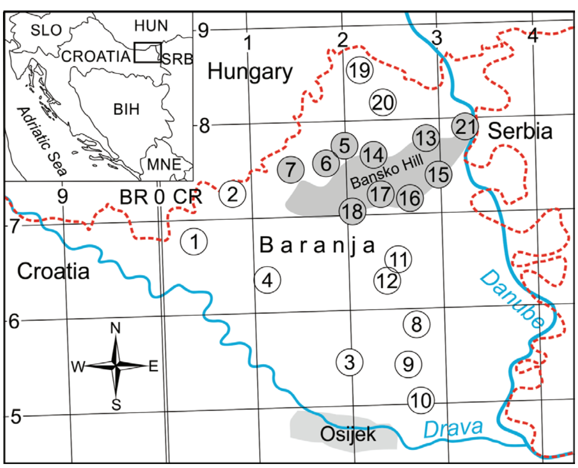

Figure 1. *Barn Owl pellet sample sites in the Baranja region (grey circles – sites around the Bansko Hill area; white circles – sites in the lowland area): 1 – Majške Međe, 2 – Luč, 3 – Darda, 4 – Jagodnjak, 5 – Branjina, 6 – Popovac, 7 – Branjin Vrh, 8 – Lug, 9 – Vardarac, 10 – Kopačevo, 11 – Jasenovac, 12 – Grabovac, 13 – Draž, 14 – Podolje, 15 – Zmajevac, 16 – Suza, 17 – Kotlina, 18 – Kamenac, 19 – Duboševica, 20 – Topolje, 21 – Batina*

Barn Owls pellets and their fragments were collected from the nesting or roosting sites (Figure 1, Appendix 1a, 1b). The numbers of specimens extracted from one pellet were determined based on the number of skulls and the related mandibles. The taxonomic determination of small mammals was performed on the basis of skull and mandible parameters *(3)*.

The diversity of small mammals in each sampling site was characterised by Shannon's diversity index (H) and by their evenness (J) (9). For landscape structure and mosaic analysis we used the 1: 50 000 map of the CORINE Land Cover Project from 2006 *(10)*. On this map circular areas with 2 km radius around the sampling sites were considered as the hunting areas of Barn Owls *(3)*. In these circles we examined the distribution of CORINE land cover habitat classes (e.g. broad-leaved forests, inland marshes, vineyards etc.) as types of landscape structure (Appendix 2), using the QGIS program. The landscape mosaic was calculated as the number of patches within the 2 km radius circle. In the edges of Bansko Hill (hilly area) and the lowland area of Baranja, the ratios of each class of landscape structure and the relative abundance of small mammal species in the sampling sites were compared using Mann-Whitney U test (Z) *(9)*. The correlation between landscape mosaic and the diversity of small mammals was analysed by Spearman's rank correlation *(9)*. Subsequently, using the same method we investigated the correlation between the ratios of each landscape class, mosaic, length of borders and the relative abundance of small mammal species, with only significant correlations taken into consideration.

RESULTS AND DISCUSSION

Altogether 2395 Barn Owl pellets and its fragments were collected from 21 settlements of Baranja in 2007 (Figure 1). There were 1211 pellets collected in the settlements from the edge of Bansko Hill, and similar number, 1184 pellets from the lowland area of Baranja. Totally 6613 prey remains were identified from the Barn Owls pellets. Altogether 99.5% of the prey consisted of small mammals, while the remaining 0.5% was made up by birds, frogs and insects (Table 1). The analysed Barn Owl pellets yielded 6581 small mammal individuals of 23 species (Table 1). From the edge area of the Bansko Hill 3323

Table 1. *Numbers and the relative abundances of prey specimens in the pellets of Barn Owls summed in the two areas and in the whole Baranja*

	Hilly area		Lowland area		Total	
	N	%	N	%	N	%
Crocidura leucodon	156	4.67	67	2.05	223	3.37
Crocidura suaveolens	211	6.32	152	4.64	363	5.49
Sorex araneus	77	2.31	45	1.38	122	1.84
Sorex minutus	8	0.24	9	0.28	17	0.26
Neomys anomalus	44	1.32	46	1.41	90	1.36
Talpa europaea	0	0.00	2	0.06	2	0.03
Eptesicus serotinus	0	0.00	1	0.03	1	0.02
Plecotus austriacus	1	0.03	0	0.00	1	0.02
Muscardinus avellanarius	4	0.12	2	0.06	6	0.09
Microtus lavernedii	0	0.00	7	0.21	7	0.10
Microtus arvalis	1887	56.51	2251	68.75	4138	62.56
Microtus subterraneus	10	0.30	5	0.15	15	0.23
Arvicola amphibius	16	0.48	20	0.61	36	0.54
Myodes glareolus	11	0.33	6	0.18	17	0.26
Cricetus cricetus	1	0.03	0	0.00	1	0.01
Apodemus agrarius	277	8.30	179	5.47	456	6.89
Apodemus flavicollis	127	3.80	120	3.67	91	1.39
Apodemus sylvaticus	49	1.47	42	1.28	247	3.74
Apodemus uralensis	1	0.03	1	0.03	2	0.03
Apodemus sp.	125	3.74	58	1.77	183	2.77
Micromys minutus	52	1.56	30	0.92	82	1.24
Mus musculus	104	3.11	77	2.35	181	2.74
Mus spicilegus	137	4.10	84	2.57	221	3.34
Mus sp.	3	0.09	4	0.12	7	0.10
Rattus norvegicus	21	0.63	44	1.34	65	0.98
Rattus sp.	1	0.03	6	0.18	7	0.10
Aves indet.	14	0.42	14	0.43	28	0.42
Pelobates fuscus	0	0.00	1	0.03	1	0.02
Anura (*Rana* sp.)	1	0.03	0	0.00	1	0.02
Gryllotalpa gryllotalpa	0	0.00	1	0.03	1	0.02
Coleoptera indet.	1	0.03	0	0.00	1	0.02
Prey	3339	100.00	3274	100.00	6613	100.00

individuals were identified, and 3258 from the lowland region of Baranja, thus the numbers of prey did not differ considering the pellets collected from the two areas. There was no difference (Z = 0.53, p = 0.60) between the diversity of small mammal species at the edge of the Bansko Hill (1.31) and the flat region (1.41), and evenness values (0.39 and 0.37 respectively) did not show any significant difference either (Z = 0.95, p = 0.35). The distribution of prey species on the edge of the Bansko Hill did not differ from that of the lowland region: the most common species was the Common Vole (*Microtus arvalis*), with proportions 56.14% and 69.73% of the prey, respectively (Table 1, Appendix 1a, 1b). Baranja is a mostly agricultural region *(7)*, which is reflected in the species composition of

Table 2. *Significant correlations found between relative abundance of preyed small mammal species and the landscape features in the Barn Owl's hunting area*

Species	CORINE land cover (code)	Rs	P
Crocidura leucodon	Pastures (231)	0.682	0.001
	Complex cultivation patterns (242)	–0.442	0.045
	Landscape diversity	0.445	0.043
Neomys anomalus	Land principally occupied by agriculture with significant areas of natural vegetation (243)	0.474	0.030
Sorex araneus	Water courses (511)	–0.453	0.039
Muscardinus avellanarius	Discontinuous urban fabric (112)	–0.497	0.022
Microtus lavernedii	Broad-leaved forest (311)	–0.448	0.042
Microtus arvalis	Border	–0.467	0.033
Myodes glareolus	Non-irrigated arable land (211)	0.522	0.015
	Mosaicity	–0.498	0.022

its small mammal fauna. The high dominance of the Common Vole supports the assumption that intensive agriculture favours generalist, highly adaptive species, and sometimes leads to its population outbreak, while it negatively influences the density of rare specialist small mammal species *(6)*. The proportion of Common Vole in the pellets collected in 2007 exceeded 62%, which is clearly a consequence of population outbreak. This can be supported by the results of studies performed in 2008 and 2009 in some parts of Baranja when the proportion of these species in the pellets was only 27% and 34%, respectively *(11)*. The Common Vole is the best-known vertebrate agricultural pest in Europe, capable of causing a significant economic damage in a population outbreak period *(12)*. Owls can play an important role in controlling its populations, thus indirectly in the reduction of damage caused to agriculture *(13)*.

The analysis of the landscape structure of the hunting area of Barn Owls showed that vineyards (Z = 2.913, P = 0.020) and the broad-leaved forests (Z = 2.56, P = 0.013) covered significantly larger area on the edge of Bansko Hill than in the lowland region, where the non-irrigated arable lands (Z = -2.37, P = 0.016) dominated. The landscape mosaic of hunting areas was significantly greater (Z = 3.29, P = 0.001) on the edge of Bansko Hill than in the mostly homogeneous agricultural lowland area. Correlation was shown between the proportions of the landscape structure classes in the hunting areas and the relative abundances of seven prey species (Table 2.).

In our study the positive correlation between the relative abundance of the Bicoloured Shrew (*Crocidura leucodon*) and the total area of pastures was shown. This is in accordance with the previous knowledge on habitat preferences (open agricultural areas and dry grasslands) of this species in Central Europe *(14)*. We also found a positive correlation of the relative abundance of this species with the diversity of the landscape. The increasing diversity of landscape structures offered more suitable habitats that resulted in higher abundance of this species. The proportion of Bicoloured Shrews was lower in the sampling sites surrounded with a larger area occupied by the complex cultivation pattern (small arable lands, orchards and gardens), thus the correlation of its relative abundance with the area of the complex cultivation pattern was negative (Table 2), which can be explained with the fact that these are not typical habitats for this species *(14)*. In our study a positive correlation between the relative abundance of Miller's Water Shrew (*Neomys anomalus*) and the total area of agricultural lands with significant areas of natural vegetation was shown (Table 2). This can be explained with the presence of wetlands along the canals in the agricultural area *(7)*, which provide suitable habitats for the individuals of this species, since it commonly occurs near slow-flowing waters and in marshes. A negative correlation was detected between the relative abundance of the Common Shrew (*Sorex araneus*) and water course area. The proportion of this species in the diet of the Barn Owl was much lower in samples collected in sites near the Danube (Table 2). Preferring cool and humid habitats, this species occurs in gallery forests *(15)*. However, Barn Owls rarely hunt in closed canopy forests *(1)*, therefore the abundance of the Common Shrew in the pellets in this case probably does not reflect the proportion of their habitats. We found a negative correlation between the relative abundance of the Common Dormouse (*Muscardinus avellanarius*) and the area of settlements in the hunting area of Barn Owls (Table 2.), which can be explained with the fact that this species prefers woodland areas and rarely occurs in settlements. Negative correlation was also found between the relative abundance of the Mediterranean Field Vole (*Microtus lavernedii*) and the area of broad-leaved forests (Table 2), since it is known that the individuals of this species prefer wetland habitats, while avoid closed canopy forests. Such preference by the Mediterranean Field Vole was also proved by the fact that it was not found in samples from the edge of the Bansko Hill, while the lowland area of Baranja with dense shrub thickets along canals provided a lot of suitable habitats for individuals of this species (Table 1.).

Although the Common Vole may temporarily settle into the forests, it will be over-competed by the Bank Vole (*Myodes glareolus*) which is a typical forest dweller *(16)*. In our study the relative abundance of the Common Vole was in negative correlation with the length of the borders (edges between different habitats - ecotones) (Table 2.). The longer the borders, the more fragmented the area is, i.e. homogeneity decreases. This is in accordance with results of the previous studies, which found positive correlation of relative abundance of this species with higher homogeneity of agricultural landscapes *(17, 18)*. It also has been shown earlier that higher predation pressure on the borders results lower population density *(19)*. The correlation between the relative abundance of the Bank Vole and the total area of non-irrigated arable land was positive, while it was negative with the mosaic pattern of the landscape (Table 2.). We have no explanation for this, since the Bank Vole prefers closed forest habitats *(16)*, while it rarely occurs in arable lands. Barn Owls can prey on them in forest edges *(20)*.

Our results indicated that an increasing of area of inland marshes in the hunting areas of the Barn Owls is reflected in the decreased number of small mammal species detected in the pellets (Rs = -0.612, P = 0.003). Among the small mammal species that we detected in Barn Owl pellets from Baranja, only the Miller's Water Shrew, the Mediterranean Field Vole and the Water Vole (*Arvicola amphibius*) preferred wetland habitats. Evenness showed positive correlation with the landscape mosaic (Rs = 0.436, P = 0.048) and the length of the habitat borders (Rs = 0.648, P = 0.001). Due to an increased mosaic pattern of the landscape with more different habitats, small mammal species preferring particular habitats cannot reach a high level of dominance, therefore more species with less abundance will be present in the landscape, i.e. the diversity of small mammals show positive correlation with mosaicity.

CONCLUSION

Our results suggest that the high dominance of the Common Vole in the case of its population outbreak negatively influenced the density of rare specialist small mammal species. Despite the fact that the Common Vole was dominant in the pellets of Barn Owls, we found significant correlations between the relative abundance of some small mammal species and the landscape structure classes in the owls' hunting area. Our study confirmed that increasing the mosaic pattern of the landscape can result in higher small mammal diversity, while the magnitude of population outbreak of the Common Vole will decrease. This means that the damage caused by this pest in agriculture is expected to be lower. These relationships should be taken into consideration when designing landscapes or changing land use.

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Appendix 1a. *Number of prey items in the pellets of Barn Owls in sample sites (1-11). (Abbreviations: H - hilly area, L - lowland area, sch – attic of abandoned school, cat - catholic church, ref - reformed church, gra - granary, UTM - Universal Transverse Mercator coordinate system)*

Samples	L01.	L02.	L03.	L04.	H05.	H06.	H07.	L08.	L09.	L10.	L11.
UTM (10×10 km)	CR06	CR07	CR15	CR16	CR17	CR17	CR17	CR25	CR25	CR25	CR26
Place (locality) Date	Majške Međe (sch) 04.10.2007.	Luč (cat) 04.10.2007.	Darda (castle) 04.10.2007.	Jagodnjak (cat) 04.10.2007.	Branjina (mill) 28.09.2007.	Popovac (cat) 28.09.2007.	Branjin Vrh (cat) 04.10.2007.	Lug (ref) 28.08.2007.	Vardarac (ref) 28.08.2007.	Kopačevo (ref) 28.08.2007.	Jasenovac (gra) 04.10.2007.
Crocidura leucodon	8	2	5	8	26	5	0	5	1	0	1
Crocidura suaveolens	18	8	19	19	20	8	2	30	6	0	15
Sorex araneus	9	1	2	13	10	5	1	12	0	0	0
Sorex minutus	5	0	0	1	1	1	0	1	0	0	0
Neomys anomalus	7	3	7	2	1	2	0	8	1	0	0
Talpa europaea	0	0	0	0	0	0	0	1	0	0	0
Eptesicus serotinus	0	1	0	0	0	0	0	0	0	0	0
Plecotus austriacus	0	0	0	0	1	0	0	0	0	0	0
Muscardinus avellanarius	0	0	0	1	0	0	0	1	0	0	0
Microtus lavernedii	0	1	1	2	0	0	0	1	0	0	0
Microtus arvalis	134	76	326	510	164	194	15	156	41	20	292
Microtus subterraneus	2	0	0	2	0	0	0	1	0	0	0
Arvicola amphibius	0	2	7	1	4	0	0	6	0	1	0
Myodes glareolus	0	0	0	3	0	0	0	1	0	0	0
Cricetus cricetus	0	0	0	0	0	0	0	0	0	0	0
Apodemus agrarius	17	10	19	51	38	12	2	26	3	0	13
Apodemus flavicollis	2	2	0	5	3	0	1	5	1	1	0
Apodemus sylvaticus	22	2	18	37	15	4	0	18	3	1	4
Apodemus uralensis	0	0	0	0	0	0	0	0	0	0	0
Apodemus sp.	5	3	5	10	10	3	0	13	2	1	2
Micromys minutus	8	1	5	5	5	0	0	4	3	0	2
Mus musculus	4	3	13	16	4	6	0	11	3	2	7
Mus spicilegus	8	4	3	31	10	3	2	4	3	1	4
Mus sp.	0	1	0	0	0	2	0	0	0	0	0
Rattus norvegicus	3	0	4	4	0	0	0	29	1	0	2
Rattus sp.	1	0	1	1	0	0	0	3	0	0	0
Aves indet.	0	1	2	6	2	0	1	4	0	0	1
Pelobates fuscus	0	0	0	0	0	0	0	0	0	1	0
Anura *(Rana* sp.)	0	0	0	0	0	0	0	0	0	0	0
Gryllotalpa gryllotalpa	0	0	0	0	0	0	0	0	0	0	0
Coleoptera	0	0	0	0	0	0	0	0	0	0	1
Prey	253	121	437	728	314	245	24	340	68	28	344
No. of pellet*	54	53	129	223	129	122	14	123	26	13	128

*the values are informative as the contents of fragmented pellets were also taken into account

Appendix 1b. *Number of prey items in the pellets of Barn Owls in sample sites (12-21). (Abbreviations: H - hilly area, L - lowland area, gra - granary, cat - catholic church, ref - reformed church, UTM - Universal Transverse Mercator coordinate system)*

Samples	L12.	H13.	H14.	H15.	H16.	H17.	H18.	L19.	L20.	H21.	Σ
UTM (10×10 km)	CR26	CR27	CR27	CR27	CR27	CR27	CR27	CR28	CR28	CR37	
Place (locality) Date	Grabovac (gra) 28.08.2007.	Draž (cat) 28.09.2007.	Podolje (cat) 28.09.2007.	Zmajevac (ref) 28.08.2007.	Suza (ref) 28.08.2007.	Kotlina (ref) 28.08.2007.	Kamenac (ref) 28.09.2007.	Duboševica (cat) 28.09.2007.	Topolje (cat) 28.09.2007.	Batina (cat) 28.28.2007.	Total
Crocidura leucodon	7	32	20	0	21	40	11	1	29	1	223
Crocidura suaveolens	22	21	80	2	22	36	19	2	13	1	363
Sorex araneus	2	1	26	0	8	21	5	4	2	0	122
Sorex minutus	0	0	6	0	0	0	0	2	0	0	17
Neomys anomalus	10	4	26	0	11	0	0	7	1	0	90
Talpa europaea	1	0	0	0	0	0	0	0	0	0	2
Eptesicus serotinus	0	0	0	0	0	0	0	0	0	0	1
Plecotus austriacus	0	0	0	0	0	0	0	0	0	0	1
Muscardinus avellanarius	0	0	0	1	3	0	0	0	0	0	6
Microtus lavernedii	0	0	0	0	0	0	0	1	1	0	7
Microtus arvalis	339	415	395	64	289	156	193	12	345	2	4138
Microtus subterraneus	0	0	2	0	3	4	1	0	0	0	15
Arvicola amphibius	2	2	8	0	2	0	0	1	0	0	36
Myodes glareolus	2	0	1	0	5	5	0	0	0	0	17
Cricetus cricetus	0	0	1	0	0	0	0	0	0	0	1
Apodemus agrarius	19	14	52	2	75	64	16	9	12	2	456
Apodemus flavicollis	8	4	8	0	11	19	3	0	18	0	91
Apodemus sylvaticus	1	34	31	1	23	10	9	0	14	0	247
Apodemus uralensis	0	1	0	0	0	0	0	0	1	0	2
Apodemus sp.	1	18	33	0	14	32	11	0	16	4	183
Micromys minutus	1	6	26	0	7	6	2	0	1	0	82
Mus musculus	9	34	15	1	15	15	14	0	9	0	181
Mus spicilegus	3	24	25	0	35	20	18	0	23	0	221
Mus sp.	0	0	1	0	0	0	0	0	3	0	7
Rattus norvegicus	1	9	0	0	2	1	9	0	0	0	65
Rattus sp.	0	0	0	0	0	0	0	0	0	1	7
Aves indet.	0	2	3	0	5	1	0	0	0	0	28
Pelobates fuscus	0	0	0	0	0	0	0	0	0	0	1
Anura (*Rana* sp.)	0	0	1	0	0	0	0	0	0	0	1
Gryllotalpa gryllotalpa	0	1	0	0	0	0	0	0	0	0	1
Coleoptera indet.	0	0	0	0	0	0	0	0	0	0	1
Prey	428	622	760	71	551	430	311	39	488	11	6613
No. of pellet*	166	282	210	32	218	101	98	14	255	5	2395

* the values are informative as the contents of fragmented pellets were also taken into account

Appendix 2. *Proportion (%) of the landscape classes in the hunting area in particular localities (Nomenclature of CORINE landscape structure: 112 - discontinuous urban fabric, 121 - industrial or commercial unit, 211 - non-irrigated arable land, 221 - vineyards, 231 - pastures, 242 - complex cultivation patterns, 243 - land principally occupied by agriculture, with significant areas of natural vegetation, 311 - broad-leaved forest, 324 - transitional woodland-shrub, 411 - inland marshes, 511 - water courses, 512 - water bodies)*

No.	Locality	112	121	211	221	231	242	243	311	324	411	511	512
01	Majške Međe	2.32	0.00	13.60	0.00	0.00	78.83	5.25	0.00	0.00	0.00	0.00	0.00
02	Luč	3.83	0.00	48.62	0.00	4.48	39.18	3.89	0.00	0.00	0.00	0.00	0.00
03	Darda	20.33	4.09	10.25	0.00	0.00	58.22	6.40	0.71	0.00	0.00	0.00	0.00
04	Jagodnjak	6.11	0.00	13.30	0.00	0.00	74.28	2.83	0.00	3.48	0.00	0.00	0.00
05	Branjina	5.28	0.00	14.93	3.41	1.16	44.47	9.15	4.33	17.27	0.00	0.00	0.00
06	Popovac	8.83	0.00	6.78	4.22	0.00	53.92	10.87	12.47	0.89	0.00	0.00	2.02
07	Branjin Vrh	7.70	0.07	15.48	0.00	0.00	48.61	12.74	0.00	15.40	0.00	0.00	0.00
08	Lug	6.63	0.00	19.33	0.00	0.00	58.17	15.45	0.30	0.12	0.00	0.00	0.00
09	Vardarac	4.30	0.00	16.08	0.00	0.00	49.14	1.66	0.00	5.60	16.85	0.00	6.37
10	Kopačevo	4.83	0.00	0.00	0.00	0.99	17.16	0.00	13.96	12.36	39.54	0.00	11.16
11	Jasenovac	0.00	0.00	61.08	0.00	0.00	0.00	38.92	0.00	0.00	0.00	0.00	0.00
12	Grabovac	3.18	0.00	57.70	0.00	0.00	17.14	20.23	1.75	0.00	0.00	0.00	0.00
13	Draž	4.19	0.00	0.00	3.53	11.71	37.79	20.59	7.15	9.04	0.00	6.00	0.00
14	Podolje	0.00	0.00	0.00	22.30	8.00	29.45	14.24	19.39	6.62	0.00	0.00	0.00
15	Zmajevac	5.08	0.00	8.55	0.00	0.00	57.03	17.45	2.18	6.65	0.00	3.06	0.00
16	Suza	3.09	0.00	30.88	0.00	0.00	55.12	10.91	0.00	0.00	0.00	0.00	0.00
17	Kotlina	2.96	0.00	0.00	18.95	0.00	50.63	8.03	16.37	3.06	0.00	0.00	0.00
18	Kamenac	1.68	0.00	1.05	13.00	0.00	82.27	0.00	2.00	0.00	0.00	0.00	0.00
19	Duboševica	5.19	0.00	27.59	0.00	0.00	40.88	26.11	0.00	0.00	0.23	0.00	0.00
20	Topolje	2.58	0.00	16.28	0.00	0.00	60.80	6.12	0.00	1.47	2.78	9.97	0.00
21	Batina	4.24	0.00	6.75	0.00	2.15	8.85	12.80	29.04	14.39	1.71	20.07	0.00