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CONTRIBUTION TO THE KNOWLEDGE OF THE BUTTERFLY FAUNA (LEPIDOPTERA: PAPILIONOIDEA) OF HRVATSKO ZAGORJE, CROATIA

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Koren, T., Lauš, B., Šašić, M., Mihoci, I., Štih, A., Bralić, P. & Gomboc, S.: Contribution to the knowledge of the butterfly fauna (Lepidoptera: Papilionoidea) of Hrvatsko zagorje, Croatia. Nat. Croat., Vol. 26, No. 2., 167-196, Zagreb, 2017.

During a nine-year survey of the Hrvatsko zagorje region carried out from 2008 until 2016 we recorded 112 butterfly species. Records were supplemented with seven species known only from literature data, which amounted to 119 species representing 60 % of the Croatian butterfly fauna. The highest butterfly diversity was registered on the mountains Ivanščica and Strahinjščica and along the Sutla River valley. Several rare and endangered species were recorded in the region, mostly grassland specialists such as *Phengaris teleius*, *Ph. alcon rebeli*, *Polyommatus thersites*, *Euphydryas aurinia* and *Zerynthia polyxena* whose habitats are declining due to changes in the use of grasslands like abandonment or, less frequently, intensification. The population of *Lycaena dispar* is still locally numerous, but its habitats are now rapidly overgrown with invasive alien plants. The butterfly diversity of Hrvatsko zagorje is high in comparison with the neighbouring region of Haloze in Slovenia. In order to maintain the high butterfly diversity in the region, grasslands and forest edges in the region are in a need of conservation actions and revitalization.

Key words: Lepidoptera, butterfly diversity, Croatia, Hrvatsko zagorje

Koren, T., Lauš, B., Šašić, M., Mihoci, I., Štih, A., Bralić, P. & Gomboc, S.: Prilog poznavanju faune danjih leptira (Lepidoptera: Papilionoidea) Hrvatskog zagorja, Hrvatska. Nat. Croat., Vol. 26, No. 2., 167-196, Zagreb, 2017.

Tijekom devetogodišnjeg istraživanja danjih leptira regije Hrvatskog zagorja provedenog od 2008. pa do 2016. godine, zabilježili smo 112 vrsta danjih leptira. Nalaze smo nadopunili sa sedam dodatnih vrsta poznatih iz literature. Tih 119 zabilježenih vrsta predstavlja 60% faune danjih leptira Hrvatske. Najveća raznolikost leptira zabilježena je na planinama Ivanščici i Strahinjščici te u dolini rijeke Sutle. Zabilježili smo i nekoliko rijetkih i ugroženih vrsta, ponajviše travnjačkih specijalista poput *Phengaris teleius*, *Ph. alcon rebeli*, *Polyommatus thersites*, *Euphydryas aurinia* i *Zerynthia polyxena* čija su staništa u opadanju zbog promjena u korištenju travnjaka poput zapuštanja, ili rjeđe, pojačanog korištenja. Populacija vrste *Lycaena dispar* još je uvijek lokalno mnogobrojna, no i njena staništa ubrzano zarastaju od strane invazivnih biljaka. Raznolikost danjih leptira Hrvatskog zagorja mnogo je veća nego raznolikost Haloza, susjedne regije u Sloveniji. Kako bi se održala visoka raznolikost danjih leptira ove regije, potrebne su brze konzervacijske akcije i revitalizacije travnjaka i šumskih rubova.

Ključne riječi: Lepidoptera, raznolikost leptira, Hrvatska, Hrvatsko zagorje

INTRODUCTION

Croatia is located at the junction of four large biogeographic zones, which is reflected in great biodiversity on a regional scale, which is also true for butterflies, compared to other European countries. At the same time, the butterfly fauna of the country is relatively under-surveyed (Jakšić, 1988; Šašić & Mihoci, 2011). Recent studies targeted mostly the Croatian islands and karstic areas that generally have greater diversity than continental areas (e.g. Habeler, 2008, Kučinić *et al*., 2010, 2014; Koren *et al*., 2012, Tvrtković *et al*., 2011, 2012). Thus there are areas where the only knowledge is based on literature or collection data sometimes older than 100 years. One of such regions is Hrvatsko zagorje.

Hrvatsko zagorje is a cultural, historical and geographical region in the north-western part of Croatia, situated between Mt. Macelj, Varaždinsko Topličko hills, Mt. Kalnik, Mt. Medvednica and bounded by the Sutla River in the western side. Climatically, the region has a moderately warm and humid climate with warm summers and cold winters (Šegota & Filipčić, 2003). Steep slopes and higher hills are mainly covered by forests, whereas in the lowland these have been transformed into a mosaic of anthropogenic habitats like pastures, meadows, orchards, arable fields, vineyards, hedges and villages, a process that started in the Middle Ages (Vučetić, 2007). On the southern slopes and shallow soils, dry calcareous grasslands are still present but due to recent agricultural transformations, with no livestock on the small farms, most of these meadows became abandoned and are now in succession and overgrown by shrubs and invasive alien plants. These are now some of the most endangered habitats in this area. In the lowland, humid grasslands or wetlands are present along the alluvial plains of rivers such as the Krapina, Krapinčica, Horvatska, Bednja, Sutla and their tributaries. Wet meadows in broad valleys are better preserved but even these are slowly being overgrown by invasive plant species and shrubs or intensively exploited, some being turned into fields or urbanized by road infrastructure. The best-preserved natural habitats in the region are wet and continental forests. Part of the Hrvatsko zagorje is covered by the Natura 2000 network, which consists of 14 areas important for species and habitat conservation. Among them six areas (upper part of Ivanščica, three areas along the Bednja, the Sutla valley at Razvor and Medvednica) are selected to protect moth and butterfly species like *Lycaena dispar, Euplagia quadripunctaria* and *Phengaris teleius*.

The low number of published records is surprising due to the vicinity of Zagreb, where many lepidopterists were active during the last hundred years. The only published data on butterfly species were published more than a century ago by Abafi-Aigner (1910). These data refer to the surroundings of Krapina. Additional, more dispersed records were published by Steiner (1916), Gušić (1917), Mladinov (1973, 1975), Marčec (2008), Šašić & Mihoci (2007), Lorković (2009), Koren & Jugovic (2012) and Koren & Štih (2013).

The paper presents the results of nine year-long survey of butterflies, which we carried out during different occasions by different authors with the addition of previously published records from the region of Hrvatsko zagorje. This contribution does not consider additional collection material represented in museum and other private collections, except for the authors' collections.

MATERIALS AND METHODS

Field surveys were carried out during the last 9 years, from 2008 to 2016 with more than 100 field days. Topography and habitat types were used to select the most suitable localities in the region. A total of 292 localities were visited during this survey, while favourable and best-preserved localities were visited several times (Fig. 1, Appendix I). Between 2008 and 2015 field data were obtained more or less at random, while in 2016 targeted surveys were carried out in the least visited areas in order to collect additional data about the butterflies of the region. Field data were entered into an Excel table and basic statistics were calculated. The spatial processing and visualisation of data were done in the program ARC GIS desktop. The EEA 10x10 km reference grid was used in order to present species diversity. Butterflies were identified using a standard field guide (Tolman & Lewington, 2008). Additionally, specimens of the genera *Leptidea*, *Colias*, *Melitaea* and *Plebejus* were collected and their genitalia were examined for correct identifications. The nomenclature of the butterflies is given according to de Jong *et al*. (2014) and of the genus *Leptidea* according to Dinca *et al*. (2011).

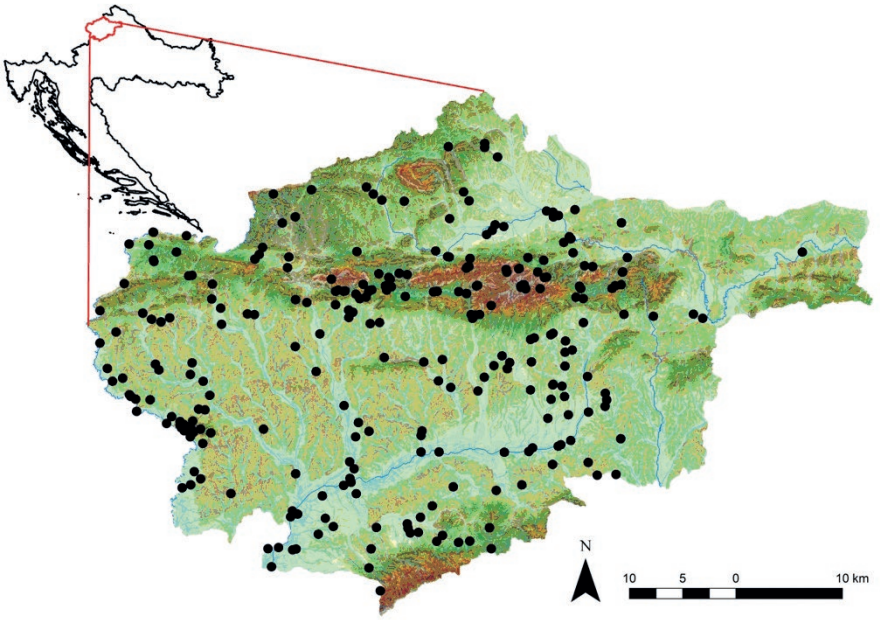

Fig. 1. Surveyed area of Hrvatsko zagorje, Croatia. Black dots represent localities surveyed.

RESULTS

More than 3300 records across the region were collected during this survey, representing 112 butterfly species. In the overview of the published data for the region, records of 99 butterfly species were found (Abafi-Aigner, 1910; Steiner, 1916; Gušić, 1917; Mladinov, 1973, 1975; Marčec, 2008; Šašić & Mihoci, 2007; Lorković, 2009; Koren & Jugovic, 2012, Koren & Štih, 2013) including seven additional species, which were not found during this study. This represents a total of 119 butterfly species found in Hrvatsko zagorje or 60% of known butterfly fauna of Croatia. Six species were not recorded during the surveys: *Aporia crataegi* (Linnaeus, 1758), *Colias myrmidone* (Esper, 1781), *Lysandra coridon* (Poda, 1761), *Argynnis niobe* (Linnaeus, 1758), *Euphydryas maturna* (Linnaeus, 1758) and *Hipparchia semele* (Linnaeus, 1758). On the other hand, 19 species were recorded for the first time in the region (Tab. 1).

Although the number of registered species is relatively high, it is important to emphasize that many species are represented by only one record or a few records for the region (e.g. Abafi-Aigner 1910, Marčec 2008). Additionally, the recent publications of Marčec (2008) and Lorković (2009) mostly represent data collected more than 50 years ago.

The region is covered by 33 EEA 10x10 km reference grid squares, 8 of which are border squares with smaller areas of Hrvatsko zagorje and without any butterfly records (Fig. 2). Overview of the number of species by squares shows that most of the squares are occupied by 21-40 species. In only one square more than 80 species were recorded, in three 61-80 species, in five 41-60 species, in 12 21-40 species, and in four 12-20 species.

The five squares with the highest butterfly diversity include mountainous areas on Strahinjčica (845,9 m a.s.l.) and Ivanščica (1.060,0 m a.s.l.) mountains, with diverse hillside and lowland parts along rivers, and the diverse Risvica and Cesar hill (509,0 m a.s.l.) also with lower parts along the Sutla River. The area of these five squares is characterized by diverse habitats; deciduous, coniferous and mixed forests, hedges, thermophilic, mesophilic and wet grasslands and meadows, and agricultural areas with settlements.

The square with the highest recorded diversity, 83 species, includes Strahinjščica mountain and parts of Macelj mountain. The richest locality within this square was Gorjani Sutinski settlement, with 43 recorded butterfly species. This locality is characterised by thermophilic meadows with hedges and scattered shrubs on the southern slopes of Strahinjčica mountain, in the vicinity of mixed oak and beech forest. The next two squares by species richness have 77 recorded species. One includes the Sutla River and the important landscape "Zelenjak – Risvica and Cesar Hill" with surroundings. This square also includes the locality with the highest recorded butterfly diversity in the whole research area, Mihanovićev Dol settlement, along the Sutla River towards Zelenjak restaurant, with 60 recorded species. There is a mixture of diverse habitats on a small surface area, like the Sutla River with surrounding vegetation with willow trees, wet meadows at river banks and dry meadows on the edges of thermophilic oak, beach and conifer forest on the south-western slopes of Cesar Hill. The other square with 77 species includes eastern parts of Strahinjščica and western parts of Ivanščica mountain. The highest species diversity was recorded again close to Gorjani Sutinski settlement, Smrečki hamlet surroundings 2, with 40 species. Habitats here are wet meadows along a small creek and a fishpond, surrounded by oak and beech forest. Two more squares include the central (66 species) and eastern parts (55 species) of Ivanščica mountain with lowlands along the Bednja River.

Several species have been found at only one locality or a few localities and can be considered as rare or locally distributed in the region (Tab. 1). Species found at only 1-3 localities are: *Carcharodus alceae* (Esper, 1780), *Spialia sertorius* (Hoffmannsegg, 1804), *Leptidea juvernica* Williams, 1946, *Pieris balcana* (Lorković, 1970), *Pontia edusa* (Fabricius 1777), *Cupido decolorata* (Staudinger 1886), *Phengaris alcon* (Denis & Schiffermüller, 1775), *Phengaris teleius* (Bergsträsser, 1779), *Polyommatus daphnis* (Denis & Schiffermüller, 1775), *Satyrium acaciae* (Fabricius, 1787), *Satyrium ilicis* (Esper, 1779), *Satyrium pruni* (Linnaeus, 1758), *Satyrium spini (*Denis & Schiffermüller, 1775), *Thecla betulae* (Linnaeus, 1758), *Boloria selene* (Denis & Schiffermüller, 1775), *Brenthis ino* (Rottemburg, 1775), *Hipparchia fagi* (Scopoli, 1763), *Lasiommata maera* (Linnaeus, 1758), *Melitaea diamina* (Lang, 1789), *Melitaea ornata* Christoph, 1893 and *Pyronia tithonus* (Linnaeus, 1767).

Tab. 1. List of recorded species with locality numbers and species data from literature. Locality numbers correspond to the ones given in the Appendix 1.

No	List of species	Locality number	Literature
		Hesperiidae	
1.	*Carcharodus alceae* (Esper, 1780)	72	
2.	*Carcharodus floccifera* (Zeller, 1847)	153, 227, 275, 291	
3.	*Carterocephalus palaemon* (Pallas, 1771)	108, 142, 143, 151, 190	
4.	*Erynnis tages* (Linnaeus, 1758)	4, 5, 7, 9, 16, 19, 27, 28, 29, 33, 34, 41, 42, 45, 49, 76, 78, 81, 97, 101, 103, 105, 119, 125, 129, 134, 143, 147, 156, 173, 177, 195, 239, 243, 244, 272, 281, 287, 289, 292	Abafi-Aigner 1910
5.	*Hesperia comma* (Linnaeus, 1758)	34, 120, 128, 129	Abafi-Aigner 1910
6.	*Heteropterus morpheus* (Pallas, 1771)	4, 9, 29, 34, 120, 126, 135, 148, 162, 168, 173, 179, 206, 243, 259, 271, 274	

No	List of species	Locality number	Literature
7.	*Ochlodes sylvanus* (Esper, 1777)	7, 8, 9, 10, 11, 12, 15, 18, 19, 23, 24, 29, 30, 33, 34, 36, 39, 40, 44, 45, 48, 49, 50, 57, 60, 76, 78, 82, 83, 85, 93, 97, 103, 104, 106, 108, 120, 121, 129, 142, 147, 148, 160, 169, 173, 179, 192, 198, 209, 211, 223, 224, 225, 227, 231, 239, 243, 244, 247, 258, 262, 263, 270, 275, 277, 278, 287, 290, 291	Abafi-Aigner 1910, Marčec 2008, Mladinov 1975
8.	*Pyrgus armoricanus* (Oberthür, 1910)	15, 28, 50, 239	Marčec 2008
9.	*Pyrgus malvae* (Linnaeus, 1758)	3, 7, 8, 26, 28, 34, 45, 49, 76, 78, 83, 90, 103, 105, 106, 115, 119, 121, 129, 134, 143, 148, 153, 156, 157, 160, 169, 173, 176, 177, 198, 227, 241, 243, 247, 249, 250, 259, 275, 277, 291	Abafi-Aigner 1910, Mladinov 1975
10.	*Spialia sertorius* (Hoffmannsegg, 1804)	78, 129	
11.	*Thymelicus lineola* (Ochsenheimer, 1808)	20, 23, 27, 28, 57, 59, 72, 91, 98, 103, 104, 108, 116, 118, 119, 120, 129, 136, 144, 148, 149, 150, 151, 155, 164, 166, 173, 177, 179, 199, 205, 207, 213, 243, 251, 264, 274, 275, 277, 278, 290	
12.	*Thymelicus sylvestris* (Poda, 1761)	11, 20, 23, 27, 34, 39, 42, 81, 94, 99, 100, 112, 113, 117, 136, 143, 144, 146, 149, 150, 155, 158, 164, 165, 173, 175, 178, 179, 186, 189, 196, 199, 205, 239, 243, 244, 269, 274, 276, 277, 278, 281, 287	Marčec 2008
Papilionidae			
13.	*Iphiclides podalirius* (Linnaeus, 1758)	8, 13, 16, 19, 30, 34, 41, 45, 49, 50, 51, 55, 66, 77, 83, 86, 90, 91, 97, 98, 101, 103, 105, 109, 120, 129, 131, 135, 136, 149, 150, 164, 166, 168, 170, 174, 179, 180, 185, 186, 188, 189, 195, 197, 213, 231, 232, 239, 244, 256, 259, 262, 271, 274, 280, 283, 287, 289	Abafi-Aigner 1910, Marčec 2008
14.	*Papilio machaon* Linnaeus, 1758	8, 14, 34, 49, 55, 60, 77, 83, 86, 90, 105, 108, 109, 113, 120, 125, 128, 129, 135, 142, 188, 219, 239, 258	Abafi-Aigner 1910, Marčec 2008
15.	*Parnassius mnemosyne* (Linnaeus, 1758)	19, 41, 66, 134, 142, 143, 181, 183, 192, 210, 211, 212, 219, 221, 222, 225, 234, 238, 265	Abafi-Aigner 1910, Marčec 2008, Mladinov 1973
16.	*Zerynthia polyxena* (Denis & Schiffermüller, 1775)	12, 19, 63, 76, 97, 103	Abafi-Aigner 1910, Marčec, 2008

No	List of species	Locality number	Literature
		Pieridae	
17.	*Anthocharis cardamines* (Linnaeus, 1758)	29, 30, 34, 52, 55, 56, 66, 83, 86, 101, 103, 105, 108, 109, 125, 129, 143, 148, 172, 177, 193, 201, 203, 230, 232, 239, 240, 261, 267, 285, 289, 292	Abafi-Aigner 1910, Marčec 2008
18.	*Aporia crataegi* (Linnaeus, 1758)		Abafi-Aigner 1910, Marčec 2008, Mladinov 1973
19.	*Colias alfacariensis* Ribbe, 1905	3, 8, 16, 19, 27, 42, 89, 121, 126, 129, 134, 143, 147, 173, 196, 280, 281, 283	
20.	*Colias croceus* (Fourcroy, 1785)	5, 8, 15, 30, 34, 40, 44, 45, 51, 60, 78, 84, 88, 93, 96, 106, 113, 124, 126, 129, 140, 160, 163, 169, 170, 175, 186, 189, 190, 208, 225, 231, 233, 235, 237, 243, 244, 247, 259, 262, 272, 278	Abafi-Aigner 1910, Marčec 2008
21.	*Colias hyale* (Linnaeus, 1758)	60, 120, 129, 132, 136, 170, 283	Marčec 2008
22.	*Colias myrmidone* (Esper, 1781)		Abafi-Aigner 1910, Marčec 2008
23.	*Gonepteryx rhamni* (Linnaeus, 1758)	4, 7, 8, 11, 19, 20, 23, 29, 30, 31, 33, 34, 40, 41, 45, 49, 50, 54, 55, 57, 65, 66, 77, 78, 81, 85, 89, 90, 91, 97, 98, 99, 100, 101, 103, 104, 105, 106, 107, 108, 115, 125, 126, 129, 138, 139, 142, 143, 144, 145, 146, 148, 149, 150, 151, 155, 170, 172, 173, 177, 178, 180, 182, 185, 188, 189, 190, 191, 192, 194, 196, 197, 201, 217, 219, 225, 227, 240, 243, 244, 247, 261, 262, 267, 274, 278, 280, 282, 283, 287, 289, 292	Abafi-Aigner 1910, Marčec 2008
24.	*Leptidea juvernica* Williams, 1946	173, 198	Marčec 2008
25.	*Leptidea morsei* (Fenton, 1882)		Lorković 1993
26.	*Leptidea sinapis* (Linnaeus, 1758)	2, 6, 7, 8, 10, 11, 14, 15, 19, 21, 23, 27, 28, 29, 30, 33, 34, 35, 36, 39, 41, 45, 49, 50, 51, 54, 58, 84, 85, 88, 90, 97, 98, 99, 103, 104, 105, 106, 108, 116, 119, 120, 123, 125, 128, 129, 134, 136, 142, 143, 144, 145, 148, 150, 151, 157, 160, 167, 173, 177, 178, 186, 190, 194, 196, 198, 201, 205, 209, 230, 231, 232, 233, 237, 238, 240, 243, 244, 247, 249, 252, 261, 262, 264, 278, 279, 287	Abafi-Aigner 1910, Marčec 2008
27.	*Pieris balcana* (Lorković, 1970)	288	Lorković 1989
28.	*Pieris brassicae* (Linnaeus, 1758)	3, 15, 24, 29, 33, 34, 40, 41, 43, 45, 49, 50, 51, 68, 73, 90, 98, 101, 103, 104, 105, 108, 110, 113, 120, 126, 128, 135, 139, 141, 148, 172, 180, 185, 192, 194, 197, 198, 210, 211, 217, 219, 222, 225, 234, 258, 269, 273, 278, 279, 287	Abafi-Aigner 1910, Marčec 2008

No	List of species	Locality number	Literature
29.	*Pieris mannii* (Mayer, 1851)	28, 29, 34, 45, 77, 95, 99, 120, 151, 197, 202, 215, 222, 223, 225, 235, 243, 244, 262, 278	Marčec 2008
30.	*Pieris napi* (Linnaeus, 1758)	2, 6, 8, 18, 25, 29, 31, 33, 34, 40, 41, 43, 45, 49, 50, 51, 61, 68, 73, 75, 76, 78, 79, 81, 83, 89, 90, 92, 95, 98, 99, 103, 106, 107, 108, 113, 115, 119, 128, 129, 133, 135, 139, 142, 144, 147, 148, 149, 154, 155, 156, 160, 161, 164, 169, 170, 172, 173, 182, 188, 190, 191, 192, 194, 196, 197, 206, 209, 210, 211, 213, 215, 216, 217, 219, 222, 225, 231, 233, 234, 238, 242, 243, 244, 248, 249, 254, 258, 260, 262, 264, 266, 268, 269, 278, 279, 282, 284, 287, 289, 292	Abafi-Aigner 1910, Marčec 2008
31.	*Pieris rapae* (Linnaeus, 1758)	1, 3, 6, 8, 15, 19, 25, 27, 28, 29, 30, 32, 33, 34, 35, 40, 41, 42, 44, 45, 49, 50, 51, 60, 64, 72, 78, 88, 95, 98, 99, 103, 104, 106, 107, 116, 120, 123, 127, 129, 134, 136, 139, 140, 144, 146, 149, 155, 156, 157, 159, 163, 164, 165, 170, 173, 180, 184, 186, 188, 189, 192, 195, 199, 213, 217, 225, 229, 231, 235, 239, 240, 242, 249, 259, 268, 269, 271, 273, 274, 278, 281, 283, 287, 289, 292	Abafi-Aigner 1910, Marčec 2008
32.	*Pontia edusa* (Fabricius, 1777)	113	Marčec 2008
		Riodinidae	
33.	*Hamearis lucina* (Linnaeus, 1758)	29, 33, 34, 45, 78, 81, 86, 103, 108, 109, 149, 220, 271, 274	
		Lycaenidae	
34.	*Aricia agestis* (Denis & Schiffermüller, 1775)	29, 34, 45, 49, 97, 103, 128, 129, 143, 243, 278	Marčec 2008
35.	*Callophrys rubi* (Linnaeus, 1758)	7, 19, 29, 30, 49, 77, 103, 105, 129, 146, 172, 180, 243, 279, 289, 292	Abafi-Aigner 1910
36.	*Celastrina argiolus* (Linnaeus, 1758)	25, 27, 29, 33, 34, 41, 45, 49, 58, 77, 90, 98, 103, 105, 108, 109, 110, 111, 113, 116, 123, 125, 129, 135, 139, 141, 142, 143, 148, 149, 155, 165, 166, 167, 184, 188, 192, 194, 197, 201, 215, 217, 219, 223, 225, 226, 227, 232, 258, 261, 267, 274, 282, 288, 289	Abafi-Aigner 1910, Marčec 2008
37.	*Cupido minimus* (Fuessly, 1775)	26, 28, 75, 87, 103, 114, 124, 129, 143, 178, 186, 205, 270	
38.	*Cupido alcetas* (Hoffmannsegg, 1804)	90, 93, 143, 153, 159	Lorković 2009, Marčec 2008

No	List of species	Locality number	Literature
39.	*Cupido argiades* (Pallas, 1771)	1, 6, 7, 15, 16, 19, 28, 29, 30, 34, 40, 45, 50, 69, 78, 81, 83, 95, 99, 103, 105, 107, 111, 112, 113, 116, 120, 124, 126, 129, 142, 143, 144, 148, 155, 157, 167, 173, 178, 196, 198, 202, 205, 233, 235, 236, 237, 241, 243, 244, 249, 260, 262, 278, 283, 287	Abafi-Aigner 1910, Marčec 2008
40.	*Cupido decolorata* (Staudinger, 1886)	88, 281, 287	Lorković 2009
41.	*Cyaniris semiargus* (Rottemburg, 1775)	7, 8, 16, 19, 134, 143, 153, 171, 173, 179, 206, 213, 224, 243, 272, 277, 281, 283, 287	
42.	*Favonius quercus* (Linnaeus, 1758)	34, 49, 96, 102	Abafi-Aigner 1910, Marčec 2008
43.	*Glaucopsyche alexis* (Poda, 1761)	103, 108, 143, 190	Lorković 2009
44.	*Lycaena alciphron* (Rottemburg, 1775)	70, 93, 120, 137, 153	
45.	*Lycaena dispar* (Haworth, 1802)	3, 10, 11, 16, 19, 22, 26, 34, 44, 48, 50, 53, 59, 67, 69, 70, 78, 84, 90, 107, 121, 126, 132, 137, 142, 143, 151, 155, 156, 160, 169, 170, 198, 204, 206, 231, 233, 236, 237, 243, 244, 250, 260, 262, 271, 275, 277	Abafi-Aigner 1910, Marčec 2008
46.	*Lycaena hippothoe* (Linnaeus, 1761)	23, 26, 36, 47, 78, 157, 169, 171, 206, 241, 243, 247, 262, 275	
47.	*Lycaena phlaeas* (Linnaeus, 1761)	15, 28, 34, 45, 60, 76, 97, 103, 109, 134, 136, 143, 160, 170, 179, 199, 247, 262, 291	Abafi-Aigner 1910, Marčec 2008, Steiner 1916
48.	*Lycaena tityrus* (Poda, 1761)	10, 11, 12, 29, 34, 36, 40, 45, 49, 76, 78, 83, 97, 103, 107, 143, 146, 151, 156, 163, 167, 168, 169, 177, 196, 206, 219, 220, 224, 233, 235, 241, 243, 262, 263, 270, 278	Abafi-Aigner 1910, Marčec 2008
49.	*Lycaena virgaureae* (Linnaeus, 1758)	29, 98, 116, 146, 148, 151, 279	
50.	*Phengaris alcon* (Denis & Schiffermüller, 1775)	116, 247	Marčec 2008
51.	*Phengaris arion* (Linnaeus, 1758)	9, 29, 30, 34, 49, 98, 262	Abafi-Aigner 1910, Marčec 2008
52.	*Phengaris teleius* (Bergsträsser, 1779)	247, 260	
53.	*Plebejus argus* (Linnaeus, 1758)	3, 4, 5, 9, 12, 15, 16, 19, 20, 25, 27, 35, 38, 39, 40, 42, 44, 50, 59, 62, 67, 84, 90, 93, 112, 120, 124, 126, 129, 132, 148, 160, 168, 170, 176, 179, 243, 258, 270, 278, 282, 287	Abafi-Aigner 1910, Marčec 2008

No	List of species	Locality number	Literature
54.	*Plebejus argyrognomon* (Bergsträsser, 1779)	5, 15, 280, 287	Abafi-Aigner 1910, Lorković 2009, Marčec 2008
55.	*Plebejus idas* (Linnaeus, 1761)	28, 142, 188	Marčec 2008
56.	*Polyommatus bellargus* (Rottemburg, 1775)	76, 77, 78, 85, 120, 129, 151, 233	Abafi-Aigner 1910
57.	*Lysandra coridon* (Poda, 1761)		Abafi-Aigner 1910, Lorković 2009, Marčec 2008
58.	*Lysandra icarus* (Rottemburg, 1775)	1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 40, 42, 44, 45, 47, 49, 50, 51, 57, 59, 60, 67, 69, 70, 73, 77, 78, 79, 81, 85, 87, 88, 89, 90, 93, 95, 97, 99, 100, 103, 106, 107, 112, 113, 117, 120, 124, 126, 128, 129, 130, 132, 134, 136, 137, 140, 143, 144, 146, 151, 153, 156, 157, 160, 161, 164, 169, 170, 171, 173, 175, 176, 179, 182, 188, 189, 195, 196, 197, 198, 199, 200, 215, 219, 220, 231, 235, 238, 239, 243, 244, 245, 250, 254, 257, 258, 259, 263, 270, 271, 272, 273, 274, 275, 276, 278, 280, 281, 283, 284, 286, 287, 290, 291	Abafi-Aigner 1910, Marčec 2008
59.	*Polyommatus thersites* (Cantener, 1835)	7, 19, 28, 49, 89, 90, 103, 113, 120, 124, 134, 143, 144, 278	
60.	*Polyommatus daphnis* (Denis & Schiffermüller, 1775)	103	Abafi-Aigner 1910, Marčec 2008
61.	*Satyrium acaciae* (Fabricius, 1787)	29, 34	Abafi-Aigner 1910
62.	*Satyrium ilicis* (Esper, 1779)	57	Abafi-Aigner 1910, Marčec 2008
63.	*Satyrium pruni* (Linnaeus, 1758)	57, 189, 243	Abafi-Aigner 1910
64.	*Satyrium spini* (Denis & Schiffermüller, 1775)	129, 134, 243	Abafi-Aigner 1910, Marčec 2008
65.	*Satyrium w-album* (Knoch, 1782)	23, 29, 34, 45, 49	Marčec 2008
66.	*Scolitantides orion* (Pallas, 1771)	29, 33, 108, 194	Abafi-Aigner 1910, Lorković 2009, Marčec 2008
67.	*Thecla betulae* (Linnaeus, 1758)	34	Abafi-Aigner 1910, Marčec 2008

No	List of species	Locality number	Literature
		Nymphalidae	
68.	*Aglais io* (Linnaeus, 1758)	3, 4, 5, 6, 8, 9, 16, 19, 29, 30, 31, 33, 34, 35, 40, 50, 52, 88, 90, 91, 98, 99, 103, 104, 105, 107, 108, 109, 110, 112, 113, 120, 125, 127, 128, 129, 133, 139, 141, 148, 152, 154, 155, 163, 164, 167, 170, 172, 179, 180, 182, 185, 188, 192, 194, 196, 198, 201, 204, 209, 211, 213, 217, 219, 224, 225, 231, 242, 243, 256, 259, 267, 282, 284, 289, 292	Abafi-Aigner 1910, Marčec 2008
69.	*Aglais urticae* (Linnaeus, 1758)	12, 29, 34, 44, 47, 49, 57, 73, 77, 97, 108, 120, 134, 143, 146, 153, 171, 172, 175, 180, 181, 187, 192, 201, 219, 224, 225, 228, 252, 253, 258, 289	Abafi-Aigner 1910, Marčec 2008
70.	*Apatura ilia* (Denis & Schiffermüller, 1775)	12, 34, 50, 68, 74, 100, 137, 142, 144, 146, 148, 152, 154, 159, 163, 167, 198, 202, 204, 207, 227, 240, 243, 244, 259, 273, 279	Marčec 2008
71.	*Apatura iris* (Linnaeus, 1758)	144, 179, 188, 217, 219, 279	Marčec 2008
72.	*Aphantopus hyperantus* (Linnaeus, 1758)	29, 33, 34, 45, 49, 50, 91, 98, 108, 127, 134, 140, 143, 149, 150, 164, 178, 179, 196, 197, 243, 271, 274, 276, 287	
73.	*Araschnia levana* (Linnaeus, 1758)	6, 7, 10, 19, 23, 28, 29, 30, 31, 32, 33, 34, 37, 38, 39, 40, 41, 45, 50, 53, 66, 67, 78, 79, 84, 88, 90, 98, 107, 108, 110, 113, 116, 123, 125, 133, 135, 141, 142, 143, 148, 150, 151, 154, 155, 159, 167, 177, 179, 184, 188, 192, 196, 197, 201, 209, 213, 215, 217, 227, 229, 234, 240, 242, 243, 248, 249, 252, 256, 259, 261, 267, 268, 271, 278, 282, 287	Abafi-Aigner 1910, Marčec 2006
74.	*Argynnis adippe* (Denis & Schiffermüller, 1775)	34, 45, 120, 146, 149, 179, 197, 211, 214, 215, 223, 224, 225, 278	Marčec 2006
75.	*Argynnis aglaja* (Linnaeus, 1758)	134, 149, 179, 222, 225, 274	Marčec 2008
76.	*Argynnis niobe* (Linnaeus, 1758)		Marčec 2008
77.	*Argynnis pandora* (Denis & Schiffermüller, 1775)	79, 97, 197, 219	
78.	*Argynnis paphia* (Linnaeus, 1758)	6, 34, 41, 45, 49, 50, 79, 107, 108, 110, 116, 120, 129, 139, 142, 148, 155, 163, 167, 188, 191, 192, 194, 197, 209, 217, 223, 224, 225, 252, 262, 274, 278, 282	Marčec 2008
79.	*Boloria dia* (Linnaeus, 1767)	1, 6, 15, 27, 29, 30, 34, 37, 45, 81, 95, 120, 124, 126, 128, 129, 134, 177, 178, 179, 186, 189, 199, 231, 233, 235, 247, 287	Abafi-Aigner 1910

No	List of species	Locality number	Literature
80.	*Boloria euphrosyne* (Linnaeus, 1758)	146, 211, 223, 238, 244	Marčec 2008
81.	*Boloria selene* (Denis & Schiffermüller, 1775)	275	Marčec 2008
82.	*Brenthis daphne* (Bergsträsser, 1780)	11, 23, 25, 33, 34, 38, 39, 58, 88, 91, 98, 100, 103, 104, 108, 109, 110, 116, 120, 129, 137, 139, 142, 144, 146, 148, 151, 160, 169, 179, 188, 189, 192, 219, 222, 225, 229, 238, 243, 256, 258, 269, 270, 277, 278, 279, 284, 286, 287	Marčec 2008
83.	*Brenthis ino* (Rottemburg, 1775)	36, 146, 179	
84.	*Brintesia circe* (Fabricius, 1775)	34, 41, 99, 120, 129, 188, 209, 278	Marčec 2008
85.	*Coenonympha arcania* (Linnaeus, 1761)	8, 11, 23, 29, 30, 31, 34, 36, 41, 68, 108, 110, 113, 120, 129, 134, 143, 148, 222, 224, 225, 249	Marčec 2008
86.	*Coenonympha glycerion* (Borkhausen, 1788)	1, 6, 7, 8, 10, 11, 15, 19, 20, 23, 25, 26, 34, 36, 39, 40, 44, 47, 49, 50, 57, 59, 67, 70, 78, 87, 90, 93, 98, 100, 103, 107, 117, 120, 124, 126, 128, 129, 134, 137, 141, 143, 153, 157, 161, 167, 169, 198, 202, 220, 221, 224, 231, 236, 237, 238, 239, 241, 243, 244, 249, 257, 260, 264, 270, 273, 275, 277, 278, 290, 291	Marčec 2008
87.	*Coenonympha pamphilus* (Linnaeus, 1758)	1, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 17, 19, 20, 22, 23, 26, 27, 29, 30, 34, 36, 38, 39, 40, 44, 45, 47, 48, 50, 51, 53, 57, 59, 61, 67, 70, 75, 76, 77, 78, 83, 84, 85, 87, 90, 93, 97, 103, 106, 107, 111, 113, 119, 120, 121, 124, 126, 129, 130, 132, 134, 137, 141, 143, 144, 147, 148, 153, 154, 156, 160, 161, 167, 169, 170, 171, 173, 176, 177, 186, 187, 189, 190, 196, 198, 200, 202, 213, 220, 225, 233, 235, 236, 239, 240, 242, 243, 244, 246, 247, 249, 250, 252, 254, 256, 257, 258, 259, 260, 262, 270, 272, 275, 276, 277, 280, 283, 287, 290, 291	Abafi-Aigner 1910, Marčec 2008
88.	*Erebia aethiops* (Esper, 1777)	33, 34, 45, 49, 103, 184, 197, 215, 217, 223, 233, 278	Marčec 2008
89.	*Euphydryas aurinia* (Rottemburg, 1775)	76, 78, 143, 144, 200	
90.	*Euphydryas maturna* (Linnaeus, 1758)		Gussich 1917
91.	*Hipparchia (Hipparchia) fagi* (Scopoli, 1763)	129, 144, 190	Marčec 2008

No	List of species	Locality number	Literature
92.	*Hipparchia (Hipparchia)semele* (Linnaeus, 1758)		Marčec 2008
93.	*Issoria (Issoria) lathonia* (Linnaeus, 1758)	24, 29, 33, 34, 37, 41, 45, 49, 128, 134, 143, 172, 179, 189, 211, 219, 222, 225, 276, 282, 289, 292	Marčec 2008
94.	*Lasiommata maera* (Linnaeus, 1758)	41	Marčec 2008
95.	*Lasiommata megera* (Linnaeus, 1767)	19, 41, 46, 83, 109, 111, 120, 170, 190, 210, 217, 243, 276, 281	Abafi-Aigner 1910, Marčec 2008, Mladinov 1973
96.	*Limenitis camilla* (Linnaeus, 1764)	34, 215, 217, 252, 279	Abafi-Aigner 1910, Marčec 2008
97.	*Limenitis reducta* Staudinger, 1901	29, 30, 33, 34, 41, 45, 49, 50, 79, 182, 192, 210, 215, 252	Marčec 2008
98.	*Lopinga achine* (Scopoli, 1763)	211, 217, 234, 266, 278, 279	Lorković 2009, Šašić & Mihoci 2007
99.	*Maniola jurtina* (Linnaeus, 1758)	1, 3, 4, 5, 6, 9, 10, 11, 15, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 44, 45, 49, 50, 51, 52, 53, 57, 58, 59, 60, 61, 62, 67, 68, 69, 70, 72, 77, 78, 81, 82, 84, 88, 90, 91, 94, 98, 99, 100, 102, 103, 104, 107, 108, 110, 111, 112, 113, 116, 117, 118, 120, 123, 124, 128, 129, 131, 132, 133, 135, 136, 137, 139, 140, 141, 144, 146, 148, 149, 151, 154, 155, 157, 159, 160, 161, 164, 165, 166, 167, 168, 169, 170, 173, 175, 178, 179, 182, 184, 188, 189, 190, 192, 194, 196, 197, 199, 202, 204, 205, 209, 210, 211, 213, 215, 217, 219, 222, 224, 225, 227, 233, 235, 236, 237, 238, 239, 240, 242, 243, 244, 247, 248, 249, 252, 256, 258, 259, 260, 262, 263, 268, 269, 270, 271, 273, 274, 275, 276, 277, 278, 279, 282, 283, 287, 290, 291	Abafi-Aigner 1910, Marčec 2008
100.	*Melanargia galathea* (Linnaeus, 1758)	4, 5, 9, 10, 23, 27, 28, 29, 31, 33, 34, 36, 37, 45, 49, 72, 77, 81, 84, 91, 94, 98, 99, 103, 104, 108, 112, 113, 116, 117, 120, 124, 126, 129, 131, 134, 136, 139, 141, 143, 148, 149, 150, 151, 155, 158, 164, 166, 168, 173, 175, 176, 178, 179, 186, 189, 199, 205, 211, 219, 222, 225, 229, 239, 243, 252, 256, 258, 264, 270, 271, 272, 274, 276, 278, 279, 280, 283, 287	Abafi-Aigner 1910, Marčec 2008

No	List of species	Locality number	Literature
101.	*Melitaea athalia* (Rottemburg, 1775)	1, 7, 8, 11, 12, 14, 15, 19, 20, 23, 26, 27, 34, 36, 37, 38, 39, 41, 44, 45, 47, 50, 57, 58, 59, 70, 78, 83, 85, 87, 90, 93, 103, 107, 111, 112, 113, 117, 120, 126, 129, 131, 134, 137, 143, 144, 146, 147, 153, 154, 161, 164, 166, 169, 171, 177, 178, 179, 181, 186, 190, 192, 198, 202, 207, 210, 211, 216, 226, 233, 235, 238, 239, 241, 243, 247, 249, 256, 257, 260, 262, 264, 265, 269, 270, 273, 275, 277, 278, 279, 283, 291	Abafi-Aigner 1910, Marčec 2008, Koren & Jugovic 2012
102.	*Melitaea aurelia* Nickerl, 1850	34, 49, 83, 85, 103, 108, 120, 129, 151, 168, 225, 275	Marčec 2008, Koren & Jugovic 2012
103.	*Melitaea britomartis* Assmann, 1847	26, 78, 153, 200	Koren & Jugovic 2012
104.	*Melitaea cinxia* (Linnaeus, 1758)	7, 70, 78, 83, 85, 129, 142, 143, 153, 200, 220, 257	Abafi-Aigner 1910, Marčec 2008
105.	*Melitaea diamina* (Lang, 1789)	11, 243, 291	Abafi-Aigner 1910, Marčec 2008
106.	*Melitaea didyma* (Esper, 1778)	1, 7, 8, 15, 19, 25, 26, 29, 30, 34, 38, 47, 49, 50, 61, 78, 91, 99, 120, 124, 126, 129, 134, 143, 171, 178, 186, 189, 220, 238, 239, 243, 256, 287	Marčec 2008
107.	*Melitaea ornata* Christoph, 1893	143	Koren & Štih 2013
108.	*Melitaea phoebe* (Denis & Schiffermüller, 1775)	5, 7, 14, 15, 19, 25, 26, 29, 30, 34, 45, 49, 50, 78, 83, 85, 103, 108, 129, 134, 143, 147, 190, 200, 220, 239, 243, 247, 257, 270, 275, 281, 287	Abafi-Aigner 1910
109.	*Melitaea trivia* (Denis & Schiffermüller, 1775)	29, 34, 49, 124, 143, 178	Abafi-Aigner 1910
110.	*Minois dryas* (Scopoli, 1763)	6, 15, 28, 29, 30, 34, 45, 49, 51, 103, 120, 126, 128, 143, 157, 225, 243, 262, 263, 271, 278, 287	Marčec 2008
111.	*Neptis rivularis* (Scopoli, 1763)	37, 49, 64, 68, 108, 192, 194, 215	Abafi-Aigner 1910, Marčec 2008
112.	*Neptis sappho* (Pallas, 1771)	6, 7, 9, 19, 29, 30, 31, 33, 34, 41, 45, 46, 49, 50, 55, 66, 75, 79, 80, 89, 90, 95, 97, 103, 108, 120, 127, 134, 135, 142, 143, 144, 149, 154, 163, 164, 179, 181, 182, 183, 184, 188, 192, 196, 197, 209, 213, 215, 216, 217, 229, 233, 234, 235, 242, 243, 252, 262, 263, 266, 269, 271, 279, 282, 284, 287	Abafi-Aigner 1910, Marčec 2008
113.	*Nymphalis antiopa* (Linnaeus, 1758)	29, 34, 105, 108, 135, 139, 174, 180, 185, 217, 218	Abafi-Aigner 1910, Marčec 2008
114.	*Nymphalis polychloros* (Linnaeus, 1758)	29, 34, 105, 108, 139, 142, 180, 192, 201, 214, 217	Abafi-Aigner 1910, Marčec 2008
115.	*Pararge aegeria* (Linnaeus, 1758)	7, 33, 34, 41, 49, 64, 71, 73, 78, 81, 103, 105, 108, 123, 174, 192, 197, 225, 234, 238	Marčec 2008

No	List of species	Locality number	Literature
116.	*Polygonia c-album* (Linnaeus, 1758)	6, 15, 23, 24, 29, 30, 31, 33, 34, 40, 41, 45, 49, 50, 52, 54, 64, 79, 90, 98, 102, 105, 108, 110, 113, 120, 123, 125, 135, 139, 142, 144, 146, 148, 159, 160, 174, 180, 184, 185, 188, 192, 194, 197, 199, 201, 204, 210, 215, 217, 219, 222, 224, 225, 226, 234, 243, 255, 259, 269, 273, 279, 282, 286, 289	Abafi-Aigner 1910, Marčec 2008
117.	*Pyronia (Pyronia) tithonus* (Linnaeus, 1767)	78	Abafi-Aigner 1910, Marčec 2008
118.	*Vanessa atalanta* (Linnaeus, 1758)	2, 8, 9, 29, 32, 33, 34, 37, 40, 41, 43, 44, 45, 49, 50, 57, 77, 78, 79, 82, 97, 103, 107, 108, 120, 122, 123, 129, 133, 135, 139, 142, 143, 144, 148, 159, 182, 184, 188, 192, 196, 202, 207, 209, 211, 214, 215, 219, 222, 223, 225, 239, 243, 244, 248, 249, 252, 263, 275, 284	Abafi-Aigner 1910, Marčec 2008
119.	*Vanessa cardui* (Linnaeus, 1758)	1, 10, 12, 15, 36, 38, 39, 40, 44, 67, 70, 90, 97, 98, 99, 109, 110, 112, 113, 120, 129, 143, 217, 219, 225, 249, 278	Abafi-Aigner 1910, Marčec 2008

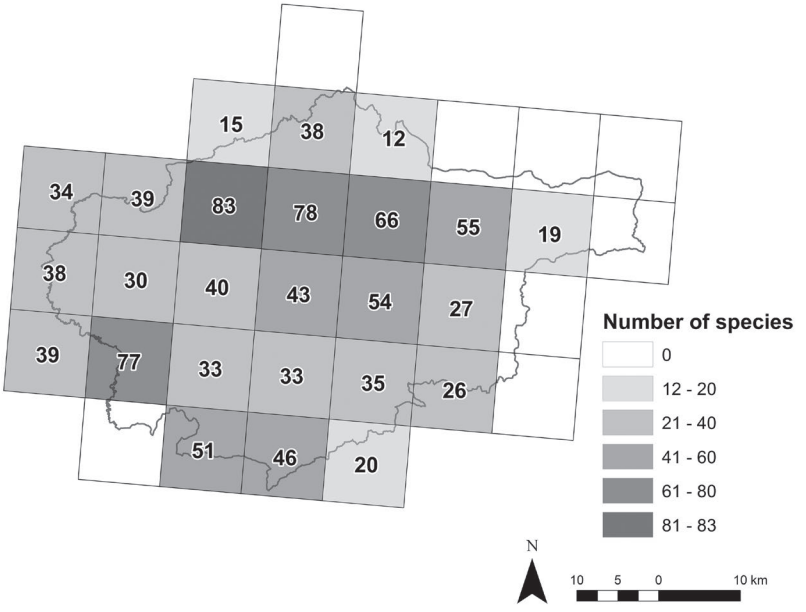

Fig. 2. EEA 10 x 10 km reference grid with the number of recorded species within each square.

DISCUSSION

In the historically extensively managed agricultural landscape of Hrvatsko zagorje with small parcels of mosaic and diverse land use and heterogeneous habitats, changes in agricultural policy and globalisation led to the decline and abandonment of pastures and meadows, with the consequence of declining butterfly diversity. Today, suitable habitats in lowland and hilly areas are dotted between arable land and forest fragments on the hills. Big areas of wet meadows are urbanised or overgrown by invasive alien plant species.

Habitat generalists like *Pieris rapae* (Linnaeus, 1758), *Pieris napi* (Linnaeus, 1758), *Leptidea sinapis* (Linnaeus, 1758), *Melitaea athalia* (Rottemburg, 1775), *Gonepteryx rhamni* (Linnaeus, 1758), *Coenonympha pamphilus* (Linnaeus, 1758), *Lysandra icarus* (Rottemburg, 1775) and *Maniola jurtina* (Linnaeus, 1758) are still common and widespread throughout the region. On the other hand, habitat specialists are usually very local and present only on suitable habitat types, which are also usually scarce and small.

Dry grasslands are one of the most endangered habitats in the region, as the only preserved patches of grasslands in the area remained in mountainous areas. They are usually located on steep or not easily accessible localities and are now abandoned and overgrown with shrubs and small trees. The best-preserved dry grasslands in the area are at the locality Plat on the southern slope of Mt. Strahinjščica. They were revitalized several years ago, and are now regularly mowed late in the season once a year, to stop the succession, which is the main cause of degradation of dry grasslands. There are several areas in the region that urgently need actions for preventing loss of grasslands, like Mt. Ivanščica, Zelenjak and on other preserved meadows in the western part of the region, near the Sutla River. Due to lack of suitable habitats dry grassland specialists like *Plebejus* spp., *Polyommatus daphnis* (Denis & Schiffermüller, 1775), *Pyrgus armoricanus* (Oberthür, 1910), *Spialia sertorius* (Hoffmannsegg, 1804), *Carcharodus floccifera* (Zeller, 1847) or even *Carcharodus alceae* (Esper, 1780) are generally very rare in the region.

Polyommatus thersites (Cantener, 1834) is another rare and a local species in Hrvatsko zagorje but also generally in Croatia, categorized as Near Threatened (Šašić *et al*., 2015). This species inhabits dry grasslands on which its host plant, *Onobrychis viciifolia* Scop., grows. In Hrvatsko zagorje we recorded this species on small grassland patches on Mt. Strahinjščica, Mt. Ivančica and Risvica and Cesar hill. On similar habitats *Phengaris alcon rebeli* (Dennis & Schiffermüller, 1775) and *Polyommatus daphnis* were found, also in very small numbers. All three species are endangered due to lack of management on grasslands being overgrown with shrubs.

Wet grasslands are found along watercourses and in areas with limited drainage in valleys. Several interesting species have been found there including a wet grassland specialist, *Boloria selene* (Dennis & Schiffermüller, 1775), which was recorded only once with a single specimen. While several historical records exist for this species in northern Croatia, it seems that it is becoming rare in Hrvatsko zagorje as the majority of wet grasslands are abandoned and declining. Similarly, in the neighbouring Slovenian region, Haloze, the species was recorded at only two of 67 surveyed localities (Verovnik, 2003). This species is not included in the Red Book of butterflies of Croatia (Šašić *et al*., 2015) but with the start of monitoring activities, we will be able to determine changes in population trends. Additionally, wet grassland species included in the Habitats Directive Annexes, *Euphydryas aurinia* (Rottemburg. 1775) and *Lycaena dispar* (Haworth, 1802) are present in these habitats and are included in the Natura 2000 network of nature protection areas of the European Union.

An additional Habitats Directive species, *Phengaris teleius*, has been observed on grasslands along the Bednja River. Its habitats are slowly overgrowing by shrubs and invasive plant species and urgent conservation actions are needed to prevent the disappearance of the species from Hrvatsko zagorje.

Species inhabiting forest clearings, forest edges and light woodlands are rarely observed. The same is true for *Hipparchia* species, with only three records of *H. fagi*, and none of *H. semele,* which is more common on karstic areas. Only a single specimen of *H. fagi* was observed in the region. We were expecting to find populations in woodlands on Mt. Ivanščica and Mt. Strahinjščica, but without success, despite many field observations. Lorković (2009) had already stated that the species was rare in lowland hill forests. Similarly, *L. achine* (Scopoli, 1763) has been observed only on Mt. Ivanščica with only a dozen observed specimens. The consecutive visits to the same locality during the last couple of years have yielded no further observation of this species, which may indicate it has become extinct or that the numbers have dropped to levels below the detectability threshold.

In contrast with the past, forests are becoming increasingly dense and not used or maintained in the same way as 40 years ago, when the edges were regularly cleaned, leaf litter was partly used in livestock keeping, and the clearings and forest edges were full of flowers. Today there is a lot less undergrowth and the forest edges are not maintained, being overgrown by shrubs, *Rubus* species and invasive plants or they are cleaned with heavy machinery, which destroys remaining plants and insects in the middle of the season. Therefore, many forest species are also declining.

Erebia aethiops (Esper, 1777) is the only member of the genus *Erebia* in northern Croatia. The presence of this species on Mt. Ivanščica was already published (Lorković, 2009) but the species was additionally discovered on Mt. Strahinjščica, Mt. Ivanščica and Risvica and Cesar hill. On the neighbouring Mt. Medvednica near Zagreb, this species was not recorded during the recent intensive survey (Koren, unpublished), indicating possible changes in the butterfly diversity. Further studies of the population of this species in northern Croatia are needed in order to access its status.

An interesting species that was observed only twice in the region is *Pyronia tithonus* (Linnaeus, 1767). Historically it was known from many regions in mainland Croatia, but with limited number of records (Jakšić, 1988). The species is common in the Mediterranean region (e.g. Istria), but in the continental part of the country it is very localized. It usually inhabits forest edge habitats like shrubs, field edges and hedgerows. Additional surveys of this species are needed, in order to access its distribution and status in the region.

Six species have not been found during our nine years of study. One is the most endangered European species *Colias myrmidone* (Esper, 1781), which is already extinct from several countries (Marhoul & Dolek, 2012). In the past it was present in the surroundings of Krapina (Abafi-Aigner 1910). During recent surveys in nearby Slovenia it was not found as either (Verovnik, 2003). The last record of the species from Croatia is from the 1990s (Krčmar *et al*., 1996), which is similar to the situation in Slovenia, where it is presumed to be extinct (Predovnik & Verovnik, 2004).

Another formerly common species which we have not found is *Aporia crataegi* (Linnaeus, 1758). In the past, it was a widely distributed species in Croatia (Lorković, 2009), also in the WE part. Brusina (1889) reports an interesting observation from his train ride from Zagreb to Varaždin: "in the places where the land was wet, or at dunghills, hundreds of butterflies could be seen, one close to another drinking from the surface, which from the distance looked like a big white sheet". He also mentions that in a nearby region, Kutinsko-Moslovačka County, money was offered for 100 caught butterflies, and during the first day, 7000 adults were caught. Nowadays, such large populations are a rarity especially in the northern part of the country. Despite natural fluctuations in numbers, it seems that the species is slowly disappearing from the northern part of Croatia. However, the statement should be confirmed with long-term monitoring. At present, its IUCN Red List status at the European scale is Least Concern, but it has been reported as regionally extinct in the Czech Republic, the Netherlands and the United Kingdom (van Swaay *et al*., 2010).

Also, we could not confirm the Natura 2000 woodland species, *Euphydryas maturna* (Linnaeus, 1758). This species is very localized and present only in the northern part of the country (Lorković, 2009). We visited several potential habitats for this species, and several of them like Lobor valley or the northern part of Mt. Ivanščica seemed very suitable as habitat is similar to the species' habitat in other parts of the country. *E. maturna* will be one of the target species for future surveys as it is present in Slovenia close to the state border (Verovnik *et al*., 2012). Additional field surveys should be carried out in order to confirm historical finding (Lorković, 1993) of another Natura 2000 species *Leptidea morsei* (Fenton, 1882) in deciduous woodland at the base of Mt. Ivanščica

In addition, *Argynnis niobe*, a species observed to be in strong decline in Europe, was not found during recent surveys. Recent studies show species dependence on very large areas of potential larval habitats with *Viola* spp. and *Plantago* (Salz & Fartmann, 2009), which might be a problem in the mosaic landscape of Hrvatsko zagorje because most of the meadows and forest edges are becoming abandoned.

Whereas the majority of butterfly species in the region are declining in abundance due to habitat loss and habitat changes, *Pieris mannii* (Mayer, 1851) seems to be expanding its range towards the north. Lorković (2009) stated that the species is rare but present on rocky areas in continental Croatia. Verovnik (2003) reports the first findings of the species in Haloze across the border and we found this species more often in Hrvatsko zagorje in recent years as well as across the border in Kozjanski Park in Slovenia. In addition, *Argynnis pandora* (Denis & Schiffermüller, 1775) is more often seen in the region, most probably due to climate change and global warming. In Slovenia, there are no known records of this species more northerly than Hrvatsko zagorje (Verovnik, 2003).

In a wider context, Hrvatsko zagorje preserves a more diverse butterfly fauna than the neighbouring region of Haloze in Slovenia, with a reported 96 species from 67 localities (Verovnik, 2003). However, looking at the situation of the remaining preserved flowering grassland and other valuable butterfly habitats, the future is not very optimistic. Small-scale farming is already disappearing as farms cannot survive and compete with globalisation. Therefore, more and more meadows are abandoned, turned into fields or too intensively managed. Forest edges, hedges and wet meadows are overgrowing with invasive alien plants. Therefore, suitable habitats for butterflies that are habitat specialists are increasingly difficult to find, and the distances between them are increasing with the disappearance of habitat patches in between. In the near future this will probably lead to local extinctions of some species, especially dry grassland specialists like *P. thersites* or *P. daphnis*. To preserve this valuable diversity in the region, renaturation of remaining grassland would be necessary and urgent. In the long term, this can work only in cooperation with local farmers, to enable them economic survival using extensive agriculture. With increasing globalisation and pressure on production processes from the global market the future does not look very optimistic even with more focused subsidies. To preserve valuable habitats in the region a joint cross-border approach with Kozjanski park and Haloze region is proposed to connect refugial habitats with potential dispersal corridors to enable sufficient gene flow between neighbouring populations of endangered species.

CONCLUSIONS

This contribution to the butterfly fauna is one of only a few extensive surveys of larger areas of Croatia, with the exception of Podravina region (Kranjčev, 1985) and the island of Krk (Habeler, 2008). With the combination of random surveys and targeted visits to the EEA 10x10 km grids, we were able to map the general butterfly biodiversity of the region. Prior to our survey the butterfly fauna of Hrvatsko Zagorje region was one of the least studied regions in Croatia, with a very limited number of literature records. During our survey, we could not record any significant expansions in the known species ranges; however, our data fill an existing gap in the known distribution of butterflies of Croatia. We still expect to reconfirm some species in the future which are known from the literature; however, no major increase in species richness is expected. The region Hrvatsko Zagorje may now be considered as one of the best studied regions in Croatia.

The largest butterfly biodiversity in the region can be found on the hills or in the mountains with preserved and diverse natural habitats. Some species historically inhabiting the region became very rare in the last century, or have possibly disappeared from the region. The most endangered habitats are grasslands and consequently, the most endangered butterflies are grassland specialists. Most of the remaining grasslands are abandoned and overgrown with shrubs and even trees. Wet grasslands are mostly covered with invasive plant species as they are not mowed, or at least, not regularly. For the long-term preservation of remaining grasslands, appropriate conservation actions and correct habitat management are needed.

As the Slovenian side of the border is also well surveyed (Verovnik, 2003), this result could be important in order to start joint conservation efforts to preserve the butterfly diversity on a broader scale. We would also encourage additional surveys and publications from the neighbouring region to gain a more comprehensive picture about the butterfly diversity of Croatia.

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SAŽETAK

Prilog poznavanju faune danjih leptira (Lepidoptera: Papilionoidea) Hrvatskog zagorja, Hrvatska

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Područje Hrvatskog zagorja jedno je od najneistraženijih područja u Hrvatskoj u pogledu raznolikosti danjih leptira, s tek ograničenim brojem literaturnih nalaza, većinom starijih od 100 godina. Naše istraživanje ove regije trajalo je devet godina, od 2008. pa do 2016. godine, prilikom čega smo posjetili 292 lokacije. Kao podlogu za kartiranje koristili smo EEA 10x10 kilometarsku mrežu, koju smo prvih godina popunjavali nesustavno, a 2016. godine ciljano smo kartirali i posjećivali slabije istražene ili neistražene lokacije. Ukupno smo zabilježili 112 vrste danjih leptira, a pregledom literature zabilježili smo dodatnih šest vrsta, što zajedno čini 118 vrsta ili 60% faune danjih leptira Hrvatske. Najveća raznolikost leptira zabilježena je na planinama Ivanjščici i Strahinjščici te u dolini rijeke Sutle. Tijekom istraživanja primijećeno je da se vrste koje su stanišni generalisti mogu susresti gotovo na svim lokacijama, dok su vrste vezane uz točno određene stanišne tipove, odnosno stanišni specijalisti, vrlo lokalne i uglavnom malobrojne. Zabilježili smo i nekoliko rijetkih i ugroženih vrsta, ponajviše travnjačkih specijalista poput *Phengaris teleius*, *Ph. alcon*., *Polyommatus thersites*, *Euphydryas aurinia* i *Zerynthia polyxena* čija su staništa u opadanju zbog promjene u korištenju travnjaka poput zapuštanja ili rjeđe, pojačanog korištenja. Populacija vrste *Lycaena dispar* je još uvijek lokalno mnogobrojna, no i njena se staništa ubrzano zarastaju od strane invazivnih biljaka. Regija Hrvatskog zagorja bogatija je vrstama nego susjedna regija Haloze u Sloveniji (Verovnik, 2003), no primijećeni su negativni trendovi u nestanku staništa. Promjene u načinu gospodarenja zemljištem, prvenstveno napuštanje tradicionalnog stočarstva kao i poljoprivrede na malim parcelama, dovelo je do zarastanja i nestanka malih fragmenata staništa. Najpovoljnija staništa poput suhih travnjaka opstaju uglavnom na termofilnim strmim obroncima brežuljaka i planina, dok su drugdje gotovo u potpunosti nestala. Zahvaljujući tome su i brojnosti vrsta vezana uz takva staništa, poput *P. thersites* ili *P. daphnis*, iznimno male. Isto tako, vlažni travnjaci uglavnom su degradirani ili prekriveni invazivnim biljkama, onemogućujući dugoročni opstanak močvarnih vrsta na području Hrvatskog zagorja. Opstanak rijetkih i ugroženih vrsta leptira na području Hrvatskog zagorja u potpunosti ovisi o usmjerenim manjim i većim akcijama revitalizacije staništa.

Appendix I. List of surveyed localities, coordinates and dates.

Locality number	Locality name	E	N	Date
1	Zagorska Sela municipality, between Luke Poljanske and Harina Žlaka settlements	46,15778	15,61258	16.8.2013
2	Zagorska Sela municipality, Poljana Sutlanska settlement, vicinity of the Sutla River	46,13041	15,61303	21.5.2016
3	Zagorska Sela municipality, Plavić settlement	46,10904	15,62236	9.7.2011
4	Zagorska Sela municipality, Zagorska Sela settlement, surroundings of Poklek hamlet	46,09826	15,62867	9.7.2011
5	Zagorska Sela municipality, Miljana settlement	46,13985	15,63247	9.7.2011
6	Zagorska Sela municipality, Zagorska Sela settlement, 500 m NE from settlement	46,10096	15,64109	16.8.2013
7	Hum na Sutli municipality, Donje Brezno settlement	46,18079	15,6418	21.5.2016
8	Hum na Sutli municipality, Prišlin settlement, close to border with Slovenia	46,2143	15,6471	21.5.2016
9	Kumrovec municipality, Razvor settlement, close to border with Slovenia 1	46,08707	15,64943	9.7.2011
10	Kumrovec municipality, Razvor settlement, close to border with Slovenia 2	46,08564	15,651	2.6.2009
11	Kumrovec municipality, Razvor settlement, close to border with Slovenia 3	46,08329	15,65704	2.6.2009
12	Kumrovec municipality, Kumrovec settlement, SW of the railway station	46,07306	15,65845	29.5.2009
13	Desinić municipality, Osredek Desinićki settlement	46,15605	15,66466	27.6.2012
14	Hum na Sutli municipality, Mali Tabor settlement, graveyard	46,21378	15,67114	21.5.2016
15	Kumrovec municipality, Kumrovec settlement, 750 m NW from settlement	46,08296	15,67475	16.8.2013
16	Desinić municipality, Desinić settlement, eastern part of the settlement	46,15103	15,67533	9.7.2011
17	Hum na Sutli municipality, Mali Tabor settlement, fishponds north of the settlement close to Slovenia 1	46,22453	15,67606	8.5.2016
18	Hum na Sutli municipality, Mali Tabor settlement, fishponds north of the settlement close to Slovenia 2	46,22442	15,67665	16.8.2013
19	Hum na Sutli municipality, between Poredje and Grletinec settlements 1	46,20095	15,67703	21.5.2016
20	Hum na Sutli municipality, between Poredje and Grletinec settlements 2	46,19985	15,67755	7.6.2016
21	Desinić municipality, Jelenjak settlement	46,11304	15,6806	14.6.2013
22	Desinić municipality, Ravnice Desinićke settlement, surroundings of Šplajti hamlet	46,10816	15,68492	2.6.2009
23	Desinić municipality, Gaber settlement	46,14879	15,68692	7.6.2016
24	Kumrovec municipality, Risvica settlement, close to the Sutla River	46,06308	15,69489	29.5.2009
25	Desinić municipality, Dubravica Desinićka settlement	46,15235	15,69737	14.6.2013
26	Kumrovec municipality, Risvica settlement	46,06895	15,701	19.5.2012
27	Hum na Sutli municipality, Hum na Sutli settlement, 1,5 km SE from the settlement	46,20794	15,70475	9.7.2011
28	Kumrovec municipality, Risvica settlement, surroundings of St. Mary Risvica church 1	46,06173	15,71118	07.06.2015, 03.07.2015, 25.07.2015, 28.08.2015, 13.09.2015
29	Kumrovec municipality, Risvica settlement, surroundings of St. Mary Risvica church 2	46,06174	15,71126	14.04.2013, 18.04.2013, 09.06.2013, 16.07.2013, 02.08.2013
30	Kumrovec municipality, Risvica settlement, surroundings of Pušlečev Jarak hamlet	46,06479	15,71134	14.04.2013, 09.06.2013, 02.08.2013
31	Kumrovec municipality, Risvica settlement, surroundings of Zelenjak restaurant	46,05956	15,71296	2.7.2013
32	Kraljevec na Sutli municipality, Draše settlement	46,00887	15,71458	7.9.2013
33	Kumrovec municipality, Risvica settlement, old quarry	46,06242	15,71571	08.06.2013, 16.07.2013, 31.07.2013

Locality number	Locality name	E	N	Date
34	Klanjec municipality, Mihanovićev Dol settlement, along Sutla River towards Zelenjak restaurant	46,05705	15,71641	14.04.2013, 08.06.2013, 15.07.2013, 31.07.2013, 02.08.2013
35	Hum na Sutli municipality, Hum na Sutli settlement, Leskov Grm hamlet	46,22183	15,7168	9.7.2011
36	Hum na Sutli municipality, Druškovec Humski settlement, Ulice hamlet	46,188	15,71993	7.6.2016
37	Klanjec municipality, Mihanovićev Dol settlement, old ruins on Cesar hill	46,06031	15,7233	2.7.2013
38	Klanjec municipality, Mihanovićev Dol settlement, along Sutla River	46,052	15,72388	29.5.2009
39	Desinić municipality, Velika Horvatska settlement, towards Kramarići hamlet	46,10471	15,72318	2.6.2009
40	Kraljevec na Sutli municipality, Kačkovec settlement	46,01151	15,72497	16.8.2013
41	Klanjec municipality, Mihanovićev Dol settlement, mountaineers house on Cesar hill	46,05878	15,72462	10.05.2012, 08.06.2013, 01.08.2013
42	Pregrada municipality, Kostelsko settlement, SW part of the settlement	46,18841	15,72396	9.7.2011
43	Klanjec municipality, Mihanovićev Dol settlement, road to mountaineers house on Cesar hill 1	46,05686	15,7259	27.6.2012
44	Desinić municipality, Donji Zbilj settlement, eastern part of the settlement	46,11449	15,72519	7.6.2016
45	Kumrovec municipality, Podgora settlement	46,06541	15,72662	16.07.2013, 01.08.2013
46	Klanjec municipality, Mihanovićev Dol settlement, road to mountaineers house on Cesar hill 2	46,05559	15,72735	27.6.2012
47	Klanjec municipality, Novi Dvori Klanječki settlement	46,02267	15,72911	19.5.2012
48	Tuhelj municipality, Pristava settlement 1	46,07547	15,73366	9.7.2011
49	Klanjec municipality, Cesarska Ves settlement, Japica top on Cesar hill	46,05859	15,7362	08.06.2013, 01.08.2013
50	Klanjec municipality, Ledine Klanječke settlement	46,01662	15,73687	16.8.2013
51	Klanjec municipality, between town of Klanjec and Lepoglavec settlement	46,04649	15,73911	16.8.2013
52	Tuhelj municipality, Prosenik settlement, vicinity of Horvatska river	46,09907	15,73889	20.04.2013, 14.06.2013
53	Tuhelj municipality, Pristava settlement 2	46,07493	15,74132	14.6.2013
54	Tuhelj municipality, Tuhelj settlement, northern part along Horvatska river	46,08719	15,74704	20.4.2013
55	Klanjec municipality, between town of Klanjec and Cesarska Ves settlement	46,05545	15,74859	7.5.2013
56	Pregrada municipality, town of Pregrada, Kuna mountain slopes north of the town	46,16854	15,74828	9.5.2012
57	Pregrada municipality, Kostel settlement, NE slopes of Kuna mountain next to Kosteljina river	46,18123	15,74899	7.6.2016
58	Pregrada municipality, town of Pregrada, suburbs	46,16083	15,75927	20.04.2013, 14.06.2013
59	Pregrada municipality, town of Pregrada, between Dubrava hamlet and Vrhi Pregradski settlement	46,14728	15,7605	7.6.2016
60	Kraljevec na Sutli municipality, Radakovo settlement, next to Lučelnica stream	46,00447	15,77379	7.9.2013
61	Pregrada municipality, Valentinovo settlement, between Pasaričeki and Makari hamlet	46,15626	15,79191	14.6.2013
62	Petrovsko municipality, Svedruža settlement, between Makari and Živičnjaki hamlet	46,15572	15,80038	9.7.2011
63	Đurmanec municipality, Jezerišće settlement, NW from the settlement	46,20255	15,80035	9.5.2012
64	Đurmanec municipality, Hromec settlement, 3,7 km N from the settlement on Macelj mountain	46,24329	15,80085	6.6.2015
65	Đurmanec municipality, Jezerišće settlement, N from the settlement	46,20652	15,80543	9.5.2012
66	Đurmanec municipality, Hromec settlement, southern slopes of the Macelj mountain	46,2125	15,80951	9.5.2012
67	Veliko Trgovišće municipality, Ravnice settlement, 800 m N-NE from Pavliši hamlet	46,0591	15,81255	29.5.2009

Locality number	Locality name	E	N	Date
68	Đurmanec municipality, Donji Macelj settlement, Macelj mountain, 2.5 km W from the Fruki hamlet	46,24357	15,81295	6.6.2015
69	Luka municipality, Luka settlement	45,95814	15,81925	7.9.2013
70	Jakovlje municipality, Jakovlje settlement, W from the settlement next to the Krapina River 1	45,94295	15,82371	29.5.2009
71	Đurmanec municipality, Gornji Macelj settlement, Macelj mountain, 2.9 km W from the settlement	46,25776	15,82221	24.9.2011
72	Jakovlje municipality, Jakovlje settlement, W from the settlement next to the Krapina River 2	45,95915	15,8321	26.6.2014
73	Đurmanec municipality, Donji Macelj settlement, Macelj mountain, sawmill surroundings in Smiljanova Graba hamlet	46,2333	15,83338	24.9.2011
74	Đurmanec municipality, Đurmanec town	46,19559	15,84001	25.9.2011
75	Đurmanec municipality, Đurmanec town, 900 m N from the town	46,20464	15,84163	9.5.2012
76	Oroslavje municipality, Stubička Slatina settlement, 2 km NW from the settlement next to the Krapina River	45,98526	15,8464	15.5.2008
77	Veliko Trgovišće municipality, Veliko Trgovišće town, next to the Krapina River	45,9902	15,84854	12.6.2010
78	Jakovlje municipality, Jakovlje settlement, Ževerinjak meadows north from Sveci hamlet 1	45,95742	15,84924	23.05.2014, 26.07.2014, 19.09.2014
79	Đurmanec municipality, Donji Macelj settlement, Macelj mountain, surroundings of Lepa Bukva resting stop	46,23854	15,84895	23.7.2013
80	Krapina municipality, Škarićevo settlement, between Mirti and Vinski hamlet	46,12904	15,85027	8.9.2013
81	Krapina municipality, road between Krapina town and Petrovsko settlement	46,16865	15,85009	9.7.2011
82	Veliko Trgovišće municipality, Jezero Klanječko settlement	46,02159	15,85208	7.9.2013
83	Jakovlje municipality, Jakovlje settlement, Ževerinjak meadows north from Sveci hamlet 1	45,95813	15,85337	15.5.2008
84	Oroslavje municipality, Stubička Slatina settlement, 1.5 km NW from the settlement next to the Krapina River 1	45,98768	15,85453	2.6.2009
85	Oroslavje municipality, Stubička Slatina settlement, 1.5 km NW from the settlement next to the Krapina River 2	45,98758	15,85488	15.5.2008
86	Krapina municipality, Krapina town	46,16628	15,86399	27.4.2010
87	Krapina municipality, Zagora settlement	46,19318	15,86822	19.5.2015
88	Đurmanec municipality, Gornji Macelj settlement	46,26155	15,86833	10.7.2011
89	Krapina municipality, Žutnica settlement, Križni jarek area	46,19631	15,87362	19.5.2015
90	Sveti Križ Začretje municipality, Završje Začretsko settlement	46,10812	15,87592	17.8.2013
91	Oroslavje municipality, Stubička Slatina settlement, Srednja Slatina hamlet	45,97076	15,88003	29.6.2012
92	Krapina municipality, Polje Krapinsko settlement, Kuhari hamlet	46,1399	15,88006	14.6.2013
93	Oroslavje municipality, Mokrice settlement, Gradičeki hamlet surroundings	46,00314	15,88461	19.5.2012
94	Oroslavje municipality, Krušljevo Selo settlement, NW from the settlement	45,98416	15,88842	29.6.2012
95	Krapina municipality, Trški Vrh settlement, between Puleki and Lopatice hamlet	46,16771	15,88711	25.7.2015
96	Jesenje municipality, Lužani Zagorski settlement, between Mrzlečki and Vrhovski hamlet	46,22663	15,89278	04.07.2015, 29.08.2015
97	Radoboj municipality, Radoboj settlement, Strahinjščica mountain, mountaineers house	46,18614	15,89368	30.03.2014, 31.05.2014, 06.07.2014, 17.07.2014
98	Jesenje municipality, Gornje Jesenje settlement, quarry on the Strahinjščica mountain	46,19566	15,89446	4.7.2015
99	Oroslavje municipality, Krušljevo Selo settlement	45,97728	15,89827	29.6.2012

Locality number	Locality name	E	N	Date
100	Radoboj municipality, Radoboj settlement, Biruši hamlet	46,16467	15,89881	16.06.2013, 08.09.2013
101	Radoboj municipality, Strahinje Radobojsko settlement	46,17596	15,89876	12.4.2014
102	Radoboj municipality, Radoboj settlement, Zgorelci Cerovečki hamlet	46,1704	15,9005	23.7.2015
103	Radoboj municipality, Strahinje Radobojsko settlement, towards Gornji Kamenečki hamlet	46,177	15,90183	10.05.2014, 21.06.2014, 03.08.2014, 24.07.2015, 17.04.2016
104	Jesenje municipality, Gornje Jesenje settlement, S from the Galovići hamlet on Strahinjščica mountain slopes	46,19708	15,90241	4.7.2015
105	Radoboj municipality, Radoboj settlement, between Gornji and Donji Kamenečki hamlet 1	46,17614	15,90838	17.4.2016
106	Oroslavje municipality, Oroslavje settlement, betveen Topličkі stream and Krapina river	46,01207	15,91034	08.05.2016, 22.05.2016
107	Sveti Križ Začretje municipality, Sveti Križ Začretje settlement	46,07949	15,91017	17.8.2013
108	Radoboj municipality, Radoboj settlement, between Gornji and Donji Kamenečki hamlet 2	46,17638	15,91049	10.05.2014, 21.06.2014, 24.07.2015
109	Radoboj municipality, Radoboj settlement, Kunšteki hamlet	46,16023	15,91465	24.06.2012, 21.07.2012, 23.07.2013
110	Jesenje municipality, Brdo Jesenjsko settlement, Kranjčeci hamlet surroundings 1	46,19531	15,91448	4.7.2015
111	Radoboj municipality, Radoboj settlement, between Jurinjaki and Tuški hamlet	46,15388	15,91511	24.6.2012
112	Zabok municipality, Zabok town, Tršinski hamlet	46,03208	15,91748	22.6.2013
113	Zabok municipality, Lug Zabočki settlement, vicinity of river Krapina	46,0181	15,91792	22.6.2013
114	Jesenje municipality, Brdo Jesenjsko settlement, Kranjčeci hamlet surroundings 2	46,19646	15,91635	19.5.2015
115	Oroslavje municipality, Andraševec settlement, 2 km NW from the settlement next to the Krapina River	46,01472	15,91937	8.5.2016
116	Jesenje municipality, Brdo Jesenjsko settlement, Kranjčeci hamlet surroundings 3	46,19586	15,91833	4.7.2015
117	Radoboj municipality, Radoboj settlement, Horvati hamlet	46,15838	15,9199	21.6.2012
118	Zabok municipality, Hum Zabočki settlement	46,02619	15,9228	11.6.2010
119	Sveti Križ Začretje municipality, Brezova settlement	46,05322	15,92446	8.5.2016
120	Radoboj municipality, Radoboj settlement, Malogorski hamlet	46,1737	15,92346	12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011
121	Oroslavje municipality, Andraševec settlement, 450 m NW from the settlement	46,0052	15,9257	22.5.2016
122	Jesenje municipality, Cerje Jesenjsko settlement, surroundings	46,20961	15,92433	29.6.2013
123	Sveti Križ Začretje municipality, Mirkovec settlement, vicinity of Mirkovac castle	46,06527	15,92771	31.8.2013
124	Radoboj municipality, Radoboj settlement, Petrići hamlet	46,16988	15,92821	20.05.2012, 23.06.2012, 04.08.2012
125	Radoboj municipality, Radoboj settlement, southern slopes of Mt. Strahinjščica beneath Sekolje top	46,18208	15,9322	12.4.2014
126	Radoboj municipality, Gorjani Sutinski settlement, between Mišeki and Florijani hamlet	46,17121	15,9358	20.05.2012, 23.06.2012, 04.08.2012
127	Bednja municipality, Šinkovica Šaška settlement, Trakošćan lake	46,26412	15,93537	10.7.2011
128	Radoboj municipality, Gorjani Sutinski settlement, NE from Draganići hamlet 1	46,17589	15,93895	30.8.2014

Locality number	Locality name	E	N	Date
129	Radoboj municipality, Gorjani Sutinski settlement, NE from Draganići hamlet 2	46,17689	15,93922	21.06.2014, 22.06.2014, 29.08.2014, 30.08.2014, 09.09.2014, 29.09.2014, 16.04.2015, 06.06.2015, 17.04.2016, 22.05.2016
130	Bedekovčina municipality, Križanče settlement	46,05797	15,94054	31.8.2013
131	Stubičke toplice municipality, Pila settlement, 1 km SE from settlement towards G.Pila hamlet	45,94255	15,94179	29.6.2012
132	Radoboj municipality, Gornja Šemnica settlement, Slivnjaki hamlet	46,1489	15,94122	9.7.2011
133	Stubičke toplice municipality, Stubičke toplice settlement, Jarki hamlet	45,95862	15,94422	18.8.2013
134	Radoboj municipality, Gorjani Sutinski settlement, NE from Draganići hamlet 3	46,17746	15,94286	20.05.2012, 23.06.2012
135	Bednja municipality, Trakošćan settlement, Trakošćan lake next to castle	46,25829	15,94387	23.7.2013
136	Donja Stubica municipality, Pustodol settlement	45,97671	15,9505	29.6.2012
137	Jesenje municipality, Brdo Jesenjsko settlement, Basaki hamlet surroundings next to Presečina stream	46,19102	15,95132	16.6.2013
138	Radoboj municipality, Gornja Šemnica settlement, between Šlepaji and Riseki hamlet	46,14985	15,95247	9.7.2011
139	Stubičke toplice municipality, Sljeme settlement, Medvednica mountain, quarry 3.5 km SE from Kraljev Vrh	45,92331	15,95569	26.6.2014
140	Bednja municipality, Šinkovica Šaška settlement, next to the Bednja River	46,2533	15,95426	7.7.2012
141	Mihovljan municipality, Mihovljan settlement, Dačnik hamlet surroundings	46,12034	15,95848	9.7.2011
142	Radoboj municipality, Gorjani Sutinski settlement, Smrečki hamlet surroundings 1	46,18093	15,95932	30.08.2014, 06.06.2015
143	Radoboj municipality, Gorjani Sutinski settlement, Smrečki hamlet surroundings 2	46,17998	15,95993	20.05.2012, 23.06.2012, 25.06.2012, 04.08.2012, 04.08.2012
144	Radoboj municipality, Gorjani Sutinski settlement, Smrečki hamlet surroundings 3	46,18006	15,95998	16.06.2013, 08.09.2013
145	Radoboj municipality, Gorjani Sutinski settlement, Smrečki hamlet surroundings 4	46,17719	15,96101	17.4.2016
146	Novi Golubovec municipality, Očura settlement, Malogorski hamlet surroundings 1	46,18801	15,96331	16.6.2013
147	Novi Golubovec municipality, Očura settlement, Malogorski hamlet surroundings 2	46,18647	15,96496	22.5.2016
148	Radoboj municipality, Gorjani Sutinski settlement, Smrečki hamlet surroundings 5	46,18005	15,96649	22.06.2014, 06.06.2015, 17.04.2016
149	Novi Golubovec municipality, Očura settlement, Bistrevići hamlet surroundings	46,1916	15,97598	7.7.2012
150	Bednja municipality, Prebukovje settlement, southern enterance to the settlement	46,25248	15,98158	7.7.2012
151	Novi Golubovec municipality, Novi Golubovec settlement	46,17204	15,98357	12.6.2011
152	Novi Golubovec municipality, Očura settlement	46,19051	15,98576	7.7.2012
153	Donja Stubica municipality, Donja Stubica settlement, Golubovec castle surroundings	45,98005	15,9878	19.5.2012
154	Donja Stubica municipality, Donja Stubica settlement, Golubovečki fishponds 1	45,9767	15,98854	18.8.2013
155	Donja Stubica municipality, Donja Stubica settlement, Golubovečki fishponds 2	45,97628	15,98863	28.06.2014, 02.08.2014
156	Donja Stubica municipality, Milekovo selo settlement 1	45,97225	15,99145	2.8.2014
157	Donja Stubica municipality, Milekovo selo settlement 2	45,97282	16,00127	2.8.2014
158	Gornja Stubica municipality, Gornja Stubica settlement, next to Piškornica stream	45,98558	16,00373	29.6.2012

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159	Bedekovčina municipality, Bedekovčina settlement, lakes	46,04081	16,0039	18.8.2013
160	Bedekovčina municipality, Lug Poznanovečki settlement, next to Vojsek stream	46,05463	16,00381	4.6.2016
161	Bedekovčina municipality, Lug Poznanovečki settlement, next to Vojsek stream across Turki hamlet	46,05852	16,00487	4.6.2016
162	Mihovljan municipality, Sutinske toplice settlement	46,1168	16,00658	9.7.2011
163	Gornja Stubica municipality, Samci settlement, road between Samci and Banšćica settlements	45,99527	16,01803	18.8.2013
164	Lobor municipality, Stari Golubovec settlement, road between Stari and Novi Golubovec settlements 1	46,17604	16,01803	7.7.2012
165	Lepoglava municipality, Lepoglava settlement, Purga Lepoglavska hamlet	46,2106	16,02024	7.7.2012
166	Gornja Stubica municipality, Volavec settlement	45,96543	16,02362	29.6.2012
167	Lobor municipality, Stari Golubovec settlement, road between Stari and Novi Golubovec settlements 2	46,17654	16,02238	17.8.2013
168	Mače municipality, Veliki Komor settlement, Podolovje hamlet next to Sutinski stream	46,10088	16,0246	9.7.2011
169	Gornja Stubica municipality, Dubovec settlement, Krapina river surroundings close to the Golčev bridge	46,04089	16,02575	4.6.2016
170	Mače municipality, Peršaves settlement, Bukalj hamlet	46,11894	16,02924	9.7.2011
171	Gornja Stubica municipality, Hum Stubički settlement, next to Toplica stream	45,97041	16,03054	19.5.2012
172	Lepoglava municipality, Lepoglava settlement, Gaveznica significant geoheritage 1	46,20592	16,03487	25.3.2012
173	Lepoglava municipality, Zlogonje settlement, between Šoštarići and Kolenići hamlet	46,29874	16,03487	10.7.2011
174	Lepoglava municipality, Lepoglava settlement, Gaveznica significant geoheritage 2	46,2056	16,03667	25.3.2012
175	Lepoglava municipality, Žarovnica settlement, next to Kamenica stream	46,23793	16,03692	7.7.2012
176	Mače municipality, Mače settlement	46,09547	16,03948	9.7.2011
177	Gornja Stubica municipality, Dobri Zdenci settlement, Pošteki hamlet	46,01145	16,04323	8.5.2016
178	Gornja Stubica municipality, Karivaroš settlement, Zenkomir hamlet	45,96458	16,05005	29.6.2012
179	Stari Golubovec municipality, Stari Golubovec settlement, Siterice hamlet	46,17636	16,04844	7.7.2012
180	Klenovnik municipality, Klenovnik settlement, from the Cari hamlet towards Goranec settlement	46,26063	16,05383	18.3.2012
181	Lepoglava municipality, Lepoglava settlement, Ivanščica mountain, quarry from Gornji Gečkovec hamlet towards Vilinska špica mountain top 1	46,19612	16,05764	4.6.2011
182	Lobor municipality, Lobor town, begining of road towards ruins of old Lobor castle	46,17473	16,058	17.8.2013
183	Lepoglava municipality, Lepoglava settlement, Ivanščica mountain, quarry from Gornji Gečkovec hamlet towards Vilinska špica mountain top 2	46,19735	16,05925	4.6.2011
184	Lepoglava municipality, Lepoglava settlement, Ivanščica mountain, quarry from Gornji Gečkovec hamlet towards Vilinska špica mountain top 3	46,1977	16,06076	17.8.2013
185	Ivanec municipality, Bedenec settlement, Bitoševlje lakes	46,25312	16,06047	17.3.2012
186	Gornja Stubica municipality, Sveti Matej settlement, Jelovečki hamlet	45,96569	16,06365	29.6.2012
187	Lepoglava municipality, Lepoglava settlement, Gornji Gečkovec hamlet	46,20447	16,06206	4.6.2011
188	Lobor municipality, Lobor settlement, quarry 700 m N from the town	46,15702	16,06382	22.06.2014, 02.08.2014, 30.08.2014, 30.08.2015, 30.08.2015
189	Lobor municipality, Lobor settlement, 330 m N from the town	46,15393	16,06536	7.7.2012

Locality number	Locality name	E	N	Date
190	Lobor municipality, Lobor settlement, surroundings of Majka Božja Gorska church	46,15667	16,06891	10.05.2014, 30.08.2014
191	Lobor municipality, Lobor town, Ivanščica mountain, old sawmill 500 m NE from ruins of old Lobor castle	46,18126	16,07016	8.9.2013
192	Lobor municipality, Lobor town, Ivanščica mountain, old sawmill 630 m NE from ruins of old Lobor castle	46,18175	16,07149	22.06.2014, 06.06.2015
193	Zlatar municipality, Zlatar town, next to the Reka stream	46,09252	16,07257	2.4.2012
194	Lobor municipality, Lobor settlement, 460 m NE from Majka Božja Gorska church	46,15717	16,07399	22.6.2014
195	Zlatar municipality, Zlatar town, road between Zlatar and Borkovec settlement	46,10416	16,08023	9.7.2011
196	Donja Voća municipality, Slivarsko settlement, Krčeki hamlet	46,29828	16,07913	10.7.2011
197	Donja Voća municipality, Rijeka Voćanska settlement, road to Vindija cave	46,30162	16,07914	24.7.2013
198	Ivanec municipality, Kaniža settlement, Donja Kaniža hamlet	46,22469	16,08208	30.7.2011
199	Marija Bistrica municipality, Laz Stubički settlement, 500 m NW from the settlement	45,97712	16,08746	29.6.2012
200	Marija Bistrica municipality, Laz Bistrički settlement, at the Krč hamlet, road crossing between Sveti Matej - Laz Bistrički	45,95938	16,08973	19.5.2012
201	Zlatar municipality, Martinšćina settlement, Ivanščica mountain, Majer mountaineers house	46,16482	16,08821	13.4.2014
202	Ivanec municipality, Kaniža settlement, meadows next to the Bednja River	46,22823	16,08886	7.8.2008
203	Zlatar municipality, Ratkovec settlement, road towards Znož settlement	46,11403	16,09174	2.4.2012
204	Ivanec municipality, Jerovec settlement, Kuljevčica hamlet, meadows next to the Bednja River	46,23296	16,09234	7.8.2008
205	Marija Bistrica municipality, Hum Bistrički settlement, Obadi hamlet	46,00866	16,09544	29.6.2012
206	Donja Voća municipality, Slivarsko settlement, Slivarčani hamlet	46,29023	16,09502	24.7.2013
207	Zlatar municipality, Gornja Batina settlement, Lončari hamlet	46,12234	16,10156	15.6.2013
208	Ivanec municipality, Jerovec settlement, Vidernjak lakes	46,23157	16,10293	7.8.2008
209	Marija Bistrica municipality, Tugonica settlement, lake north from the Mesari hamlet	46,04092	16,10505	18.8.2013
210	Ivanec municipality, Knapić settlement, road towards the top of Ivanščica mountain, Vuglovečka steza area 1	46,19531	16,10593	15.6.2013
211	Ivanec municipality, Knapić settlement, road towards the top of Ivanščica mountain, Vuglovečka steza area 2	46,19306	16,10684	12.06.2011, 18.07.2011
212	Ivanec municipality, Knapić settlement, road towards the top of Ivanščica mountain, Vuglovečka steza area 3	46,1931	16,10698	4.6.2011
213	Zlatar municipality, Gornja Batina settlement, between Gornja Batina and Kadoići hamlet	46,11149	16,10798	9.7.2011
214	Zlatar municipality, Gornja Batina settlement	46,1167	16,11096	15.6.2013
215	Ivanec municipality, Prigorec settlement, road towards the top of Ivanščica mountain, Žgano vino area 1	46,19591	16,12133	25.7.2013

Locality number	Locality name	E	N	Date
216	Ivanec municipality, Prigorec settlement, road towards the top of Ivanščica mountain, Žgano vino area 2	46,19594	16,12158	7.6.2015
217	Ivanec municipality, Prigorec settlement, road towards the top of Ivanščica mountain, Žgano vino area 3	46,1963	16,12196	12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011, 16.09.2011, 26.06.2012, 15.06.2013
218	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 2	46,18131	16,1239	5.7.2014
219	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 2	46,18014	16,12426	22.06.2014, 24.07.2015
220	Marija Bistrica municipality, Marija Bistrica town, road towards Brezje hamlet	46,01342	16,12636	26.06.2008, 19.05.2012
221	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 3	46,18245	16,12651	15.6.2013
222	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 4	46,18154	16,127	4.6.2014
223	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 5	46,18244	16,12807	25.7.2013
224	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 6	46,17894	16,12975	28.6.2014
225	Ivanec municipality, Prigorec settlement, Ivanščica mountain top, surroundings of mountaineers house 7	46,17926	16,13	12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011, 16.09.2011
226	Ivanec municipality, Prigorec settlement, road towards Ivanec at Risje area	46,20541	16,13243	12.6.2011
227	Marija Bistrica municipality, Poljanica Bistrička settlement, lakes north from the Habazini hamlet	46,04169	16,13468	21.04.2013, 18.08.2013
228	Zlatar municipality, Donja Batina settlement, Majdaki hamlet	46,0937	16,13633	19.5.2012
229	Zlatar municipality, Završje Belečko settlement 1	46,13636	16,1362	9.7.2011
230	Zlatar municipality, Petruševec settlement, Vuki hamlet	46,1174	16,13738	2.4.2012
231	Marija Bistrica municipality, Poljanica Bistrička settlement, bridge over Krapina river north from the Habazini hamlet	46,04473	16,13922	18.8.2013
232	Zlatar municipality, Završje Belečko settlement 2	46,13761	16,14068	2.4.2012
233	Ivanec municipality, Prigorec settlement, surroundings of Beli zdenci spring SE from the settlement	46,1933	16,14451	8.8.2008
234	Ivanec municipality, Prigorec settlement, Ivanščica mountain, Šumi area SE from the top	46,17921	16,14753	4.6.2011
235	Ivanec municipality, Prigorec settlement, road towards Ivanečka Željeznica	46,20307	16,15166	8.8.2008
236	Ivanec municipality, Prigorec settlement, Ivanščica mountain, Šumi spring surrounding 1	46,18867	16,15259	8.8.2008
237	Ivanec municipality, Ivanečko naselje settlement, meadows next to the Bednja River 1	46,24482	16,15487	7.8.2008
238	Ivanec municipality, Prigorec settlement, Ivanščica mountain, Šumi spring surrounding 2	46,1891	16,15525	15.6.2013
239	Konjščina municipality, Bočadir settlement, Kosovci hamlet	46,06972	16,15753	27.04.2010, 08.07.2012, 17.08.2013
240	Zlatar municipality, Donja Selnica settlement, surroundings of Gornja Selnica castle 1	46,14031	16,16068	21.04.2013, 31.08.2013
241	Konjščina municipality, Klimen settlement, Šćurići hamlet	46,08585	16,16132	27.04.2010, 22.05.2010
242	Marija Bistrica municipality, Šušobreg Bistrički settlement, fishpond east of the Jantoleki hamlet	46,03086	16,16357	31.8.2013

Locality number	Locality name	E	N	Date
243	Konjščina municipality, Klimen settlement, Suvići hamlet 1	46,09793	16,16353	11.06.2010, 10.07.2010, 05.08.2010, 30.06.2011, 09.07.2011, 10.07.2011
244	Ivanec municipality, Ivanečko naselje settlement, meadows next to the Bednja River 2	46,24396	16,16275	7.8.2008
245	Zlatar municipality, Donja Selnica settlement, surroundings of Gornja Selnica castle 2	46,14159	16,16348	12.6.2013
246	Konjščina municipality, Klimen settlement, Suvići hamlet 2	46,09846	16,1638	27.4.2010
247	Ivanec municipality, Ivanečko naselje settlement, meadows next to the Bednja River 3	46,23986	16,16328	30.7.2011
248	Konjščina municipality, Šušobreg settlement, Martinci hamlet, meadows next to the Krapina River 1	46,04626	16,17026	31.8.2013
249	Ivanec municipality, Ivanečko naselje settlement, meadows next to the Bednja River 4	46,24103	16,16938	30.05.2014, 27.07.2014, 21.10.2014
250	Konjščina municipality, Šušobreg settlement, Martinci hamlet, meadows next to the Krapina River 2	46,04747	16,17339	19.5.2012
251	Konjščina municipality, Gornja Konjščina settlement, Gornji Kereši hamlet	46,09698	16,17467	9.7.2011
252	Ivanec municipality, Salinovec settlement, Ivanščica mountain, Melje area	46,21838	16,17598	19.6.2010
253	Konjščina municipality, Gornja Konjščina settlement, Donji Kereši hamlet	46,08821	16,17767	10.5.2012
254	Budinšćina municipality, Sveti Križ settlement, Hruškari hamlet	46,11391	16,17806	9.7.2011
255	Budinšćina municipality, Sveti Križ settlement, Keliši hamlet	46,12562	16,17814	21.4.2013
256	Budinšćina municipality, Pažurovec settlement, farm surroundings	46,13517	16,17859	9.7.2011
257	Konjščina municipality, Kosovečko settlement	46,07277	16,18248	19.5.2012
258	Ivanec municipality, Salinovec settlement, meadows next to the Bednja River 1	46,2232	16,18267	19.6.2010
259	Konjščina municipality, Donja Konjščina settlement, at the lake	46,05107	16,18542	08.07.2012, 17.08.2013
260	Ivanec municipality, Salinovec settlement, meadows next to the Bednja River 2	46,22145	16,18467	7.8.2008
261	Budinšćina municipality, Pažurovec settlement, road towards Budinšćina	46,12751	16,1869	21.4.2013
262	Ivanec municipality, Ivanečka Željeznica settlement	46,20968	16,18743	8.8.2008
263	Ivanec municipality, Stažnjevec settlement, a fishpond NE from the settlement	46,24608	16,18951	20.7.2014
264	Budinšćina municipality, Zajezda settlement, Ivanščica mountain, towards Degaći hamlet	46,17215	16,19109	5.6.2011
265	Budinšćina municipality, Pokojec settlement, Ivanščica mountain, SW from Mali Oštri top 1	46,18139	16,19533	5.6.2011
266	Budinšćina municipality, Pokojec settlement, Ivanščica mountain, SW from Mali Oštri top 2	46,17949	16,19689	5.6.2011
267	Budinšćina municipality, Zajezda settlement, Ivanščica mountain, towards the hunting house	46,17098	16,20002	13.4.2014
268	Budinšćina municipality, Zajezda settlement, surroundings of the Zajezda castle	46,15071	16,20035	31.8.2013
269	Ivanec municipality, Željeznica settlement, road towards Ćivrača hamlet	46,19877	16,20147	15.6.2013
270	Hrašćina municipality, Jarek Habekov settlement	46,10512	16,20554	4.6.2016
271	Konjščina municipality, Jertovec settlement, Mačkovići hamlet	46,03268	16,20673	8.7.2012
272	Hrašćina municipality, Husinec settlement, Cerinski hamlet	46,07515	16,20684	8.7.2012
273	Ivanec municipality, Željeznica settlement, Čovrani hamlet	46,19801	16,21137	15.6.2013
274	Bedenica municipality, Otrčkovec settlement	46,0219	16,21775	8.7.2012
275	Hrašćina municipality, Vrbovo settlement, Granoši hamlet surrounding	46,08003	16,22694	4.6.2016

Locality number	Locality name	E	N	Date
276	Hrašćina municipality, Vrbovo settlement, Markovići hamlet surrounding	46,0911	16,22714	8.7.2012
277	Hrašćina municipality, Vrbovo settlement, road towards Hrašćina	46,08557	16,22892	4.6.2016
278	Budinšćina municipality, Pokojec settlement, Ivanščica mountain, Frnčev Krč hamlet 1	46,17963	16,235	12.06.2011, 18.07.2011, 19.08.2011, 16.09.2011
279	Budinšćina municipality, Pokojec settlement, Ivanščica mountain, Frnčev Krč hamlet 2	46,1819	16,23893	5.6.2011
280	Bedenica municipality, Omamno settlement, next to Omamno stream	46,02257	16,24062	8.7.2012
281	Bedenica municipality, Turkovčina settlement, Travnik meadows	46,0527	16,24612	8.7.2012
282	Budinšćina municipality, Pokojec settlement, Ivanščica mountain, Frnčev Krč hamlet 3	46,18284	16,24583	17.8.2013
283	Ivanec municipality, Lovrečan settlement	46,23508	16,24613	10.7.2011
284	Novi Marof municipality, Bela settlement, Belski dol quarry 1	46,19341	16,24753	10.7.2011
285	Novi Marof municipality, Bela settlement, Belski dol quarry 2	46,19342	16,24758	21.4.2013
286	Novi Marof municipality, Bela settlement, Belski dol quarry 3	46,19369	16,24787	5.6.2011
287	Novi Marof municipality, Podrute settlement, Žegri hamlet	46,15783	16,24964	10.7.2011
288	Novi Marof municipality, Bela settlement	46,2058	16,25341	21.4.2013
289	Novi Marof municipality, Topličica settlement, fishponds	46,15625	16,28528	14.4.2013
290	Novi Marof municipality, Novi Marof town	46,15807	16,33395	4.6.2016
291	Novi Marof municipality, Moždenec settlement, meadows next to the Bednja River north from Degači hamlet	46,15466	16,34532	4.6.2016
292	Varaždinske Toplice municipality, Svibovec settlement	46,21073	16,46634	14.4.2013