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THE CONSEQUENCES OF LONG-TERM LAND USE CHANGES TO AGRICULTURE, GRASSLAND VEGETATION AND SELECTED INVERTEBRATES IN THE MARGINAL MOUNTAIN REGION OF SLOVAKIA

Abstract: The paper reviews driving forces of land use change, related subsequent changes in the management practices and their consequences for agrobiodiversity, grassland vegetation and spiders in the Poloniny National Park (NE Slovakia). It was found that despite unprecedented changesof the socio-economic systems and the land management during the studied period, the region still hosts a high biodiversity. The latest development after the CAP adoption has brought both positive (increase of the area of managed grasslands, restoration of abandoned grasslands) and negative effects (unification of grassland management, simplification of the landscape structure and decline of the habitat heterogeneity). The implications for the main grassland types and invertebrate species are discussed and proposals for the sustainable rural development and biodiversity enhancement were formulated.

Key words: *marginal area, agriculture decline, land use changes, agricultural management, CAP, biodiversity, grasslands, spiders.*

INTRODUCTION

The Poloniny National Park (NE Slovakia) represents the biodiversity hot-spot located at political and biogeographic borders. The nature values of the region were recognized early and already in period 1964–67 the network of the state nature reserves was established aiming especially in protection of the primeval forests. In 1977 the region was declared as the "Východné Karpaty" Landscape Protected Area and later, in 1997 as the Poloniny National Park. The region is part of trilateral (Slovakia/Poland/Ukraine) Biosphere Reserve Eastern Carpathians of the UNESCO Man and Biosphere Programme. The region has a specific position in

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transition zone between Western and Eastern Carpathians resulting in the unique communities composed of species from both regions.

The agriculture has underwent significant changes in the studied region since mid-20 century. The socialistic industrialisation after the World War II, collectivisation of agriculture from the 1970 s and the agriculture decline after the massive political and socio-economic changes of 1989 have caused substantial pressures to agroecosystems and especially to grasslands in the region. The part of the region was impacted also by construction of the water reservoir for the drinking water in early 1980-ties connected with removal of 7 villages and consequent land abandonment. The implementation of the Common Agricultural Policy (CAP) in last 10 years provided greater financial support to restart agricultural activities in the Poloniny NP. The aim of this paper is to review driving forces of the land use change, subsequent changes in agrobiodiversity, management practices and their consequences for grassland vegetation and selected invertebrate groups in the region.

1. METHODOLOGY

Due to the interdisciplinary focus of the paper, several methods of ecological, socio-economic and GIS analysis were employed to produce integrated results. Data on socio-economic trends was collected from local censuses, statistics, historical photographs and books, brochures, maps and legislative documents. In addition, qualitative research methods, including semi-structured interviews, questionnaires, rating exercises and focus groups with stakeholders, were deployed to investigate local understandings of past and future trajectories of landscape change. The interdisciplinary research included a scenario approach with evaluation of three contrasting scenarios developed in the BioScene project [9]: Business As Usual (BAU) – assumes that current trends continue with support payments for agriculture; Agricultural Liberalisation (LIB) assumes withdrawal of all support to the agriculture sector and removal of export aids; Managed change for biodiversity (MCB) assumes withdrawal of agricultural support (similarly as in LIB) but here these funds are diverted to public and private nature conservation programmes designed to halt biodiversity loss and to encourage landscape management to meet biodiversity objectives. The scenario approach used a range of techniques to examine the implications for biodiversity, landscape and livelihoods, including results of partial single-discipline analysis, expert judgements of multidisciplinary country teams and stakeholder input in the form of feedback.

To analyse consequences of agricultural management of the area, we carried out the study of spiders on 11 study plots at Ruské, Starina and Kolbasov cadastral areas (Table 1) in both years 1999 and 2011.

Spiders were collected by pitfall traps method from June to October in both years. Five traps (0.3 l glass cups, 4 cm in diameter in 1999 and 0.5 l plastic cups, 6 cm in diameter in 2011) were set in a line on each study plot in the distance of 5 m. They were emptied monthly. Formalin (4%) with detergent was used as preservative solution. Additionally, we compared the dominance structure, spider compo-

Table 1: List of the spider study plots – location, their habitat type and applied management

No	Study plot	Type of non forest habitat	Management in 1999	Management in 2011
1.	Ruské 2	Mountain meadow and pasture, alliance *Nardo-Agrostion tenuis*	not mowed	not mowed
2.	Ruské 3	Mountain meadow and pasture, succession stage, alliance *Calamagrostion arundinaceae*	not mowed	once mowed
3.	Ruské 4	Fen meadow, alliance *Caricion davallianae*	not mowed	once mowed
4.	Ruské 5	Mesophile meadow, alliance *Arrhenatherion elatioris*	not mowed	not mowed
5.	Ruské 6	Nitrophilous fringe communities, alliance *Galio-Alliarion*	not mowed	once mowed
6.	Ruské 7	Mesophile meadow, alliance *Arrhenatherion elatioris*	not mowed	once mowed
7.	Ruské 8	Wet meadows, alliance *Calthion*	not mowed	once mowed
8.	Ruské 9	Nitrophilous fringe communities, alliance *Galio-Alliarion*	not mowed	twice mowed
9.	Ruské – Sihla	Wet meadow, alliance *Calthion, Molinion caerulae*	once mowed	once mowed
10.	Starina 11	A poor mesophile meadow, alliance *Violion*	not mowed	not mowed
11.	Kolbasov 17	Wet meadow, alliance *Calthion*	not mowed	once mowed

sition on family and species levels, and analyzed the species changes between two periods. Two indices for pairwise comparisons (Shannon's species diversity index – H', H' max and Pielou's equitability index – J) were calculated. We evaluated the presence and threat status of the spider species according to the Red List of Spiders of Slovakia [5].

2. RESULTS

2. 1. LANDSCAPE AND AGRICULTURE CHANGES

Agriculture came through many changes in the last century in Slovakia [8] but the greatest footprints in the landscape and environment were caused by the collectivisation and intensification. The most of small parcels were merged into large blocks and managed by big collective farms. Practises in the intensive agricultural management [12] were based on less diverse farming and orientation on the yield increase of some specific crops, application of the fertilizers and pesticides, conversion of natural elements to the arable land with expanding the size of crop fields, inconvenient forms of grazing. This process took place in mountainous regions of Slovakia at beginning of 1970 s. All regions recorded increase of homogenous landscape due to transformation of mosaics of arable land, pastures and forests, usually

separated by bulks with non-forest vegetation, to large intensive agricultural units in accessible localities (adjacent to villages). On the contrary, the most distant agricultural patches were abandoned and overgrown and forest expanded [1]. In the Poloniny NP, abandonment was radical and succession processes was significant – more than 20% of the area [6].

The agricultural area of the Poloniny NP has gone through many changes after World War II, having significant impact on landscape structure and biodiversity. The region is recording continuous decrease in number of population after they reached peak in 1960 s and 1970 s and the farming is exclusively performed by big farms. Other crucial factors in agricultural decline are remoteness, unsuitable economic and livelihood conditions, and evacuation of seven villages due to construction of water reservoir Starina for drinking water [7] linked with the area abandonment. Transformation of society in 1990 s was an era of economic decline, especially because of transition period from central to market economy, subsidies reduction, land properties adjustments, etc. Landscape was confronted by abandonment, at the same time the use of agro-chemicals was reduced. Processes of depopulation and overgrowing of agricultural land in the Poloniny NP was strengthening.

The last period (after accession of Slovakia to EU in 2004) is connected to increased support to agriculture and its environmental functions through the Common Agricultural Policy – CAP. The grasslands abandoned for many years are now managed again – especially at lower altitudes, the landscape has been cleared from shrubs on agricultural land and the secondary succession leading to forest has been interrupted and stopped. Regardless there is still concern about the maintenance of mountain grassland communities that are of greater biodiversity importance but with limited access and requiring specific extensive management [1]. Recent subsidies (the CAP) are focused on support of large scale farming on the easily accessible grasslands and using large machinery. The subsidy is determined by the managed area and small plots (e. g. mountain grasslands) are not included in the Land Parcel Information System and thus not eligible for financial support from the CAP. Therefore individual farmers have not been integrated into the farming process [3]. This trend supports further depopulation of the area and abandonment of small narrow parcels in nearby settlements, their overgrowing or transformation to intensive meadows. Recovery of farming management in whole area is not realistic in short time also due to economically unfavourable conditions, weak social capital and infrastructure.

The driving forces of changes described above are summarised in table 2 together with their impact on agriculture and land use. Presented drivers are distinguished as generic drivers that originated from general trends in Slovakia and site-specific drivers that are due to local development or position. Both types of drivers played important role in the landscape development of this region [3].

Table 2: Driving forces and their consequences to agriculture and land use

Description	Consequences to agriculture and land use
Socialistic industrialisation (G) – 1950s – 1970s	
– massive development of the Slovak industry after World War II, oriented mostly on heavy industry – introduction of big machinery, chemical treatments – decreased importance of agriculture in general – commuting of people to big industrial centres (outside the Poloniny NP)	Major impact to A: less time for small farming, orientation on large-scale intensive farming with support of big machinery. Minor impact to LU: changes mostly outside of the area.
Collectivisation (G) – 1970s	
– collective husbandry and ownership – productivity as the only target (intensification) – central planning, market managed by the state – establishment of two large farms in the area (the only managers of agricultural land until now)	Major impact to A: decline of extensive farming, orientation on large-scale intensive farming, abandonment of localities of difficult access Major impact to LU: small fields merged into large and intensively managed blocks, increase of forest and non-forest woody vegetation/scrub, decrease of arable land, decrease of land use classes
Political-social-economic transformation (G) – 1990s	
– transition from centrally governed society to civil society – from central planning to free market – economic crisis, decrease of GDP per capita, rise of unemployment, decline of heavy industry and agriculture – increased regional differences	Major impact to A: significant drop of agricultural support, expansion of abandoned agricultural areas Major impact to LU: increase of forest and non-forest woody vegetation/scrub
Accession to EU (G) – from 2000	
– availability of pre-accession and EU funds, boost of economy – implementation of CAP since 2004 (incl. agri-environment) – support to regional development, establishment of new economic sectors and networks – strengthening of international cooperation.	Major impact to A: increased support to agriculture, many previously overgrown agricultural patches are mowed or cleared Minor impact to LU: no significant changes, slight increase of grasslands, decrease of arable land and scrubs
Declaration of conservation areas (SS) – 1964–1967, 1977, 1997	
– 1964–67: State Nature Reserves, – 1977: Protected Landscape Area, – 1997: National Park – limits for activities in the protected areas (agriculture, forestry, recreation)	Minor impact to A: limits for agricultural intensification (heavy machinery, fertilisers), maintenance of mountain grasslands by NP Administration Minor impact to LU: without significant changes, support to forest and grassland maintenance

Description	Consequences to agriculture and land use
Construction of water reservoir Starina – 1980s (SS)	
– establishment of hygienic protection zone (HPZ) of water sources – inhabitants of 7 villages evacuated and settlements removed, human activities very limited	Major impact to A: abandonment of farming in the the vast majority of area of HPZ until the CAP (rapid succession), since the CAP only grassland management Major impact to LU: arable land transformed to grassland in area of HPZ, significant increase of forest and scrub
Remoteness of the area (SS)	
– location at very north-east part of SK (PL and UA border) – development of economic activities and infrastructure has been marginal – commute to work outside the area – depopulation since 1960 s, lack of successors in farming	Major impact to A: continual abandonment of farming since 1970 s and especially since 1990 s, decline of individual farming Major impact to LU: significant increase of forest and scrub

Legend: A – agriculture, LU – land use, (G) – generic driving force, (SS) – site-specific driving force. Sources: [4], [2], [7], [8], [10], [1], [3].

The land cover of the study area during last half of century was determined by many anthropogenic factors and by some natural factors as well. It is necessary to have in mind that the main changes in west part of the study area were driven especially by water reservoir construction and evacuation of 7 villages. The landscape dynamics of the study area during last 50 years was high – changes in land cover during studied period were recorded in area of 16 793 ha that represents more than 49% of the whole study area. The main part of arable land and mosaics with grasslands in west part of the study area became overgrown by shrubs, some of them vanished and were transformed to forests. Increase of forest was recorded in eastern part as well due mainly to gradual abandonment of extensive grasslands. The total area of this type of change represents nearly 7000 ha. Other 176 patches of shrubs were transformed to woodlands, representing 3350 ha of new forest stands.

The establishment of patches of intensive grasslands is connected with intensification of the agriculture and so called collectivisation that was initiated in the study area during 1970 s. They originated from former 71 patches of extensive grasslands – area of 111.7 ha. Significant changes in the area of arable land (fields) were recorded. Their area was decreased by 533 ha in comparison with 1949 due to extinction of 41 patches. This is closely related to system of management of agricultural land in past. While arable land was traditionally managed by individual farmers in form of narrow strips, these strips were merged into large blocks in 1970 s and managed by cooperatives and state enterprises. Currently, under influence of agriculture decline and re-structuralisation, some areas of arable land are transformed to grasslands or are abandoned. Because of shrub and trees succession they are changing to transitional woodland/shrubs.

Total area of extensive grasslands has changed only a little, but we recorded changes in their location. Some patches (only 22 ha) were overgrown by shrubs and trees, 52 new patches were established. On the other side, almost two thirds of extensive grasslands with trees were transformed to shrubs or woodlands – decrease by 1260 ha. We can summarize the main types of the change as follows:

- Increase of woodland area because of grassland abandonment and transformation from shrubs
- Establishment of intensive grasslands and new agriculture-industrial areas during period of agriculture intensification
- Abandonment of arable land in the evacuated area and its transformation to grasslands and woodland/shrubs,
- Establishment of water reservoir Starina,
- The complete removal of settlement (7 villages) in west part of the study area.

2. 2. GRASSLANDS

The biodiversity value of the study area is highly determined by the grasslands. Therefore we are focusing mainly on the extensive grasslands and priority habitats and species that are closely connected to them. The grasslands are also very sensible to the land use change, especially agricultural decline and thus represent high potential for assessment of the landscape change consequences. The overview of the main grassland types of the study area, their significance and status provides table 3.

With the agriculture decline in the region, the mountain meadows – poloniny – has been abandoned among the first. During the time, the species composition of abandoned poloniny meadows changes in favour of highly dominating tall grasses (*Calamagrostis arundinacea*, *Deschampsia cespitosa*, *Luzula luzuloides*) or dwarf shrubs (*Vaccinium myrtillus*, *V. vitis-idaea*). The species richness of plant communities falls down to the half – from more than 60 down to less than 30 species – and unique communities with East-Carpathian species disappear. Also the abandoned low-situated meadows become overgrown by shrubs mostly like *Rosa canina*, *Crataegus* sp. div., *Rubus idaeus*, *Corylus avellan*a, the pastures by *Juniperus communis* as well. Even here the species diversity falls down and dominate species with high competition ability. These changes cause the retreat of animal species adapted to managed meadows and pastures (e. g. birds *Lanius excubitor*, *Lulula arborea*) and probably of birds of prey as well (loss of prey area). On the other hand, these sites can offer good life-conditions for ecotone and woodland species like birds *Lanius collurio*, *Sylvia nisoria*, *Crex crex*, but also for big mammals either herbivorous (*Bison bonasus*) or carnivorous (*Ursus arctos*).

For estimation of the future change of grasslands we used the modelling approach [11] trying to indicate consequences of different scenario on biodiversity mainly through the status of extensive grasslands. Both total number of habitats and total area can be consider as indicators. As the results (Fig. 1) have shown, the general trend of afforestration and grasslands distribution decline is documented in all scenarios.

Table 3: Grassland habitats and species that are negatively affected by agricultural decline

Habitat type	Current status	Habitat significance	Species	Targets
Mountain meadows (poloniny)	Not managed, getting overgrown by tall grasses and small shrubs (Vaccinium)	Unique species composition, these communities occur within Slovakia only in the study area	Dianthus barbatus, Viola dacica, Campanula abietina, Melampyrum herbichii, Tephroseris papposa	Conservation of representative parts, "in situ" protection
Wet meadows	Only some of them are managed, other – change of species composition, domination of small number of species, afforestation in progress	Well-preserved types, representative on national scale	Oenanthe banatica, Achillea ptarmica, Orchis elegans, Thalictrum flavum, T. lucidum, Dactylorhiza majalis, Epipactis palustris	Preserving of the most valuable localities for the nationally important species
Extensively grazed pastures	The majority not managed, getting overgrown by shrubs	Not high significance	Spiranthes spiralis, Orchis morio	Preserve at least a sample of these habitats
Fens	Limited mowing, a part of them not managed, under threat of extinction in case of shrubs invasion	Higher density of fens in comparison with other regions, well-preserved community structure	Orchis maculata, Triglochin palustre, Valeriana simplicifolia, Dactylorhiza majalis, Epipactis palustris	Preserving of the most valuable fens

Based on the total area and number of patches of the grasslands the BAU performed as the best scenario, although the distribution of small mountain meadows decreased significantly compared to the Biodiversity scenario. As the mountain meadows represent the greatest biodiversity value this fact should be considered in later conflict management. Distribution of habitats suitable for *Crex crex* delivered better results in the BAU in comparison to the Biodiversity scenario. In both cases, the Liberalization scenario predicted the worst results. Finally, considering extensive grasslands distribution, the modelling approach has revealed that the BAU and the Biodiversity scenarios implying more positive consequences on biodiversity in comparison with the Liberalization scenario. However, an expert knowledge has to be involved in conflict management and there is a need for more general statements on the scenario consequences on biodiversity in the study area.

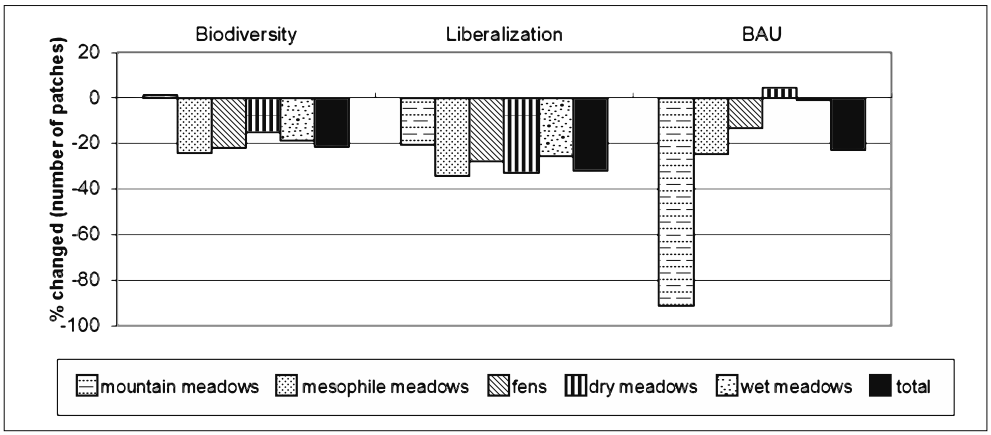

Figure 1: Consequences of individual scenarios to grassland habitats (total area compared to 2003)

For mountain meadows, the materialisation of the BAU scenario is the most probable. The field survey of the mountain poloniny meadows indicated that the dominant part of grasslands have changed structure in such degree that it is not possible to restore them, only small portion of "poloniny" grasslands is in suitable state. Because the poloniny meadows are not included into the Land Parcel Information System, it is not possible to receive the CAP support for these grasslands and their management in larger scale is not probable. In lower positions we recorded after start of implementation of the CAP increase of the area of managed grasslands and restoration of some grasslands abandoned for several decades. On other hand, we found that the grassland management becomes more uniform and this unification leads to simplification of the landscape structure and decline of the habitat heterogeneity.

2. 3. SPIDER COMMUNITIES

During 2011 (from June to October) we carried out the research ground living spider communities on 11 study plots in the non-forest ecosystems of the Poloniny National Park. Our aim was to identify change of the spider coenoses structure between two studied periods. A total of 8,559 specimens belonging to 175 species and 21 families were captured. While we recorded 1,444 individuals belonging to 82 species from 18 families in 1999, in 2011 we captured 7,115 individuals belonging to 161 species from 21 families. The number of individuals and species at each study plot and also in the whole study area increased significantly in 2011 compared to the earlier period (tab. 4). We recorded 26 threatened species listed in the Red List of Spiders of Slovakia [5]. The highest numbers of the threatened species were presented in the mesophile and wet meadows. The montane meadows and acid mesophile meadows represented the higher equitability and species diversity of the epi-

geic spider communities calculated on the basis Shannon's and Pielou's indexes. The high number of species and epigeic communities show high spider biodiversity of non-forest ecosystems in the investigated area.

Table 4: Evaluation of the epigeic spider communities of study sites in the Poloniny National Park

Study plots	N. sp.		Red list		N. ind.		H'		H' max		J	
	1999	2011	1999	2011	1999	2011	1999	2011	1999	2011	1999	2011
Ruské 2	27	50	4	3	100	366	2,68	2,48	3,29	3,91	0,81	0,63
Ruské 3	28	51	1	6	98	518	2,8	2,72	3,33	3,93	0,84	0,69
Ruské 4	19	40	2	5	124	902	2,08	2,2	2,94	3,68	0,71	0,6
Ruské 5	29	62	1	6	173	700	2,72	2,59	3,36	4,12	0,81	0,63
Ruské 6	16	51	0	8	139	880	1,87	2,39	2,77	3,93	0,67	0,61
Ruské 7	18	51	0	5	150	539	1,97	2,42	2,89	3,93	0,68	0,62
Ruské 8	17	45	1	4	84	752	2,05	2,41	2,83	3,8	0,72	0,63
Ruské 9	14	61	0	5	232	1225	1,25	2,31	2,63	4,11	0,47	0,65
Ruské – Sihla	23	39	4	5	193	894	2,34	2,27	3,13	3,66	0,75	0,62
Starina 11	26	47	0	5	89	654	2,69	2,6	3,25	3,85	0,83	0,68
Kolbasov 17	22	43	0	4	62	606	2,68	2,29	3,09	3,76	0,87	0,61

N. sp.: number of species; Red list: number of threatened species listed in the Red List of Spiders of Slovakia; N. ind.: number of individuals; H', H' max: Shannon's species diversity index and its maximal value; J: Pielou's equitability index.

There are considerable differences in the species composition and the dominance structure in study sites in 1999 and 2011. In 1999 species *Cybaeus angustiarum* and *Cicurina cicur* were the eudominants. In 2011, another 3 species were the most abundant, namely *Pardosa riparia, Piratula hygrophila* and *P. latitans* (Fig. 2). The most increasing abundance was documented for *Pardosa riparia*. This species is typical for managed meadows and pastures, the restart of agricultural activities after 2004 had considerable influence on its abundance and also for overall species composition. On the other hand, abundance of *Cybaeus angustiarum* drastically decreased. *Cybaeus angustiarum* is species typical for moist shaded forests. The abandoned non-forest habitats shaded by self-seeding shrubs and trees in different stages of the succession in previous period (1999) were more suitable for this species as regularly mown meadows later. Values of the indexes of species diversity (H' to H' max) and equitability (J) are considerably different and they have decreasing character for compared periods on each study plot except plot Ruské 9 where they increased in 2011 (Tab. 4). The decreasing values of the index are influenced mainly by increasing dominance of species that prefer managed habitats, namely *Pardosa* and *Piratula* species.

In 11 studied plots we found out 26 species listed in the Red list of Slovakia [5] (Tab. 5), what represent 7% of threatened spider fauna of Slovakia. Three times more threatened species were recorded in 2011 (24 species) than in 1999 (8 species). The findings of the critically endangered species *Peponocranium orbiculatum*, the endan-

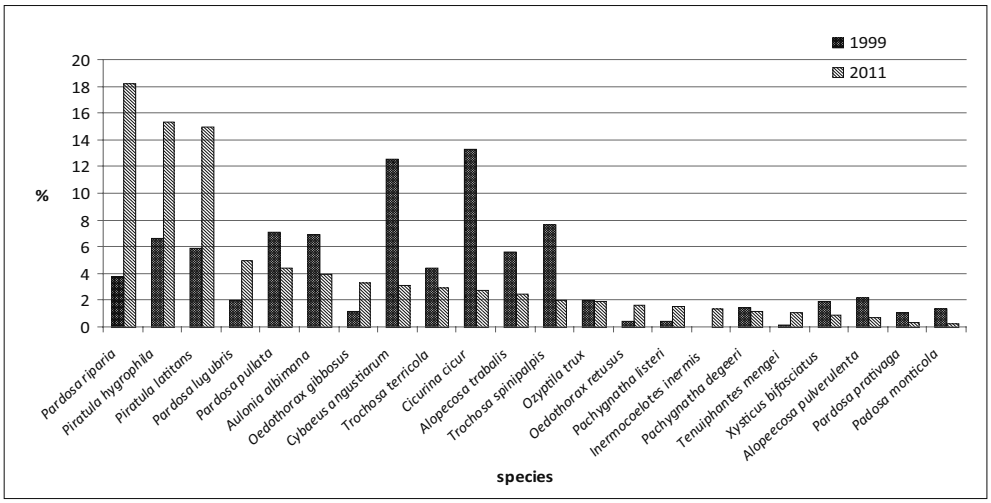

Figure 2: Dominance of selected species (D > 1%) in the study sites in 1999 and 2011

gered species *Centromerita concinna, Peponocranium praeceps and Mastigusa macrophthalma* in 2011 and findings of the critically endangered species *Peponocranium ludicrum* in 1999 are of great importance since these species had been reported in Slovakia only a few times before. The highest numbers of the threatened species were presented in the mesophile meadows.

The comparisons of ground living spider communities confirm that there are great differences in the structure of araneocoenoses on 11 study plots between 1999 (when study sites were abandoned) and 2011 (when sites were mostly extensively mowed). Changes were documented in several parameters, including increasing species richness and number of threatened species, low similarity of communities in two studied years and quite low number of common species.

CONCLUSIONS

Our results indicate that despite significant changes in the land use in general and in agriculture in particular during the studied period, the region still hosts a high biodiversity. The start of implementation of the Common Agricultural Policy and especially Agri-Environmental Programme after accession of Slovakia to the European Union brought a new input to the agriculture in the studied region and the area of managed grasslands increased significantly. We recorded also restoration of some grasslands abandoned for several decades. The study of spider communities in permanent plots in 1999 and 2011 indicates increased abundance, taxonomic diversity, and occurrence of threatened spider species. This is probably effect of reintroduction of the low-intensity grassland management. We recorded also negative trends that represent the grassland management unification, the consequent simplification of the landscape structure and decline of the habitat heteroge-

Table 5: Occurrence of threatened species on 11 study plots in 1999/2011

RL	Species	1	2	3	4	5	6	7	8	9	10	11
NT	*Robertus neglectus* (O. P.-Cambridge, 1871)	–	–	–	–/1	–/5	–/1	–	–/19	–	–	–
LC	*Agyneta cauta* (O. P.-Cambridge, 1902)	–	2/0	1/–	–	–	–	–	–	1/1	–	–
NT	*Agyneta ramosa* Jackson, 1912	1/–										
LC	*Agyneta subtilis* (O. P.-Cambridge, 1863)	–	–	–/3	–	–	–	–/1	–	–	–	–/2
EN	*Centromerita concinna* (Thorell, 1875)	–	–	–	–/1	–/1	–	–	–	–	–	–
NT	*Erigonella hiemalis* (Blackwall, 1841)	–	–/1	–	–/1	–/3	–	–/1	–/1	–	–	–
LC	*Meioneta saxatilis* (Blackwall, 1844)	–	–	–/2	–	–/2	–	–/1	–	–	–/5	–
VU	*Metopobactrus prominulus* (O. P.-Cambridge, 1872)	–	–	–	–	–	–/1	–	–	–	–	–
VU	*Neriene furtiva* (O. P.-Cambridge, 1871)	–	–	–	–	–	–	–	–	–	–/2	–
NT	*Notioscopus sarcinatus* (O. P.-Cambridge, 1872)	–	–	–/1	–	–	–	–	–	2/–	–	–/1
VU	*Palliduphantes milleri* (Starega, 1972)	–/3	–/4	–	–	–	–	–	–	–	–	–
VU	*Pelecopsis mengei* (Simon, 1884)	–	–	–	–	–/3	–	–	–/1	–	–	–
CR	*Peponocranium ludicrum* (O. P.-Cambridge, 1861)	1/–	–	–	–	–	–	–	–	–	–	–
CR	*Peponocranium orbiculatum* (O. P.-Cambridge, 1882)	–	–/1	–	–	–/1	–	–	–	–	–	–
EN	*Peponocranium praeceps* Miller, 1943	–	–/1	–	–	–/3	–	–	–/2	–	–/1	–
DD	*Pocadicnemis juncea* Locket et Millidge, 1953	–	–	1/–	–	–	–	–	–	4/1	–	–/2
LC	*Styloctetor stativus* (Simon, 1881)	–	–	–	–/3	–	–	–	–	–/5	–	–
LC	*Troxochrus scabriculus* (Westring, 1851)	–	–	–	–	–	–	–	–	–	–	–
LC	*Walckenaeria acuminata* Blackwall, 1833	1/1	–	–	–	–/2	–	–	–	–	–	–
NT	*Walckenaeria kochi* (O. P.-Cambridge, 1872)	–	–	–/5	–	–	–	–	–	3/–	–	–/3
DD	*Pardosa alacris* (C. L. Koch, 1833)	–	–	–	–	–	–	–	–	–	–/1	–
EN	*Mastigusa macrophthalma* (Kulczyński, 1897)	–	–	–	–	–	–/1	–	–	–	–	–

RL	Species	1	2	3	4	5	6	7	8	9	10	11
LC	*Phaeocedus braccatus* (L. Koch, 1866)	–	–	–	–/3	–	–/1	–	–	–	–	–
VU	*Xysticus lineatus* (Westring, 1861)	1/3	–/3	–	1/4	–	–/5	2/6	–/16	–/2	–/1	–
VU	*Sitticus caricis* (Westring, 1861)	–	–	–/5	–	–	–	–	–	–/2	–	–
DD	*Talavera thorelli* (Kulczyński, 1891)	–	–/2	–	–	–	–	–	–	–	–	–
	Number of individuals – 1999	4	2	2	1	–	–	2	–	10	–	–
	Number of individuals – 2011	7	12	16	13	20	9	9	39	11	10	8
	Number of species – 1999	4	1	2	1	–	–	1	–	4	–	–
	Number of species – 2011	4	6	5	6	8	5	4	5	5	5	4

RL – categories of the Slovak Red List: CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened, LC – least concern, DD – data deficient

neity. The "poloniny" mountain meadows representing the most important grassland type are not eligible for the CAP support and thus they are largely abandoned and gradually disappearing.

There are several measures that by our opinion should be applied to improve situation of non-forest habitats and species in the studied region. It is important to include the most valuable grasslands in the farming support system and therefore inclusion of local small and medium-sized enterprises and farmers into the agricultural and environmental support schemes is inevitable. To achieve maximal area managed, it is suitable to apply mosaic utilisation of larger areas and sequence of management practices on the same plot (simulation of traditional use and support the species diversity) as well as to use controlled grazing or soil fertilisation for maintenance of the grassland productivity. The strengthening of close and permanent contacts of the nature conservation institutions with other relevant institutions and the farmers in the study area is inevitable. National Park Administration together with other local stakeholders should be active in public awareness rising and support of environment-friendly economic activities that could accelerate local employment and rural development. The measures include application for grants to manage sites of biodiversity importance, support to agro-tourism and other "green" forms of tourism, development of local information centres, accommodation facilities and services for tourists. The support of cross-border cooperation could facilitate rural development of the region as well.

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