

## ABANDONMENT OF AGRICULTURAL LANDSCAPE AFTER 1989: A CASE STUDY FROM THE POVAŽIE REGION, SLOVAKIA

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### **Abandonment of agricultural landscape after 1989: a case study from the Považie region, Slovakia**

Political changes after 1989 followed by the accession of the Central and Eastern European countries to the EU was accompanied by many socio-economic processes with direct or indirect effects on agricultural landscapes. The aim of this study was to investigate the consequences of transformation of socialist cooperative farming into open market cooperative farming. Land cover mapping obtained from photointerpretation of aerial photographs and orthophotomaps was used to quantify land cover changes that took place between 1986 and 2009. As a case study, a rural region with heterogeneous natural conditions situated in western Slovakia was chosen. Through the analysis of land cover changes, agricultural land modification was assessed at the local scale. A significant part of the permanent grasslands changed into shrub and forest associations during the researched period. These findings were discussed with local farmers and the landowners. Although the main phase of abandonment of grasslands occurred during the 1990s, the recent status heavily depends on the EU subsidies applicable to the less favoured area (LFA) scheme. Smaller meadows will most probably disappear due to technical difficulties connected with their management.

**Key words:** agricultural landscape, land cover, extensification, abandonment, Slovakia

### INTRODUCTION

Assessments of agricultural landscape structure and its changes have been given a lot of attention in recent years above all with regard to the considerable shrinkage of biodiversity in agro-ecosystems (Altieri 1999, Stoate et al. 2001, Horak et al. 2013 and Overmars et al. 2013). In this context, the most dramatic intervention into the historical structure of landscape in the former socialist countries was collectivization of agriculture in the 1950s. Collectivization completely changed the overall character of the rural landscape (Lipský 1995, Bičík and Jeleček 2005 and 2009 and Palang et al. 2006). Political changes after 1989 led to transition from the state-controlled to market-driven economies in Central and Eastern Europe and the former Soviet Union. It was accompanied by massive socio-economic and institutional changes that involved substantial and widespread abandonment of agricultural land. The rates and patterns of land cover (LC) changes varied considerably, both in Russia and in the post-socialist and post-communist countries of Central and Eastern Europe (Kuemmerle et al. 2006, Baumann et al. 2011, Kopecká et al. 2012 and Prishchepov et al. 2013). Abandonment of agricultural land substantially affects both the environmental and socio-economic landscape functions. According to Prishchepov et al.

(2013), only a few quantitative studies have examined the determinants of the post-socialist abandonment of farmland and it is not clear whether the same set of factors determine abandonment of farmland in different countries. MacDonald et al. (2000) point out that abandonment trends are especially marked in mountain areas. Kyselka (2012) and Havlíček and Chrudina (2013) confirmed the dependence of farmland abandonment on the altitude and inclination of terrain.

Evaluation of land cover changes (LCC) provides a first insight into the ongoing processes in a territory and enables integrated environmental assessment of these processes (Croissant 2004 and Shoyama and Braimoh 2011). LCC are considered suitable environmental indicators at different scales. For the monitoring of rural policies, implementation of agri-environmental programmes and good agricultural practice (GAP), indicators have to reflect site-specific features, especially terrain inclination. Case studies are important for understanding of the complex relationship between social and natural systems and this is the reason why monitoring of land cover changes at the local level is so important (see e.g. Bell et al. 2009, Kizos et al. 2010 and Primdahl et al. 2010).

Development of long-term land use changes based on local case studies has recently been evaluated in several studies. Analytical maps of land use were derived from old military topographic maps, as well as topographic base maps (Havlíček et al. 2012 and Skokanová et al. 2012) and orthorectified monochrome aerial photographs (Mojses and Petrovič 2013 and Štefunková et al. 2013), using several time periods by the process of on-screen digitization. Relationships between long-term land use changes and relief characteristics have been studied by Štych (2011) and Havlíček and Chrudina (2013). Blažík et al. (2011) characterize the agricultural transformation trends after 1989 and their impact on the landscape using statistical data. The changes were evaluated on the basis of several indices reflecting the intensity of land use in the districts of Dunajská Streda, Levice, Prievidza, and Stará Ľubovňa (Slovakia).

The goal of this research was to explore the extent of agricultural land extension and abandonment at the local scale and through the interviews with local farmers and the landowners reveal the driving forces of these processes. A territory with heterogeneous natural conditions was chosen in order to observe changes that occurred in different types of agricultural landscape.

This study represents an evaluation of landscape changes based on interpretation of aerial photographs and the orthophotomaps with the purpose of pointing to the changes in arable land use that occurred due to transformation of agricultural systems during the last two decades.

## STUDY AREA

The study area is situated in the mountain-basin contact territory of the Czech-Slovak borderland. It is a part of the Považie region in Slovakia and consists of the villages of Bohunice, Pruské, Krivoklát and Vršatské Podhradie. The dominant agricultural subject in this area is the Agricultural Cooperative Vršatec – one of the three agricultural cooperatives that originated in 1991 by division of the former Socialist Cooperative Farm Pruské<sup>1</sup>. The cooperative cul-

tivates a total of 1,529 hectares of agricultural land in the subject area and its vicinity.

The natural conditions of the subject area are those typical for three geomorphological regions: alluvial plain, foothills, and mountains (Fig. 1). These regions are further divided into geomorphological subunits based on the classification by Mazúr and Lukniš (1980). Soil types were identified via the web service of the Research Institute of Soil Science (2013).

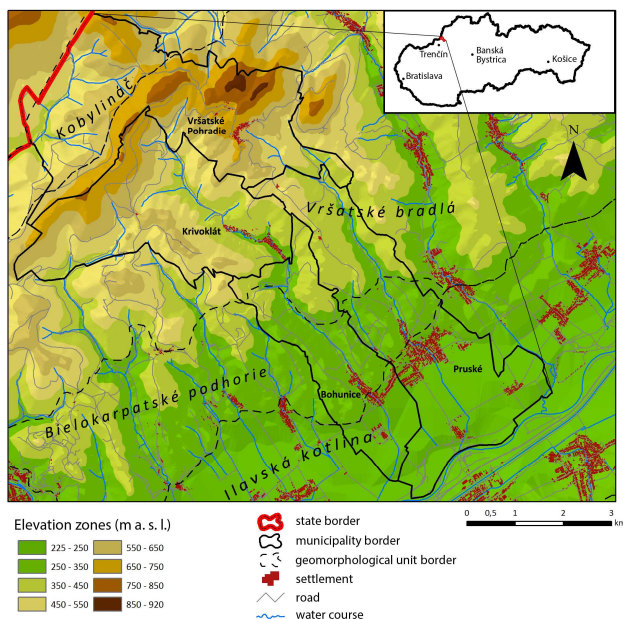


Fig. 1. Location of the study area in the Slovak Republic

### Alluvial plain of the Ilavská kotlina Basin

The geomorphological sub-unit of the Ilavská kotlina Basin in the southern part of the study area is a flat depression of tectonic-erosion origin. The basin consists of sediments of the River Váh and its tributary streams. The altitude of the basin is about 230 m with the relative height ranging up to 30 m. It is the most fertile territory of the subject area where the fluvial soils are the dominant soil type. This area is in the warm, moderately humid climate zone with mild winters.

<sup>1</sup> *Agricultural cooperatives* are one of the main types of agricultural business models that originated on the basis of the former *Socialist cooperative farms* in Slovakia after 1989. They usually farm large blocks of fields that are rented from many small landowners.

### Submontane region of the Bielokarpatské podhorie

The Bielokarpatské podhorie is a medium rugged highland that rises sharply in the northern direction. The prevailing soil types in this area are less fertile luvisols and rendzinas. The climate in the area is moderately warm and moderately humid.

### Mountainous regions of the Vršatské bradlá and Kobylínáč

The geomorphological subunits Vršatské bradlá (Vršatec Klippen Area) and Kobylínáč comprise very complicated tectonic units of mountainous landscape type. The highest peak is Chmelová (926 m a.s.l.). The dominant soil types of the Vršatské bradlá area are rendzina soils and cambisols. The climate is moderately cool and very humid.

As illustrated in the map of the study area (Fig. 1), the villages of Pruské and Bohunice are situated at the foot of the mountains and a large part of their territories coincides with the fertile alluvial plain. On the other hand, Vršatské Podhradie and Krivoklát are typical mountain villages with a rather extensive character of agriculture.

## MATERIALS AND METHODS

The research approach consists of a three-step procedure:

- Identification of land cover classes for each time horizon (1986 and 2009),
- Detection of agricultural land extensification and abandonment,
- Identification of driving forces of land cover flows based on interviews with local stakeholders.

### Identification of land cover classes for each time horizon (1986 and 2009)

Aerial images from two time horizons were used in order to obtain information about the spatial structure of agricultural land. The photos from 1986 capture the state before the beginning of transformation of agriculture when the market economy was reintroduced. The orthophotomap from 2009 focuses on the contemporary landscape structure.

Geometrical adjustment by the LMS method of orthorectification and the resulting orthophotomosaic were carried out in the Leica Photogrammetry Suite software using the digital terrain model (DMR3, cell size 10 m) and the orthophotomap from 2009 as the referential layer. Aerial images were processed into the TIFF format in the S-JTSK coordinate system. Digitization of aerial pictures was accomplished in ArcGIS 9.1.

Visual image interpretations were made by on-screen digitizing and resulted in individual vector data layers for each time horizon. The minimum mapped area was 500 m<sup>2</sup> and minimum width of polygons was 10 m. Areas smaller than 500 m<sup>2</sup> were added to the adjacent unit with the next lesser number of the same sub-class. Mapping scale on the screen varied between 1:1 000 and 1:3 000.

Image interpretation and classification required a clear definition of land cover classes. In order to produce a more precise description of the rural land-

scape structure the extended 5th level of the CORINE Land Cover nomenclature (Kopecká 2006) was applied. This nomenclature was developed by the hierarchical sub-division of the CORINE Land Cover nomenclature for the scale 1:50 000 (Feranec and Ořahel 1999 and Bossard et al. 2000).

#### Detection of agricultural land extensification and abandonment

Land cover changes were examined on the basis of chosen land cover flows with the main focus on the extensification and abandonment of agricultural land. Land cover maps (polygons) of both time horizons were converted from vector into raster grid. Afterwards the land cover flows were examined by the use of Raster Calculator (“Con” function) in the ArcGIS 9.1. Extensification was represented by the change of arable land classes into grasslands, large-scale arable land into small-scale arable land and the change of intensive fruit orchards into arable land or grasslands. Conversion of arable land and grasslands into shrubs and forests as well as that of fruit orchards into shrubs or abandoned fruit orchards was considered as an abandonment of agricultural landscape.

#### Identification of the driving forces of land cover flows based on interviews with local stakeholders

The research ambition was to understand the main reasons for the extensification process and the abandonment of agricultural land during the monitored period. The semi-structured interview with a set of open questions was chosen to detect the driving forces of the recorded landscape changes. This form of research allows the respondents to discuss and raise issues of agricultural management practices in different periods. The basic analysis of the driving forces was performed through the interviews with the managers of the cooperative farm Vršatec, small local farmers and old landowners.

## RESULTS

#### Changes in landscape structure between 1986 and 2009

The year 1986 provides the picture of the landscape structure resulting from the socialist collectivization. Arable land consisted of large fields<sup>2</sup> – the most conspicuous feature and consequence of collectivization with direct expression in landscape structure. Consolidated arable land blocks (16.9% of the overall surface area of the territory) were situated mostly in the Ilavská kotlina Basin and on slightly undulating parts of the geomorphological subunits of the Bielo-karpatské podhorie and Vršatské bradlá. Another distinct landscape element situated on the boundary between the municipalities of Pruské and Bohunice is a series of orchards and berry plantations with an area of 145 ha (3.3% of the total area). Forests and semi-natural areas occupied 51.79% of the territory in 1986.

The second time horizon (2009) is characterized by a significantly smaller extent of intensive fruit orchards (91 ha) while berry fruit plantations com-

<sup>2</sup> Large fields were mapped as classes 21112 (1-30 hectares) and 21113 (>30 hectares).

pletely disappeared. The proportion of forest and semi-forest areas increased up to 57.52%.

Land cover flows at the first hierarchical level between the years 1986 and 2009 are presented in Table 1. Total land cover change amounted to 451.28 hectares representing 10.1% of the territory. The most significant interclass change is represented by the conversion of 324 hectares of agricultural areas into forest areas. The more detailed explanation of this process will be discussed further.

**Tab. 1. Land cover flows at the CLC first hierarchical level during the period 1986-2009**

Year	CLC	2009								Total	Change
		1		2		3		5			
1986	1	<b>159.11</b>	88.78	<b>14.08</b>	7.86	<b>5.94</b>	3.32	<b>0.08</b>	0.04	<b>179.21</b>	<b>20.10</b>
		78.90		0.83		0.23		6.54		4.02	4.45
	2	32.12	1.63	<b>1 610.99</b>	81.89	<b>324.05</b>	16.47	<b>0.08</b>	0.00	<b>1 967.24</b>	<b>356.25</b>
		15.93		95.35		12.65		6.13		44.16	78.94
	3	<b>10.34</b>	0.45	<b>64.38</b>	2.79	<b>2 232.22</b>	96.76	<b>0.09</b>	0.00	<b>2 307.03</b>	<b>74.81</b>
		5.13		3.81		87.12		7.57		51.79	16.58
	5	<b>0.08</b>	7.32	<b>0.03</b>	2.29	<b>0.01</b>	1.14	<b>0.98</b>	89.24	<b>1.09</b>	<b>0.12</b>
		0.04		0.00		0.00		79.75		0.02	0.03
	Total	<b>201.65</b>	4.53	<b>1 689.47</b>	37.93	<b>2 562.23</b>	57.52	<b>1.22</b>	0.03	<b>4 454.58</b>	<b>100.00</b>
	Change	<b>42.54</b>	9.43	<b>78.48</b>	17.39	<b>330.01</b>	73.13	<b>0.25</b>	0.05	<b>100.00</b>	<b>451.28</b>

CLC classes: 1 – Artificial areas, 2 – Agricultural areas, 3 – Forest areas, 5 – Water bodies

– area in hectares

– proportion of the class area in 2009 (area in %)

– proportion of the class area in 1986 (area in %)

### Extensification of agriculture

The most important change within the extensification process was the change of almost 143 ha of arable land into grasslands (Tab. 2 and Fig. 2). More areas of this type of land cover change are located in the vicinity of Krivoklát village within the geomorphological unit of Vršatské bradlá. These areas are situated in the steep zones with the dominant occurrence of cambisols and rendzinas. Originally small terrace fields, pastures and meadows existed here. In the late 1950s during the socialist collectivization, the terrace fields were ploughed-up and together with what were once grasslands consolidated into large blocks of arable land. Cultivation of large blocks in the steep zones was technically too complicated and because of lower fertility of soils also economically ineffective. These two factors were crucial in the decision to abandon farming in the steep zones in the 1990s when Slovak agriculture underwent a very difficult period because of restricted subsidies and permanently changing rules.

The second area of change of arable land into grasslands is located in the hinterland of Vršatské Podhradie village, which is characterized by very similar natural conditions to those in Krivoklát village and a cold and humid climate.

A significant area of large scale arable land changed into grasslands is situated in the Bielokarpatské Podhorie foothills. The main impulse in this process was the appeal of the Ministry of Agriculture of the Slovak Republic within the Programme of Rural Development supported by the European Union (EU) structural funds. The change was part of a project oriented to grassing of arable land with slope exceeding 10% (6°) supported by agri-environmental schemes. Thanks to this action grass covered more than 60 hectares of arable land in steeper zones.

**Tab. 2. Analysis of extensification of agriculture during the period 1986-2009**

CLC conversion	CLC 1986	CLC 2009	Area (ha)	%
Arable land ↓ Grasslands	21111	2311	12	6.1
	21111	2312	3.4	1.7
	21112	2311	114.4	57.9
	21112	2312	2.1	1.1
	21113	2311	6.9	3.5
	21113	2312	1.3	0.7
	21121	2311	1.6	0.8
	21121	2312	0.9	0.5
	Σ		142.6	72.2
Arable land with large plots (> 1 ha)	21112	21111	19.2	9.7
↓	21113	21111	22.0	11.1
Arable land of small-sized plots (< 1 ha)	Σ		41.2	20.9
Berry fruit plantations	2222	21112	10.1	5.1
↓	2222	2311	2.5	1.3
Arable land and grasslands	2222	2312	1.3	0.7
	Σ		13.7	6.9
Extensification of agriculture			197.5	100.0

Legend of CLC classes: 21111 Arable land of small-sized plots (< 1 ha), 21112 Arable land of medium-sized plots (1-30 ha), 21113 Arable land with large plots (> 30 ha), 21121 Arable land of small-sized plots with scattered vegetation, 2222 Berry fruit plantations, 2311 Grassland (pastures and meadows) prevailingly without trees and shrubs, 2312 Grassland (pastures and meadows) prevailingly with (up to 30%) trees and shrubs.

The extensification in the Ilavská kotlina Basin was different. The basin has considerably better natural conditions for agriculture than the hills. It is characterized by semi-heavy fluvisols and warm climate. Around 40 hectares of large-scale arable land was changed into small scale arable land<sup>3</sup> here. It is the land of the former collective farms that was predominantly cultivated by the original owners (or their descendants) after restitution. After 1989, self-employed farmers also cultivated part of this small-scale arable land. However, their number has been markedly decreasing in the last decade.

The last type of change, within the scope of extensification, is transformation of a part of the intensive fruit orchards into arable land and grasslands. These intensive fruit orchards were planted in the deep socialist era and belonged to the socialist cooperative farm Pruské till its transformation in 1991. The species composition of the trees did not suite the local climate conditions. The new agricultural cooperative was not interested in the management of these orchards in the open market conditions. The new owners of the orchards switched to game management and the berry fruit production (raspberries, currants and gooseberries) ended. Recently they have tried to make a local business with apple juice on a smaller part of the renewed orchard.

For a detailed analysis of the proportions of particular classes in the monitored time periods see Šebo (2013).

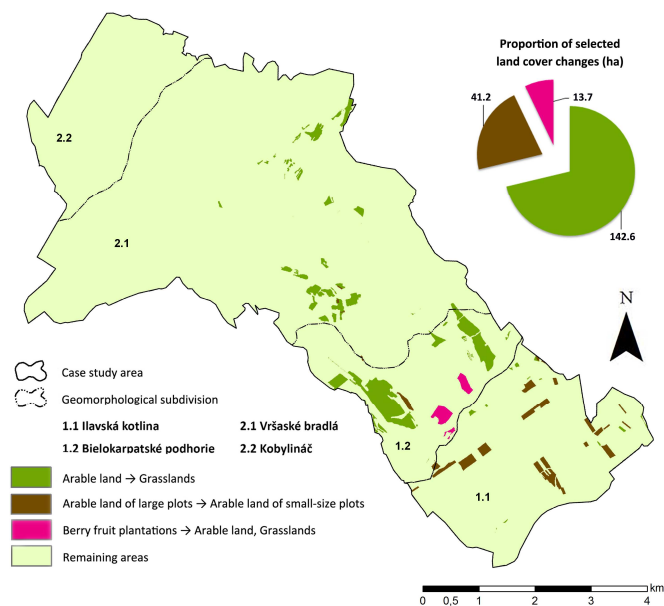


Fig. 2. Extensification of agriculture during the period 1986-2009

<sup>3</sup> Fields with the size below 1 hectare were mapped as *small-scale arable land*.



## Abandonment of farmland

The change of permanent grasslands into shrub and forest associations in the studied region seems to be the most important change of farmland in the period between 1986 and 2009. A total of 361.6 ha representing almost 6% of the total area of the subject territory changed in this way (Tab. 3 and Fig. 3).

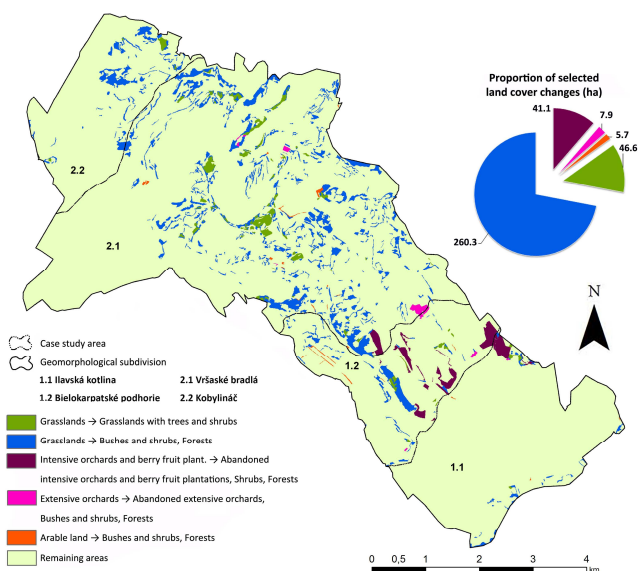


Fig. 3. Abandonment of agricultural landscape, 1986-2009

According to the manager of the agricultural cooperative, the real reasons for the abandonment of grasslands were the political instruments applied during the transformation period of the 1990s. Economic reforms – price liberalization and sudden restriction of governmental subsidies led to a rapid decrease in demand for the local plant and animal agricultural products. These changes had their reflection not only in the landscape, but also in the reduction of the number of employees in agriculture. The fact that the mechanism and the rules for agricultural subsistence were constantly changing between 1990 and 2000 led to confusion in the sector. The process lacked transparency and the rules were often contradictory. The importance of natural conditions in the cultivation of arable land and grassland was minor. In the case of grassland the decisive factors were time and technical accessibility. Larger meadows and pastures with undemanding relief and better accessibility were also cultivated after 1989. The first succession phase began in smaller meadows on steeper slopes that are not easily accessible for heavy machinery. The grasslands in the area of the Vršatské bradlá and Kobylínáč geomorphological subunits are good examples of such natural conditions. Imperfect mowing of margins also played a noticeable role in the abandonment of grasslands. The consequence was the free expansion of

forest into grassland margins. The majority of abandoned linear areas were formed in this way. Abandonment of grasslands stopped just before Slovakia joined the European Union in 2004. During the years 2002 and 2003 farmers realized that the subsidies for maintaining grasslands would be allocated for mown and grazed parcels only. As a result, more attention was paid to the maintenance of grasslands.

**Tab. 3. Analysis of agricultural landscape abandonment 1986-2009**

CLC conversion	CLC 1986	CLC 2009	Area (ha)	%
	21111	3113	0.4	0.1
	21111	3131	0.2	0.1
	21111	3243	0.8	0.2
Arable land	21112	31112	0.2	0.0
↓	21112	3113	0.3	0.1
Bushes and shrubs, Forests	21112	3243	3.6	1.0
	21121	31112	0.1	0.0
	21121	3113	0.1	0.0
	Σ		5.7	1.6
	22211	22211b	5.9	1.6
Extensive orchards	22211	31111	1.0	0.3
↓	22211	3113	0.3	0.1
Abandoned extensive orchards,	22211	3135	0.2	0.0
Bushes and shrubs, Forests	22211	3243	0.6	0.2
	Σ		7.9	2.2
	22212	22212a	8.4	2.3
	22212	22212b	23.5	6.5
	22212	31111	2.3	0.6
Intensive orchards	22212	3113	1.2	0.3
↓	22212	3131	0.2	0.1
Abandoned intensive orchards,	22212	3135	0.9	0.2
Bushes and shrubs, Forests	22212	3243	1.6	0.4
	2222	2222b	1.7	0.5
	2222	3113	0.4	0.1
	2222	3243	0.9	0.2
	Σ		41.1	11.4
Grasslands prevailingly without trees and shrubs	2311	2312	46.6	12.9
↓				
Grasslands prevailingly with trees and shrubs				
	Σ		46.6	12.9

Tab. 3 continued

	2311	31111	41.7	11.5
	2311	31113	0.1	0.0
	2311	3113	26.7	7.4
	2311	3121	2.2	0.6
	2311	3131	11.2	3.1
	2311	3133	2.6	0.7
Grasslands	2311	3135	1.8	0.5
↓	2311	3243	34.0	9.4
Bushes and shrubs, Forests	2312	31111	34.4	9.5
	2312	31112	0.2	0.0
	2312	3113	34.8	9.6
	2312	3121	1.5	0.4
	2312	3131	10.4	2.9
	2312	3133	13.5	3.7
	2312	3135	4.9	1.3
	2312	3243	40.2	11.1
	Σ		260.3	72.0
Abandonment			361.6	100.0

Legend of CLC classes: 21111 Arable land of small-sized plots (< 1 ha), 21112 Arable land of medium-sized plots (1-30 ha), 21113 Arable land with large plots (> 30 ha), 21121 Arable land of small-sized plots with scattered vegetation, 22211 Extensive orchards, 22211b Abandoned extensive orchards – advanced succession phase, 22212 Intensive orchards, 22212a Abandoned intensive orchards – initial succession, 22212b Abandoned intensive orchards – advanced succession, 2222 Berry fruit plantations, 2222b Abandoned Berry fruit plantations in the advanced succession phase, 2311 Grassland (pastures and meadows) prevailing without trees and shrubs, 2312 Grassland (pastures and meadows) prevailing with (up to 30%) trees and shrubs, 31111 Broad-leaved forests with continuous canopy, 31112 Bank vegetation, 31113 Road vegetation, 3113 Broad-leaved forests with discontinuous canopy, 3121 Coniferous forests with continuous canopy, 3131 Mixed forests with continuous canopy (individual trees alternate), 3133 Mixed forests with discontinuous canopy (individual trees alternate), 3135 Mixed forests with continuous canopy (groups of trees alternate), 3243 Bushes and shrubs.

A specific factor influencing the maintenance of some grassland on steeper slopes is the capacity and willingness of employees to operate the machinery in extremely difficult natural conditions. Cases where meadows were abandoned because the tractor operator retired are not rare.

The change of grasslands into shrubs and forests has been preceded by the change of permanent grasslands into the class of more than 46 ha of permanent grasslands with dispersed vegetation, which was recorded on.

The third most important group of changes relates to abandonment of intensive orchards when 8.4 ha were identified in the initial stage of succession and 23.5 ha in the advanced stage of succession. Apart from the changed approach and aims of the new owners (see Section 4.2), the inappropriate composition of fruit tree varieties was also a factor in the abandonment of the former intensive orchards. Some berry plantations, which did not change into arable land or

grasslands, were already in an advanced stage of succession or changed into shrubs and broad-leaved forest with discontinuous canopy.

In the case of extensive orchards with tall-trunk fruit trees, 5.9 ha in the advanced succession phase were also identified. Less distinct manifestations of abandonment were identified in arable land. The cause in the majority of cases was the gradual expansion of forest edges as a result of less precise ploughing.

In the alluvial plain area abandonment was recorded to a minimal extent and it was related to the expansion of the alluvial forest.

## DISCUSSION

The abandonment of agricultural land is nowadays a problem in the majority of European countries and very often it is connected with population ageing and depopulation of marginal regions. On the other hand, this process also brings some positives into specific regions; for example, progressive spontaneous forestation lowers the risk of erosive processes (MacDonald et al. 2000). The abandonment of semi-natural grasslands endangers not only the rare phytocenoses but also related zoocenoses (see e.g. Schneider and Fry 2005 and Špulero<sup>v</sup>á 2008).

Although the abandonment of extensive tall-trunk orchards is less striking in space, it is very difficult to compensate for their loss. Old orchards represent not only the natural element but also the cultural heritage in landscape. They are genetically adapted to the local soil and climatic conditions and they are an important landscape feature. Abandonment of orchards is closely connected to the destruction of the orchard meadows, which are characterized by their high biodiversity and significant occurrence of rare herbal and animal species (Žarnovičan et al. 2012).

During the socialist large-scale agricultural cultivation, part of the arable land in the subject area was situated in steep terrain. Unfavourable natural conditions (slope, soil and climate) were the factors that resulted in grassing of several areas of arable land in the regions of the Vršatské bradlá Klippen. Similar results were presented in the paper by Havlíček et al. (2012). The viability of the cultivation of these areas highly depends on the less favoured area (LFA) support that is a tool to avoid the decline of agriculture as an economic base of rural areas, subsequent depopulation and loss of the cultural and social values of these areas. According to the Rural Development Programme of the SR 2007 – 2013 (Ministry of Agriculture of the SR 2007), the LFAs were classified into 3 categories: mountain areas, other LFAs, and areas with specific handicaps. Farmers in the cadastral territory of Vršatské Podhradie (altitude 600 – 700 m a.s.l.) and in the cadastral territory of Krivoklát (slope gradient over 20%) receive the highest support for farming. The cadastral territory of Bohunice receives a minimum LFA support due to low soil fertility, while the territory of Pruské is outside the LFA.

Agricultural subjects operating in the researched area became economically viable after the transformation of the ex-socialist cooperative farms. This positive trend was not only influenced by the LFA subsidies but also by the changes in production structure modified to market needs. Grasslands invaded by shrubs

and trees tend to remain abandoned leading to subsequent forest succession due to the high cost of converting such fields back to agriculture. Prishchepov et al. (2013) hypothesize that the limited economic incentive for recultivation of abandoned agricultural lands represents an additional factor contributing to long-term abandonment.

Overgrowing of meadows and pastures by woody vegetation is a problem of the whole country and has been observed in Slovakia since 1989. Decline in the traditional labour intensive practices and abandonment of marginal agricultural land was also observed in the study area. Abandoned agricultural land is generally found in unfavourable natural conditions (higher elevations, steeper slopes, poor soils etc.). According to local landowners, causes of abandonment lie in the decline of animal production, weakened organizational structures in agriculture but also lack of administrative control, changed land ownership and land reforms.

As Lambin et al. (2000) point out case studies highlight the importance of decision-making by land managers when facing a range of response options. External driving forces of land-use change open new and/or close old options, but the final land management decision is made by actors who are influenced by socio-cultural and political factors as well as by economic calculations.

## CONCLUSION

Information obtained from aerial images may provide valuable knowledge about general trends in land use and cover change. Rapid socio-economic changes in the era following the transformation of the Socialist Cooperative Farm Pruské into the contemporary Agricultural Cooperative Vršatec and the gradual transition to the conditions of the Common Agricultural Policy (CAP) have led mostly to the change of arable land into grassland. Decline of animal production consequently resulted in a significant share of abandoned grassland in less accessible areas. Field observation confirmed the relevant influence of the local topography in forestation dynamics. This process has some eco-stabilizing effects, which are also documented by the high share of natural and semi-natural areas. On the other side it is connected with the regression of diverse landscape structure and gradual loss of the rare meadow communities.

As Tab. 3 implies, the effects of abandonment of arable land were minimal in the subject area. Considering the recorded process of extensification – change of the arable land into grasslands we can conjecture that in the case of further decrease of the livestock population the cessation of cultivation in these localities is unavoidable.

Compensatory subsidies for cultivation in the less favourable areas in combination with direct payments are important sources of income for the farmers. Despite this support the decline of agrarian production in the areas with harsh natural conditions continues. LFA support and agri-environmental measures indicate the positive influence of CAP measures on the landscape utilization. On the other hand, their effect is not strong enough to prevent the abandonment of agricultural land. Sustaining the traditional rural landscape structure is crucial for the maintenance of diversity, both biodiversity and cultural diversity (Antrop 2005).

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## PUSTNUTIE POĽNOHOSPODÁRSKEJ KRAJINY PO ROKU 1989 NA PRÍKLADE REGIÓNŮ POVAŽIA

Politické zmeny, ktoré sa udiali po roku 1989, sa výrazným spôsobom prejavili v štruktúre poľnohospodárskej krajiny viacerých krajín. Bilancovanie zmien krajiny pokrývky prostredníctvom analýz leteckých a satelitných snímok je významné najmä pri hodnotení pustnutia poľnohospodárskej krajiny. V príspevku sú prezentované výsledky hodnotenia zmien krajiny pokrývky v štyroch vidieckych obciach v oblasti stredného Považia s výrazne heterogénnymi prírodnými podmienkami. Zmyslom štúdie bolo predovšetkým upozorniť na signifikantnosť niektorých parciálnych zmien krajiny pokrývky.

Predmetné územie sa nachádza v severozápadnej časti Slovenska na území Trenčianskeho samosprávneho kraja, na hranici s Českou republikou. Pozostáva zo štyroch vidieckych obcí: Pruské, Bohunice, Vršatské Podhradie a Krivoklát. Celková rozloha územia je 44,5 km<sup>2</sup>, nadmorská výška sa pohybuje v rozmedzí 235-925 m n. m. Oblasť Ilavskej kotliny sa vyznačuje rovinatým reliéfom, ktorý postupne prechádza do mierne zvlneného Bielokarpatského podhoria. Montánny typ krajiny reprezentujú Vršatské Bradlá a Kobylináč (obr. 1).

Na báze leteckých snímok z rokov 1986 a 2009 boli detekované prejavy extenzifikácie poľnohospodárstva, ktoré zahŕňali zmeny ornej pôdy na trávne porasty, premeny veľkoblukovej ornej pôdy na maloblokovú a premenu ovocných sádov na ornú pôdu (obr. 2 a tab. 2). V ďalšom bode boli analyzované prejavy pustnutia, ktoré sa na sledovanom území prejavili najmä premenou trávnych porastov na lesy a kroviny a postupným zarastaním opustných ovocných sádov v dôsledku prirodzenej sukcesie (obr. 3 a tab. 3).



Plošne najvýznamnejšou zmenou v sledovanom časovom horizonte bola premena trvalých trávnych porastov na spoločenstvá krovín a lesov. Celkovo bolo takto zmenených až 260 hektárov, čo je takmer 6 % z celkovej rozlohy predmetného územia. Zmenám triedy trávnych porastov (TTP) na krovité a lesné porasty predchádza zmena triedy TTP na TTP s rozptýlenou vegetáciou, ktorú sme zaznamenali na viac ako 46 hektároch.

Príčiny týchto zmien súvisia so zmenami vlastníckych vzťahov, zmenami záujmov a starnutím populácie. Vzhľadom na to, že väčšina zo sledovaného územia spadá do rôznych kategórií znevýhodnených území, predstavuje finančná pomoc poskytovaná v rámci týchto schém dôležitú súčasť prostriedkov potrebných na zabezpečenie kultivácie trávnych porastov.

