

## Land cover changes in the Visegrád Group between 1990 and 2012

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**Abstract:** The countries of the Visegrad group share many common traits in their historical development. During the socialist era the countries followed a largely similar development path, and the subsequent social and economic transformation also involved similar processes, which had a great impact on the land cover. Extensive suburbanisation and greenfield investments became the driving force of a rapid urban sprawl, the disintegration of Comecon and loss of protected markets led to agricultural abandonment and fallow lands, while the EU integration and access to CAP support again altered the circumstances for agricultural activity.

The aim of my paper is to analyse the land cover change processes in the Visegrad Group following the political and economic transition. To identify the similarities and differences between the countries, the analysis was carried out for the whole group and also for each country.

The analysis was based on Corine Land Cover raster datasets with 100-meter resolution for 1990 and 2012. The high number of the original categories (34 for the whole Visegrad Group) was reduced by merging them into the following categories: artificial surfaces, arable land, vineyards and fruit cultivations, grasslands, complex cultivation patterns, forests, wetlands and other natural areas and water bodies. For the analysis, the Terrset Land Change Modeller and ArcGIS software were used.

The results indicate that even in the case of the most general land cover change trends, which are common in country-level (increase in the share of artificial surfaces and forests, loss of arable land), there are big differences in the spatial patterns of the change. The expanse of arable land of the Polish eastern periphery and the decrease in the Czech periphery clearly illustrates the effect of region- and country-specific factors. The limitations of the Corine Land Cover database are also observable through the false increase of artificial surfaces in Poland.

**Keywords:** Visegrád Group, Corine Land Cover, political and economic transition, artificial surfaces, heterogeneous agricultural areas

### Introduction

The historical development of the Visegrád countries shows many similarities. It is especially true for the second half of the twentieth century, when the region was incorporated into the Eastern Bloc. The economies of the state socialist countries often considered very similar to each other. While there is a truth in it for example in case of their industrial policy, in fact, the three Visegrád countries implemented markedly different agricultural models during the decades of communism.

Czechoslovakia adapted the soviet sovkhoz-kolkhoz model without inclinations (Doucha and Divila 2008). Hungary also adapted the main elements of this model (albeit the transformation only finished after the revolution), but in a less constrained way. In some territories (like the Danube-Tisza Interfluve) the farmers could retain their land ownership, and agricultural activity in small household plots was also encouraged (Csatári and Farkas 2008). Opposed to this, small-scale family-farming system persisted in Poland during the socialist era, with a significant share of state farms only in the so called “regained territories”. But in spite of these differences, some of the main land cover change processes were similar in the three countries (decrease in arable land, increase in artificial surfaces and forests) (Bezák and Mitchley 2014; Farkas and Lennert 2015; Gubka et al. 2013). After the political and economic transition, significant changes in the land cover patterns could be anticipated. From the five types of driving forces of land use change (political, economic,

cultural, technological and natural), four underwent drastic changes during and after the transition (Hersperger and Bürgi 2009). Just like in the preceding historical periods, many of the changes were common for each country during these two decades: the disintegration of Comecon and the loss of protected markets, loosely controlled urban sprawl in the wake of socioeconomic transformation, accession to the EU and the introduction of the CAP subsidiaries and regulations. All these changes had an impact on the land use, but the question is: combined with the unique national and regional characteristics, have they had the same effect?

The aim of my paper is to analyse the main land cover patterns and their changes after the political and economic transition, and to identify the common and country-specific land cover change trends. Since land cover change is a key element of the post-productivist rural restructuring, my focus will be on the rural areas.

### **Materials and methods**

The Corine Land Cover database was used for analysing the land cover changes of the Visegrád Group. This data collection was coordinated by the European Environmental Agency for more than thirty years, and uses the same methodology for all the participating countries. For the Visegrád group, datasets are available for the reference years of 1990, 2000, 2006 and 2012. To ensure compatibility with the Terrset Land Change Modeller software, I used raster datasets with the resolution of 100\*100 meters.

From the original 44 land cover categories, 32 appear in the Visegrád countries. At this number, it is hard to highlight the general land cover change trends, so the number of land cover categories has to be reduced for the analysis. The eight aggregated categories are the following: artificial surfaces, arable land, vineyards and fruit cultivations, grasslands, heterogeneous agricultural area, forests, wetlands and other natural areas and water bodies.

The changes between the aggregated categories were analysed in country and local administrative unit (LAU-2) level (in case of Poland, the urban and rural part of the urban-rural gminas were considered as independent analytical units). I also introduced two spatial categories – rural and remote rural. I consider all local units rural, which have less than 5000 inhabitants (regardless of administrative status) or do not possess city rights. Those rural areas, from where it takes at least 45 minutes to reach the nearest city with at least 50000 inhabitants are considered remote rural (while the remaining rural settlements are considered commutable rural). For the data processing and the analysis, the ArcGIS and Terrset Land Change Modeller software were used.

### **Results and discussion**

The Table 1. shows the distribution of the eight land cover categories in the Visegrád group. In three countries (Czechia, Hungary and Poland) arable land is the largest category, while due to its generally elevated landscape, forests cover the most area in Slovakia. Natural physical conditions play an important role in case of other categories too. Because of its semi-arid puszta-type habitats, Hungary has the highest share of grasslands from the four countries. Some categories cover only a small part of the Visegrád group (vineyards and fruit cultivations, wetlands and other natural areas), but play an important role in the formation of its landscape or as habitats with rich biodiversity.

Table 1: The share of the aggregated land cover categories in the countries of the Visegrád Group

	Poland	Czechia	Slovakia	Hungary
<b>Artificial surfaces</b>	3.3%	6.0%	5.7%	5.6%
<b>Arable land</b>	44.9%	45.1%	34.4%	53.5%
<b>Vineyards and fruit cultivations</b>	0.3%	0.6%	0.8%	2.3%
<b>Grasslands</b>	9.0%	3.7%	7.1%	9.7%
<b>Heterogeneous agricultural area</b>	10.5%	9.1%	8.7%	5.2%
<b>Forests</b>	30.2%	34.7%	42.1%	20.7%
<b>Wetlands and other natural areas</b>	0.5%	0.2%	0.6%	1.1%
<b>Water bodies</b>	1.4%	0.7%	0.4%	1.8%

Source: Own elaboration based on Corine Land Cover database

Due to the urbanisation characteristics of the earlier periods, the artificial surfaces display an especially uneven spatial pattern. Besides the agglomeration of the capital cities, the Upper Silesian conurbation and the Ore Mountains Mining Region are the most notable concentrations. While the share of artificial surfaces is quite similar in Czechia, Hungary and Slovakia, Poland shows significantly lower proportion of artificial area (Table 1).

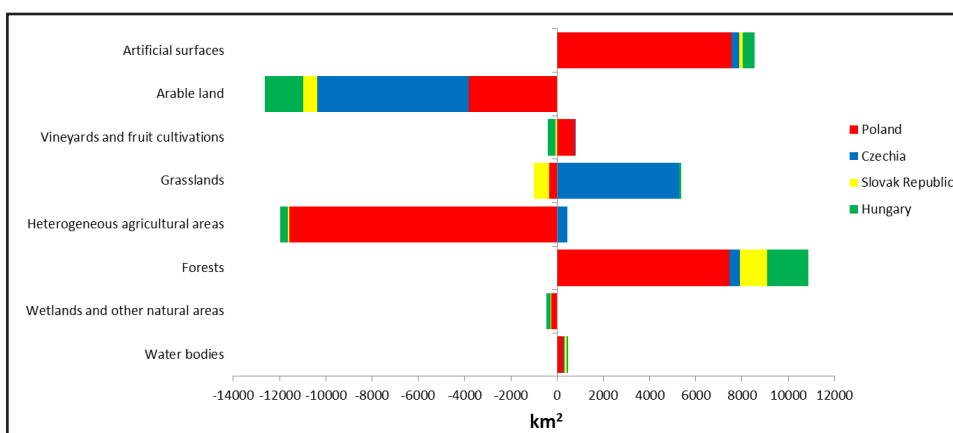


Figure 1: Change in land cover by each category between 1990-2012. Source: Own elaboration based on Corine Land Cover database

The heterogeneous agricultural area is a very diverse category. It contains lands principally occupied by agriculture with significant areas of natural vegetation, and the original Corine category called complex cultivation patterns. It was a diverse category in itself, connected to intensive agricultural activity like horticulture. Complex cultivation patterns include scattered farm areas and garden zones, which are typical accessory elements of the market towns of the Hungarian Plain. This also reveals that not all inhabited areas belong to the category of artificial surfaces.

As we can observe in Figure 1., the political and economic transition did not disrupt some of the most important land cover change trends. The increase of artificial surfaces and forests and the decrease of arable land continued in the period of 1990-2012. These are common trends for each country. In the case of other land cover categories (e.g. vineyards and fruit cultivations, grasslands), the direction of changes is not so unambiguous.

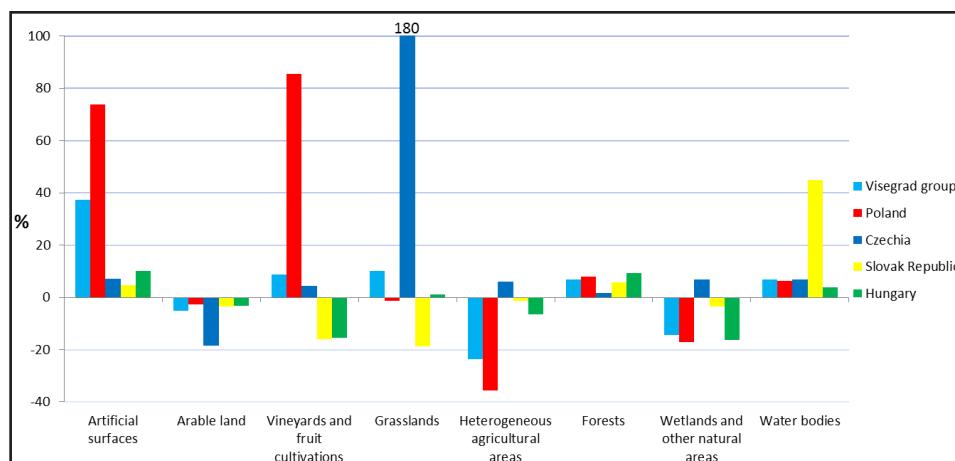


Figure 2: Relative change in land cover by each category, 1990-2012 (in percentage of the land cover in 1990)  
Source: Own elaboration based on Corine Land Cover database

In Figure 2., we can observe that there are vast differences in the rate of changes even in the case of common trends. For example, the share of artificial surfaces increased everywhere, but in Poland, it is almost doubled just in two decades. There are also big differences in the loss of arable land - in Czechia, this category decreased with almost one-fifth of its original extent. We can also observe some radical changes in the case of categories where common trends are not apparent, like the drastic increase in the area of vineyards and fruit cultivations in Poland or in the area of grasslands in Czechia. We can suspect that country- or region-specific circumstances are behind these unique processes. The case of Slovakia supports this claim: the significant increase in water bodies can be connected to a single event: the opening of the Gabčíkovo water reservoir.

The analysis in the local administrative (LAU-2) level uncovered some of these unique factors. In case of artificial areas, the significant differences between Poland and the rest of the countries reappear in the change patterns. In Czechia, Hungary and Slovakia, increase is limited to the local units in the urban areas of capitals and regional centres. This process can be adequately explained with intensive suburbanisation and greenfield investments following the political and economic restructuring (Stanilov and Sýkora 2014). However, in Poland, a more general increase can be observed. After analysing the changes with the introduced urban/commutable rural/remote rural categories, this land cover change trend seems more and more peculiar. The increase was moderate (a little more than 20%) in the urban local units, in the commutable and even in the remote rural areas the area of artificial surfaces more than doubled just in two decades. No spatial process (e. g. counterurbanisation) can explain such an immense expanse in the periphery. Further investigation revealed that the main source of this transition was the heterogeneous agricultural area land cover category. It was already mentioned that besides agricultural areas, this category can also include inhabited areas. It is also true to Poland, where the houses of the villages are often spread out along the roads in a scattered pattern, mixed with agricultural lands. A large part of these settlements was categorised as heterogeneous agricultural area in 1990, but this methodological decision was revised in the following datasets, and these areas later appeared as artificial areas. It indicates that in many cases real transformation to artificial surfaces did not occur, and gives an answer to why was Poland's artificial land cover so low in 1990.

The influence of region- or country-specific factors can be found in other transformations too. While the decrease of arable land was general, there are large areas of Poland where the area of arable land actually increased. These areas can be mostly found in the eastern part of the country. In these areas small-scale family farming persisted during the socialist era (Bański 2011). The relatively low unemployment of these regions indicates that many former industrial workers returned to subsistence farming. This safety net function explains why market-controlled land abandonment avoided the region (Zgliński 2008).

The Czech peripheries serve as an opposite example, where a significant transformation (more than 20%) from arable land to grassland occurred. Behind this we can also suspect country-specific reasons – these areas underwent population exchange after the Second World War, and the new residents could not get attached to their land before its nationalisation. After the restitutions, this lack of emotional ties led to land abandonment in the changing market environment. Also, some of the LFA subsidiaries in the mountainous parts of Czechia also favour grasslands (Štolbová 2007).

Incidentally, the increase in grasslands can also be observed in urban and commutable rural areas. For example in Hungary, the increase in the aforementioned areas exceeds the increase in the remote rural areas. Arable land abandoned in hopes of later investments often turned into grassland for the time being – thus the more intensive expanse.

Amongst the categories with modest overall share, the land cover change of vineyards and fruit cultivations is also heavily dependent on local conditions, which indicates that the special characteristics of the producing regions have growing importance in the market economy.

## **Conclusions**

Land use change is one of the key processes of rural restructuring in the developed world. Using the Corine Land Cover database, the land cover changes in the Visegrád Group after the political and economic transition were analysed using eight aggregated land cover categories. The results indicate that the political and economic transition did not disrupt the most important land cover change trends (decrease in arable land, increase in artificial surfaces). The most general land cover change trends are common for each county (increase in the share of artificial surfaces and forests, loss of arable land), but apart from that, the effect of regional and national factors is clearly observable. Typical examples for that are the increase in arable land in the Polish eastern periphery, and the significant decrease of the same category in the peripheral Czech regions. Moreover, the reasons behind the exceptional increase of artificial surfaces in Poland also reveal the limitations of the Corine Land Cover database.

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