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# Spatial variability of multifunctional landscape as the basis for potential differences of regional „smart growth“ of rural areas – the examples from Poland

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**Abstract:** *Management of multifunctional landscape in conformity with the prerequisites of the sustainable and harmonious development constitutes currently one of the priorities of spatial policy in the countries of European Union. This policy assigns a special significance to rural areas, subject to a very strong human pressure and the associated functional and spatial transformations of landscape. The purpose of the present report is to identify the conditions of regional development of the rural areas, linked with the concept of „smart growth“, and to illustrate them with the results of analysis of the factors determining this process, conducted for two territorial units of Poland, corresponding to the provinces of Greater Poland – situated in western Poland, and Podlasie – in the north-eastern part of the country. The choice of these provinces was by no means incidental, since they are representative, in terms of numerous socio-economic features, for the larger areas of western and eastern Poland. The results obtained indicate that smart growth can be considered a very important tool in development of the regional growth policies. It allows, on the one hand, for making use of the natural resources of the environment and of the socio-economic potential of the region, while on the other hand – to optimise regional growth in accordance with the principles of sustainable development.*

**Keywords:** *multifunctional landscape, sustainable development, smart growth, rural areas.*

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## Introduction

One of the priorities of spatial policy in the countries of European Union is constituted currently by the correct, that is – conform to the prerequisites of sustainable and harmonious development – management of the natural and cultural landscape (European Strategy of Sustainable Development 2001). The general principles of managing space, understood as the multifunctional landscape, are

included, in particular, in several of the basic documents of the European Communities, such as the Pan-European Strategy of Biological and Landscape Diversity (1995), European Perspective on Spatial Development (1999), European Landscape Convention (2000), and European Strategy of Sustainable Development (2001). A high number of precepts forwarded in these documents concern the subject of the rural areas. Currently, it is just the rural areas that are undergoing the most intensive civilisation-related transformations, it is within them that the very strong processes of environmental destruction are taking place, involving the change of their natural character and of the quality of their sanitary status. These areas are, as well, subject to the most intensive functional-spatial changes. The changes of the landscape function give rise to appearance of a new human space, endowed with the environmental, economic and social dimensions, whose attribute is constituted by development (Benfield et al. 2001; Degórski 2003a).

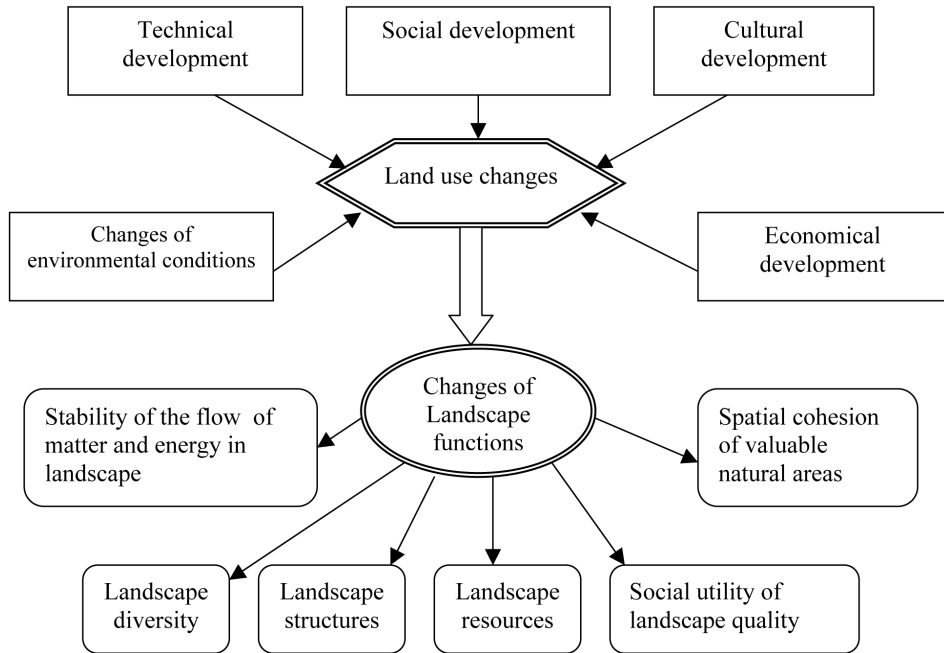
One of the tools allowing for the optimisation of this development is smart growth. This concept associates the ideas of sustainable land use, sprawl control and spatial order. Smart growth means smart management of resources in both growing and declining communities. Smart growth, like sustainable development, is at the same time productive and environmentally, economically and socially sound, while enhancing the choices that people have regarding housing, jobs, recreation and transportation. The long-term needs of people, businesses and environment ultimately define what is smart and sustainable growth and what is not (Smart Growth Network 2002).

One of the most important items in the procedures of elaboration of strategies related to the smart growth concept is determination of the local and regional conditions for the sustainable development, and then indication of its directions conform to the environmental, social and economic potential of a given area. In construction of such strategies an essential role is played by the generation of optimum solutions linking land use and multifunctionality of landscape, and establishment of the foundations for the sustainable development in each of the sectors of economy (including agriculture), across the entire natural-economic-social system. The primary goal in this process is to enhance the existential safety and the quality of life of the inhabitants.

The purpose of the work here reported is to identify the conditions for regional development, referring to the concept of smart growth in the domain of rural areas, and to provide an illustration based on the examples of results from the analysis of factors determining this process. The latter analysis was carried out for two territorial units in Poland, corresponding to the provinces of Greater Poland (Wielkopolska), situated in western Poland, and Podlasie, situated in the north-eastern part of the country. The choice of these two provinces was by no means incidental, since they are representative, in terms of numerous socio-economic characteristics, for the larger areas of the western and eastern parts of Poland.

## Changes in land use and landscape functions in rural space

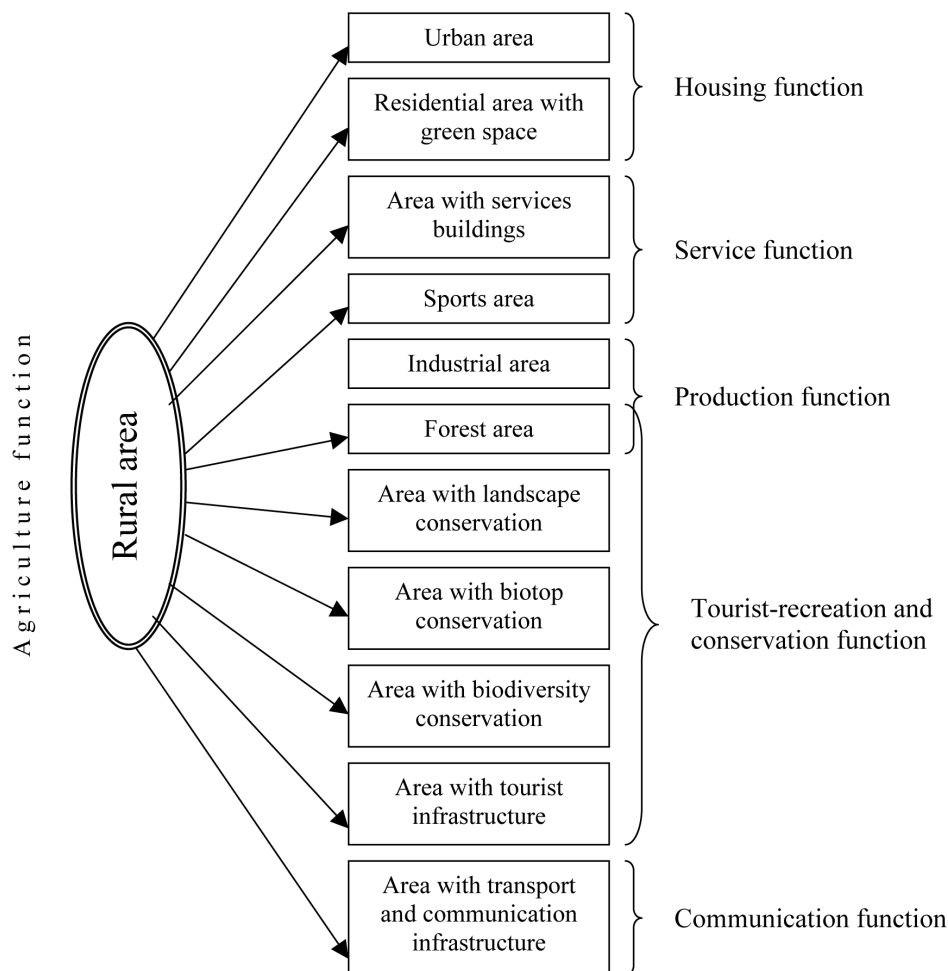
One of the consequences of the civilisation-related development of the population is constituted by the structural transformation, reflected through land use changes, generating, in turn, the functional and spatial changes in landscape (Figure 1). Along with these changes there are also transformations in the domains of resources, structure, diversity, stability of the matter and energy fluxes in landscape (the geo-dynamic and bio-geo-chemical processes), spatial cohesion of the areas valuable for their natural assets, or the social utility of landscape quality (Degórski 2003b).



**Figure 1.** Structural transformation of landscape

An exceptional place is taken in all these changes by the rural areas. These areas, as indicated already, are the most active element of space in the civilisation-related transformations. They are, in particular, the locus of the change from the traditional agricultural functions into the residential, transport, industrial, service or tourist-recreational functions (Figure 2). These areas are therefore subject to the strongest processes of anthropisation of landscape.

A special role is played in the dynamics of the functional and spatial changes over rural areas by the mutual relations between the areas used for both plant and animal farming production and the forest areas. Until the turn of the 20<sup>th</sup> century the deforestation processes, proceeding with a variable intensity, dominated in Europe, and therefore also in Poland. At the beginning of the second



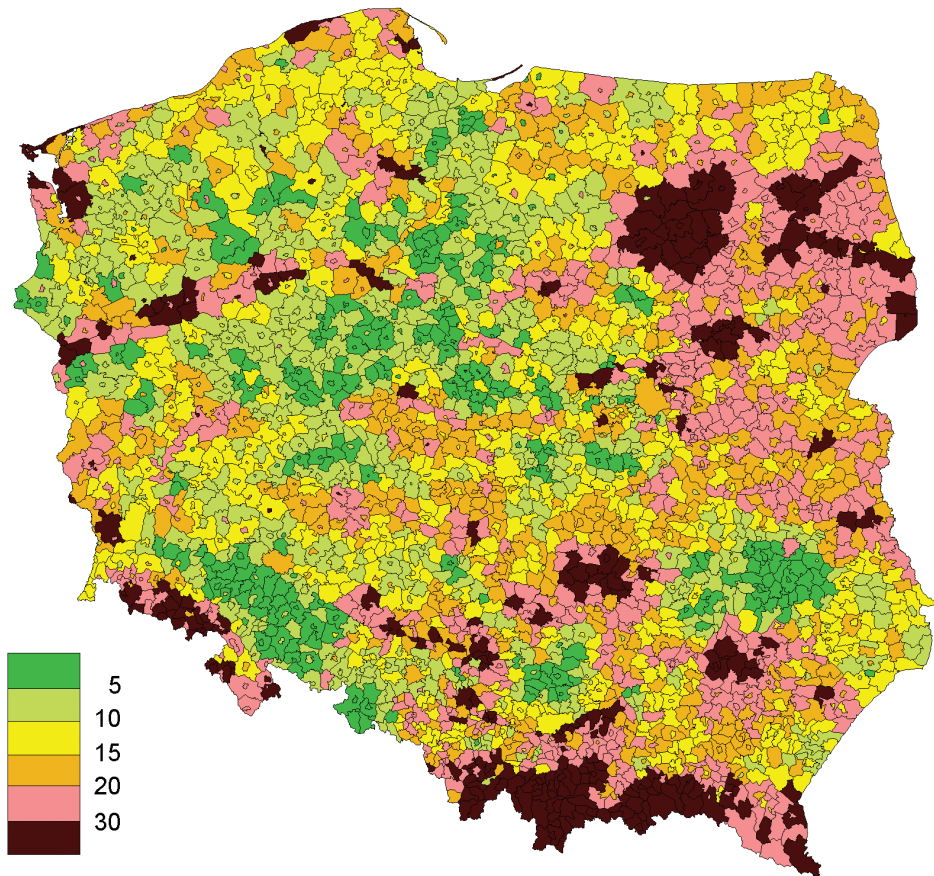
**Figure 2.** Functional and spatial changes of rural landscape

millennium the share of forest areas in Poland was at about 70% (Maruszczak 1988; Degórska 1996). It decreased by the turn of the 20<sup>th</sup> century to approximately 40%, and then by the 1930s and 1940s – to roughly 22% (Degórska 1996). The decrements of the forest share were mainly brought about by the transformation of forest areas into agricultural land, mainly arable land. This land was used for food production, directly or indirectly, or for other crops. In some cases land was cleared where forests grew on soils poor in nutrients, like podzolic earths, classified as the poorest quality soils. In the second half of the 20<sup>th</sup> century these soils were the first to be excluded from the agricultural use and assigned for other forms of use. They were either forested again, or used for housing, commercial or industrial investment projects. This process caused that during the last 50-60 years the forest share in Poland has been increasing, while the share of arable land has been decreasing. The contemporary forest shares of the two provinces in question are 25.2% for the Greater Polish province, and

29.6% for the Podlasie province. Agricultural land accounts for, respectively, 63.4% and 59.5% (*Statistical yearbook...* 2003).

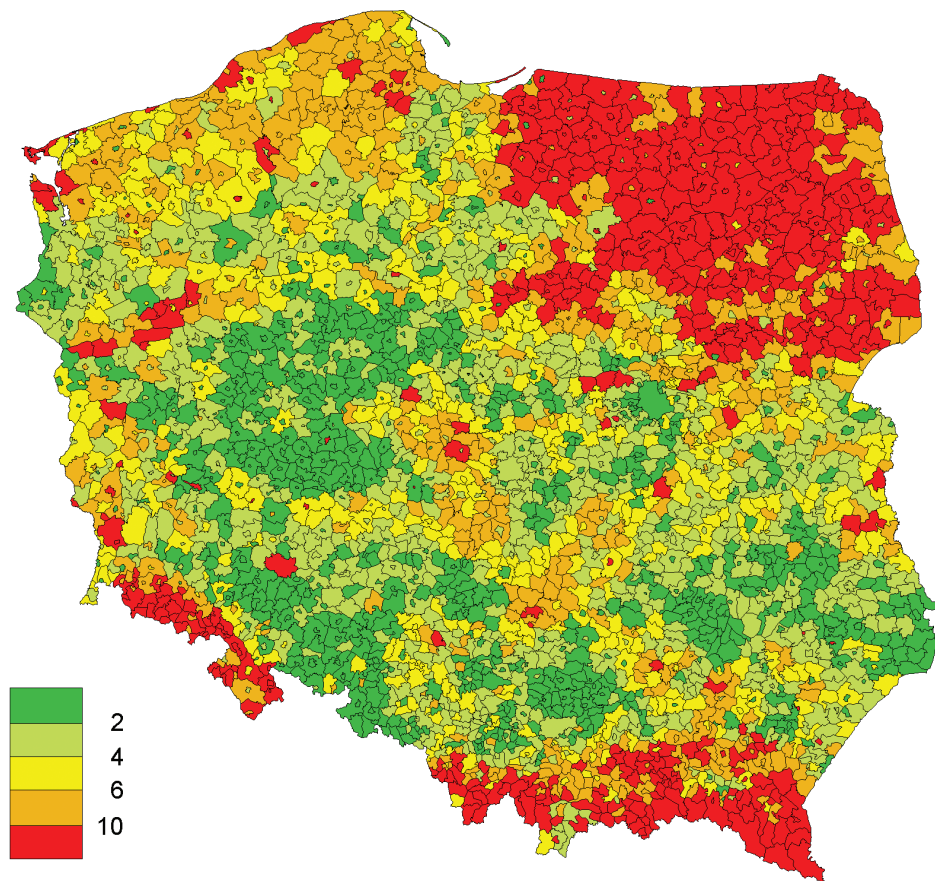
In the category of agricultural land an important role is played, side by side with arable land, also by meadows and pastures (Figure 3 and 4). Meadows, especially in eastern Poland, are characterised by an extensive or semi-extensive exploitation form, which enhances certainly the landscape value of the area with respect to its biodiversity, and also allows for the preservation of the ecosystems in the semi-natural or alike form. A high share of meadows and pastures in the land use structure means also a potential capacity of developing cattle raising based on grazing. Total area of meadows and pastures in the Greater Polish province equals 289,900 hectares, and in Podlasie province – 402,400 hectares.

Both sustainable development and smart growth depend largely upon the preservation of the natural and landscape assets of the environment and therefore also upon the most valuable objects in these terms. This applies to the areas containing highly valued natural elements, both biotic and abiotic, as well as the ones



**Figure 3.** Meadows as a percentage of total agriculture area. Total agriculture 2001 (according Kulikowski 2003)





**Figure 4.** Pastures as a percentage of total agriculture area. Total agriculture 2001 (according Kulikowski 2003)

characterised by the unique features or naturalness of landscape, which have been subject to legal protection. The two regions analysed feature high shares of legally protected areas, which decidedly increases their tourist and recreational value. The shares of the legally protected areas in the total surfaces of the two provinces are 31.3% in Greater Poland and 31.9% in Podlasie province. These areas include the most important protection forms, that is – national parks (one in Greater Poland and four in Podlasie voivodship), and nature reserves (96 and 88, respectively). Both provinces include also the areas incorporated in the NATURA 2000 system.

### **The natural-economic-social factors and smart growth**

Besides the land use data concerning analyse of smart growth procedures, we have to collect data connected with many aspects of nature and socio-economic development. The factors determining the regional development conform to the

concept of smart growth can be classified in four basic groups. These groups of factors correspond to:

- properties of the environment,
- social development,
- economic development,
- cultural and historical development.

Factor analysis, carried out in the elaborates meant to determine the strategies conform to the smart growth idea for the rural areas, for which agricultural function remains the basis of the functional-spatial structure, should include the prerequisites for sustainable agriculture. It integrates three main goals: environmental health, economic profitability, as well as social and economic equity. In this concept it is most important to work out the compromise between the natural and human resources. Stewardship of natural resources involves maintaining and enhancing the vital resources base for a long time. Stewardship of human resources includes consideration of social responsibilities, such as working and living conditions of farmers, the needs of rural communities, and consumer health and safety both in the present and in the future. Hence, the fundamental questions, which are accounted for in the work on sustainable agriculture constitute the complement to the smart growth factor analysis in the domains of farming and natural resources, plant production practices, animal production practices, as well as their economic, social and political context.

The most important natural resources accounted for in evaluation of agricultural space include soils, climatic and water conditions. In terms of conditions for agricultural production both areas here considered are characterised by medium quality soils (domination of the classes III and IV of the Polish soil classification), featuring very good sanitary characteristics (*Atlas...* 1997). These soils are in close to 100% free of contamination with heavy metals (Table 1). On the other hand, the regions in question differ as to the potential risk of water and wind erosion, to which agricultural land is exposed. The areas exposed to such risk constitute, respectively, 16.8% and 27.6% of the total areas in case of water erosion, and 26.9% and 42.6% for wind erosion (*Statistical Yearbook...* 2003).

**Table 1.** Percentage share of contamination free soils in total area of soil cover

Elements	Wielkopolska	Podlasie
Pb	99.82	100.00
Zn	99.33	99.87
Cu	99.89	100.00
Ni	99.96	99.97
Cd	99.96	100.00

In view of the postulate of preserving the nutritional potential of the soils and of their edaphic functions for the satisfaction of food supply needs of the population, it is important, when elaborating the smart growth strategies, to define the



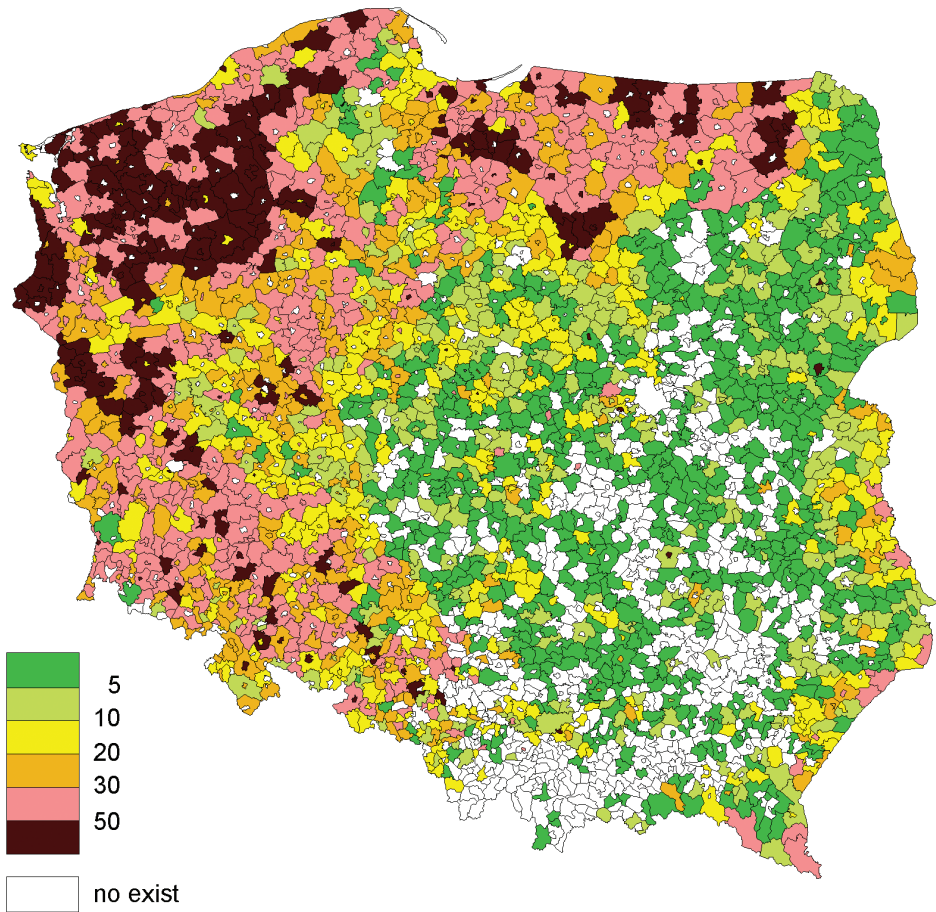
optimum conditions of managing the agricultural land, the degree of chemical treatment, the use of mechanical equipment, and application of genetic modifications in agricultural production. Thus, finding of the compromise between the extensive forms of economy and intensification of activities in farming belongs among the most important procedures in the establishment of the development directions. The regions in questions differ decisively as to the levels of intensification of agricultural production. These differences can be seen, in particular, through the level of use of mineral fertilisers, NPK (the Greater Polish province: 107 kg per hectare, Podlasie province: 79.8 kg per hectare), or of the calcium fertilisers (74.9 kg per hectare and 59.2 kilograms per hectare, respectively). The consequence of the higher intensity of agricultural production is the higher yield in both plant production (Table 2) and animal production.

**Table 2.** Yield per hectares of same arable plants

Arable	Yield per hectars dt.ha <sup>-1</sup>	
	Wielkopolska	Podlasie
wheat	41.9	28.7
potatoes	196	177
sugar	390	326

A very significant factor influencing the landscape of rural areas is constituted by the agrarian structure. The acreage of farms is closely associated with the organisation of rural space, its patchwork and spatial order. It is of high importance for the concept of smart growth not only from the point of view of aesthetics of landscape, perceived by the local community, but also from the point of view of economic evaluation of landscape as the medium of development of the tourist and recreational function, as well as optimisation of production. Conform to the results of the agricultural census of 2002 both of the areas considered feature relatively low share of small farms (i.e. between 1 and 5 hectares) in the total surface area of agricultural land, below 5%, while the average for Poland equals 19.9% (Kulikowski 2003). The acreage structure is dominated by the average farms, with few large farms. Yet, the share of the latter in total area of farms is significant. Thus, in particular, in numerous communes of Greater Poland the share of the very large farms (i.e. of more than 50 hectares of area) exceeds 30% of the total area of private farms (see Figure 5).

Agrarian structure, together with the socio-economic level and the historical-cultural factor, is the generating factor for the character and spatial setting of structures, amounting to the spatial order associated with the morphogenetic types of rural settlements in landscape. Thus, irregular villages dominate in the Greater Polish voivodship, while in Podlasie province it is the lineal street or row villages that dominate. The shapes of habitat areas are accompanied by definite patterns of fields in space. Small, irregular villages, occur in conjunction with the block or block-and-belt field patterns, while large villages coexist with the stripe and forest-and-stripe patterns (Szulc 2002).



**Figure 5.** Agriculture farms above 50 hectares as a percentage of total agriculture area of individual farming 2002 (according Kulikowski 2003)

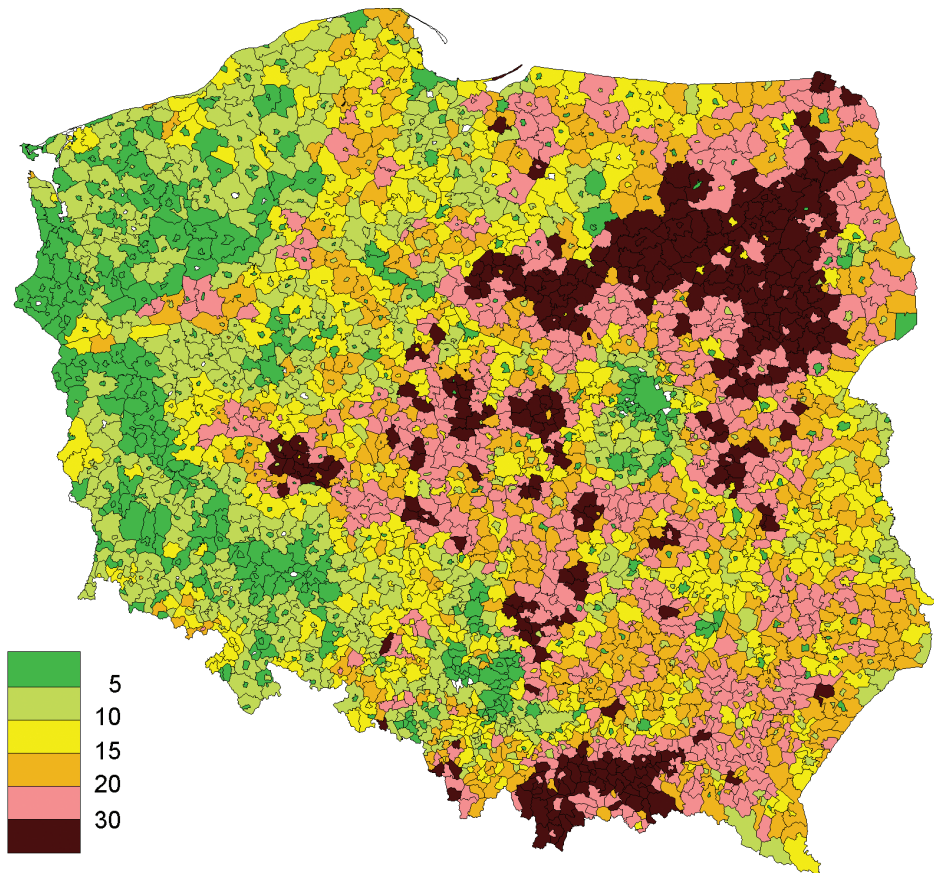
One of the most important elements conditioning smart growth is constituted, from the sociological point of view, by the society, understood as the subject, for whom the entire development concept is being elaborated. The regions in question differ considerably also with respect to the social development. The Greater Polish province, with the surface area of 29,800 sq. km, is inhabited by close to 3.4 million people, while the province of Podlasie, of 20,200 sq. km of area, is inhabited by a much smaller number of people: 1.2 million. This difference is reflected, as well, through the spatial distribution of population. The population densities are equal, respectively, 113 and 60 persons per sq. km. Despite the fact that the percentage share of people inhabiting the rural areas in both provinces is similar (amounting to 42.5% in Greater Poland and to 44% in Podlasie), the average densities of population within the rural areas are, correspondingly, different, namely 53 and 29 persons per sq. km (*Statistical Year-book... 2003*).

The economic circumstances within a given area exert a direct influence on the level and structure of employment. In the case of the two regions analysed we can see quite distinct differences, which exist between the western and eastern parts of the country. Employment in agriculture in relation to total employment amounts to 25.9% in Greater Polish province, while it attains 46.4% in the Podlasie province. The bigger dismemberment of farms and the lower possibilities of finding employment in the non-agricultural sectors of economy in the East of the country entail lower commercial value of agricultural production (2,615 PLN per 1 hectare in Greater Poland and 1,436 PLN per 1 hectare in Podlasie). This is paralleled by the lower level of socio-economic development in Podlasie: the GNP per capita in the Greater Polish voivodship is equal 18,900 PLN, while in the Podlasie voivodship – 13,174 PLN. Therefrom an increased rate of migration, in particular – of the younger people. The consequences of this fact can be seen in the increasing average age of the population inhabiting the rural areas of Podlasie, and the decreasing magnitude of the birth rate (which is equal in Greater Poland approximately 1‰ and in Podlasie – only 0.2‰) as well as the real population increase. This phenomenon is highly disadvantageous from the point of view of the smart growth, since it weakens the possibilities of the region's socio-economic development and, through the decrease of the population numbers, may lead to the disappearance of regional identity, so important in the cultural and social development of Europe.

The higher level of technical development of the region, expressed, in particular, through high industrialisation, development of infrastructure and intensification of agricultural production, means higher consumption, including consumption of natural resources, but also – potentially – higher emission of pollutants, bigger production of waste, both solid and liquid, etc. For the prerequisites of sustainable development and smart growth this increased pressure on the environment does not necessarily have to amount to an increased degradation of the environment and the worsening of living conditions of the local communities. Yet, limitation of the consequences resulting from the influence exerted by the industrial and technical development is a very difficult task, requiring definite financial outlays, especially in the domains of water management, waste disposal and storage, as well as pollution emission control. The purpose of the respective undertakings must be constituted by the improvement of life quality and health safety of the society through, for instance, production of healthy food or development of infrastructure promoting healthy lifestyles. In case of the areas under analysis one should emphasise the significant differences in the levels of extraction of natural resources and in the effects of their use, existing between the two voivodships. Water extraction is almost 20 times higher in the Greater Polish province than in Podlasie (1905 hm<sup>3</sup> and 89 hm<sup>3</sup>, respectively), of which industry uses only 84.3 hm<sup>3</sup> and 16 hm<sup>3</sup>, respectively. Hence, the difference results primarily from the levels of water extraction and use for agricultural and municipal purposes. Higher water consumption means higher production of wastewater. Industrial and municipal liquid waste amounted in 2002 to 195 hm<sup>3</sup> in the Greater Polish province and to 38.1 hm<sup>3</sup> in Podlasie. Likewise, emission

of dusts was five times higher in Greater Poland than in Podlasie (10.9 thousand tonnes and 2.0 thousand tonnes, respectively), according to the *Statistical Yearbook...* (2003).

The level of economic development of a given region, the socio-cultural conditions and the natural dispositions of the environment, expressed, in particular, through the land cover, determine spatial organisation on rural areas, as well as directions of spatial development and directions of agricultural production. Production profile may undergo changes with the change of one of factors, which becomes, in definite conditions, the determinant of development. Such a phenomenon is being observed during the recent years over the areas in question. Traditionally, and until quite recently, the region of Greater Poland has been the primary milk producer. Of late, due to a high potential of meadows in the region encompassing northern Masovia and Podlasie, as well as significant investments into the dairy industry in the region, Greater Poland lost its leading position in milk production. There has been a significant increase of cattle raising in north-



**Figure 6.** Number of dairy cows per 100 hectares of agriculture land. Individual agriculture (according Kulikowski 2003)

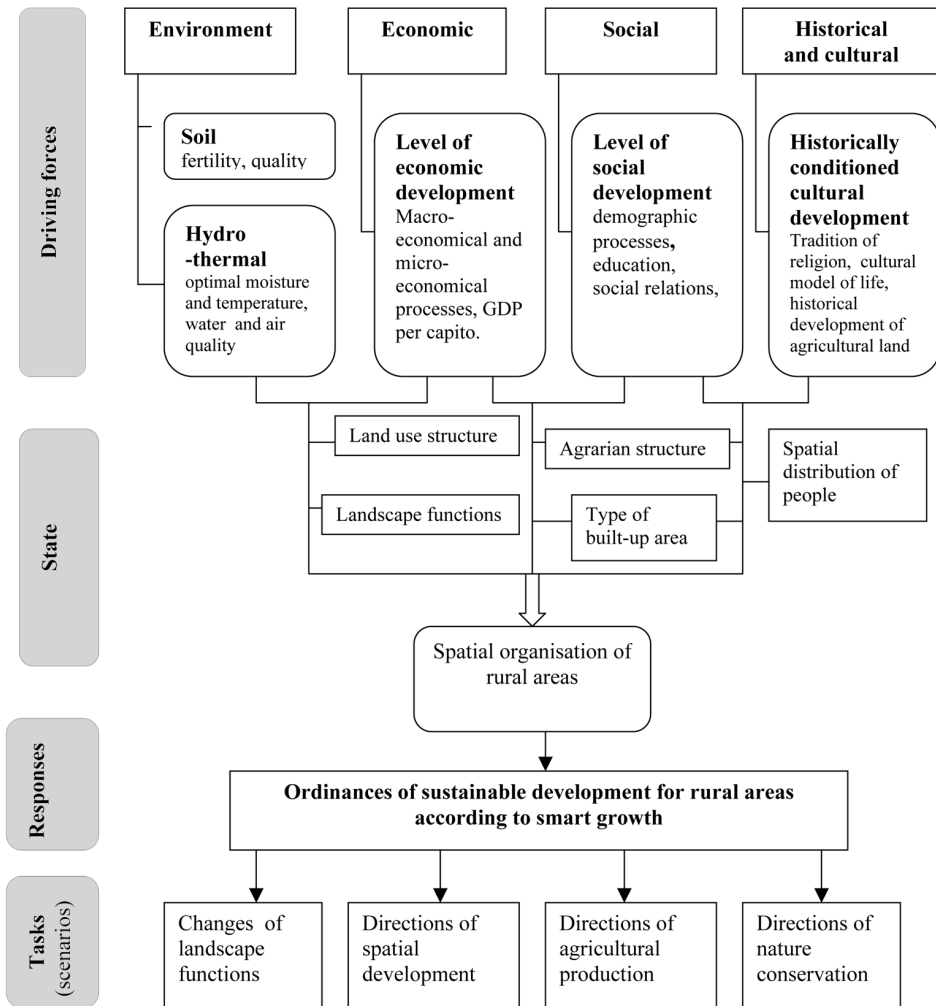


ern Masovia and Podlasie (53.5 units per 100 hectares, compared to 38.6 units per 100 hectares in Greater Poland), including milk cows (Figure 6). The consequence of this change is the increased milk production, so that Podlasie produces now  $1.28 \cdot 10^9$  tonnes of milk per annum, while Greater Poland –  $0.86 \cdot 10^9$  tonnes.

## Model ordinances for sustainable land development

The next step in smart growth procedures after data collecting and their spatial analyse is modelling and preparing some scenarios for regional development which are determining a multifunctionality of the landscape concerning to the socio-economic development and environmental protection policy. Also, solution of those procedures have to take into consideration assumptions of CAP (Common Agricultural Policy of EU). The comprehension thereof and the correct management and determination of the development directions, that is – conform to the natural-social-economic potential of a region, requires generation of very precise solutions being in accordance with the smart growth concept. That is also why it is essential in the search for the tools meant for the local or regional smart growth to develop model ordinances for sustainable development. The structure of this model is strongly connected with four items: driving forces, state, responses and tasks (Figure 7). The ordinances cover a broad range of topics, from neighbourhood design and energy efficiency to watershed management and pollution prevention. The goal is to cover the aspects of sustainable development that may be reasonably achieved through the ordinances and to provide for the voluntary fulfilment of their prescriptions.

The analysis of interdependence between the factors determining spatial organisation, carried out for the two regions of Poland, indicated mutual connections and interrelations of these factors. On the basis of evaluation of the prerequisites for sustainable development and smart growth of the provinces considered we can clearly see the differences in directions of development of rural areas, associated with the natural-social-economic potential of the regions as the conditioning related to regional policy. In the Greater Polish province this would be the strengthening of the agricultural function through the growth of the medium sized and large farms, increasing production intensity and at the same time caring for the ecological and sanitary standards of production, and thus also for food quality. In the province of Podlasie, side by side with agricultural function, the tourist and recreational function as well as the protective function of the environment will be very strongly developed. In view of the highly clean environment, not destroyed by human impact, the areas subject to legal protection must constitute the instrument for the economic development of the voivodship in this particular region. Agricultural production, on the other hand, should be based mainly upon ecological farming, turning out very high quality „healthy food“. Cattle raising will be further strengthened as the direction in agricultural production, with main orientation at milk production.



**Figure 7.** Proposal of the model ordinance for sustainable development for areas according to smart growth ideas

## Summary

In the light of factor analysis, carried out for the two territorial units of Poland (the Greater Polish and the Podlasie provinces) from the standpoint of their development according to the precepts of smart growth, we can state that this concept allows for the optimisation of the spatial and economic development of rural areas, in which the fundamental assumptions of sustainable development are accounted for, and the elaborated procedures and instruments, applied in landscape management, make it possible, in particular, to:

- take advantage of the natural potential of the environment,
- account for the socio-economic level of the society,



- enhance life quality of the society,
- solidify the cultural and historical identity of the local society,
- produce healthy food,
- monitor sprawl,
- establish spatial order.

Thus, smart growth can be considered as a very important instrument in the elaboration of the regional development policy, allowing, on the one hand, for making of appropriate use of the natural resources of the environment and of the socio-economic potential of the region, while optimising, on the other hand, the regional development in accordance with the principles of sustainable development.

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