DIVERSITY OF RURAL LESS-FAVOURED AREAS IN PODLASIE PROVINCE, POLAND

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ABSTRACT

In this study we present multivariable characterization of 105 communes in Podlasie province; almost all of these communes have status of LFA (less-favoured areas). The eleven variables which are indicators of enironmental and socio-economic conditions were used for evaluation of regional differentiation. Statistical methods i.e. principal component analysis (PCA) and hierarchical cluster analysis (Ward's method) afford us to identify most important variables and to clasify communes into 5 distinct clusters. Among the studied variables these showing farmer skills, land use, farm production intensity, activities of rural local populations were the major descriptors for adequate quantitative characterizing and discriminating the communes in Podlasie province. Quality of agro-ecological environment was not an important factor discriminating the rural LFAs.

Key words: less-favoured areas, regional diversity, rural development

INTRODUCTION

Unequal development of the rural areas is an issue of many countries in the world, roughly 40% of the developing world's rural population lives in less-favoured areas (LFAs). These areas have low agricultural potential because of limited and uncertain rainfall, poor soils, steep slopes, or other biophysical constraints, as well as they may have higher agricultural potential, but with limited access to infrastructure and markets, low population density, or other socio-economic constraints [21].

Because of diversity of LFAs in different world's regions (in EU too) it is necessary to treat them individually and adjust the policy for the most important problems in particular regions [2].

From the joining Poland to EU in year 2004, part of all rural areas is treated as less-favoured areas (LFA). Recognition of some areas as LFA is based mainly on the Quality Coefficient of Agricultural Areas, which takes into consideration soil quality, climatic and environmental conditions in individual communes as well as demographic conditions (population density and share of people living in farms) [13]. Obtaining such a status affords these subregions for special support. It gives a chance for equal development with other areas, which have better environmental and socio-economical conditions. The additional subsidies from the EU founds are allotted for LFA depending on their types (lowland, mountain, special).

Wide diversity of the rural areas occurs at the village and regional levels (communes) in less-favoured areas (LFAs). To quantify and capture spatial patterns of rural landscape, many agricultural and socio-economic variables, characterizing land use, agricultural productivity and social conditions of the population in LFAs, have been used [4, 5, 7, 19, 21]. The knowledge of the spatial variation of these variables is strongly needed for sophisticated landscape management in LFAs and selection of local policy instruments to enhance sustainable rural development in these areas [19].

A defining feature of LFAs is that environmental and socio-economic constraints are more limiting than in the favored areas. This creates particular challenges for the farm households, researchers and policymakers alike [1].

The aim of the paper was to assess the diversity among 105 rural communes across Podlasie province (102 communes have been recognized as LFAs) for 11 agricultural and socio-economic variables recorded in 2002 [18].

MATERIAL AND METHODS

Data for 11 variables: productivity of agro-ecological environment (X_1), percentage of small (1-5ha) farms (X_2), percentage of very fragmented farms (X_3), percentage of farm managers without agricultural education (X_4), percentage of farmers older than 65 years (X_5), share of fallows area (X_6), farm area per one tractor (X_7), livestock density (X_8), percentage of households with pensions as the main source of income (X_9), percentage of self-supply farms (X_{10}), percentage of farms selling their products for less than 3 000 EURO per year (X_{11}) were collected in an agricultural survey (PSR 2003). These attributes are indicators to a thorough quantification of spatial rural diversity across the studied LFA [5]. Principal component analysis (PCA) was performed for the all these variables after standardization to identify a core set of variables that are major, key-attributes contributing to the overall spatial diversity of the province. Principal component analysis is a statistical method that transforms a number of correlated variables into a smaller number of uncorrelated variables called principal components. The first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible. The hierarchical cluster analysis (Ward's method) was used to classify the similar rural communes [4, 7, 22]. This method is distinct from all other cluster analysis methods because it uses an analysis of variance approach to evaluate the distances between clusters. It is commonly used in regional taxonomy [14].

RESULTS AND DISCUSSION

On the base of results showed in table 1, we can say, that the highest coefficients of variation values among examined variables had share of fallows area (X_6) and percentage of self-supply farms (X_{10}). It indicates big differences between communes for these variables. The smallest variability had the productivity of agro-ecological environment (X_1), percentage of farm managers without agricultural education (X_4) and farm area per one tractor (X_7).

All examined variables are directly or indirectly connected with human agricultural activity and these variables are characteristics of rural landscapes variability, which is a subject of many agricultural and socioeconomic investigations in last years [6, 10, 12]. Applying principle components analysis in estimation of spatial variability for different experimental units (farms, regions) affords for their multivariable evaluation[7, 11, 17]. Conducting this type of statistical analyses enables estimation of variability between examined units as well indication of the most influenced variables [4, 11].

Table 1. Means, maximum and minimum values, standard deviations and coefficients of variation for examined variables and theirs correlation coefficients with principle components (PC1, PC2, PC3)

	PC1	PC2	PC3	mean	min	max	Standard deviation	CV
X_1	0.475	0.180	0.667	54.5	36.2	76.1	8.1	14.8%
X_2	-0.865	-0.156	0.309	36.9	13.6	91.9	18.6	50.5%
X_3	0.017	0.656	-0.089	14.2	5	26	5.8	40.5%
X_4	-0.284	0.689	-0.200	37.1	22.7	60.8	7.1	19.2%
X_5	-0.822	0.261	0.120	15.7	5.4	48.2	10.4	66.2%
X_6	-0.819	-0.440	-0.052	15.0	0.9	71.2	15.4	102.4%
X_7	-0.489	-0.083	-0.693	13.3	8.8	24.6	3.2	23.9%
X_8	0.892	0.041	-0.018	62.0	13	111	23.2	37.4%
X_9	-0.942	0.128	0.139	23.1	9.5	56.6	12.3	53.1%
X_{10}	-0.757	-0.146	0.242	5.6	0	39	5.6	101.5%
X_{11}	-0.683	0.365	0.085	39.5	25	65	11.4	29.0%

Table 2. Means and standard deviation of examined variables for clusters of communes.

variables	No of cluster 1	2	3	4	5	all clusters
	mean (standard deviation)					
X_1	45.11 (5.46)	50.41 (5.6)	54.36 (5.91)	49.59 (7.02)	59.59 (7.5)	54.5 (8.09)
X_2	74.1 (12.97)	58.29 (10.31)	44.13 (16.33)	29.77 (8.56)	23.2 (5.44)	36.91 (18.65)
X_3	9.29 (3.45)	17 (4.83)	13.97 (4.70)	17.47 (7.82)	13 (4.91)	14.21 (5.76)
X_4	34.96 (11.86)	44.5 (10.20)	36.42 (5.33)	39.12 (6)	35.11 (5.57)	37.08 (7.11)
X_5	25.49 (11.25)	39.13 (6.00)	17.27 (6.92)	10.56 (2.35)	9.31 (2.62)	15.65 (10.36)
X_6	53.96 (11.21)	29.3 (10.95)	15.51 (9.26)	15.64 (11.76)	3.95 (2.55)	15 (15.36)
X_7	12.77 (1.59)	17.61 (4.87)	13.21 (2.09)	15.38 (3.35)	11.49 (1.65)	13.34 (3.19)
X_8	22.71 (6.70)	32.4 (7.96)	48.69 (11.77)	71.58 (10.99)	81.43 (14.01)	62.02 (23.22)
X_9	40.5 (8.20)	47.85 (6.50)	27.42 (6.86)	18.19 (3.27)	13.17 (2.43)	23.14 (12.29)
X_{10}	19.06 (9.57)	9.46 (4.04)	6.36 (4.31)	4.1 (2.18)	2.33 (1.61)	5.56 (5.64)
X_{11}	40.71 (9.76)	57 (9.19)	47.41 (7.39)	36.05 (6.58)	30.75 (6.75)	39.48 (11.43)
No of communes per cluster	7	10	29	19	40	105

Variables strongly correlated with first principal component in the largest degree decide about differentiation of studied communes, variables correlated with next principal components have much less influence for total variability. In our research the first three components together explained 72% of the whole spatial variation in the 11 variables. Definitely the first principle component had the most share in variability explaining. It explained 48.8% of total variability. The metrics strongly negatively correlated with the first component (PC1) included X_2, X_5, X_6, X_9, X_{10} and X_{11}. However the X_8 was positively correlated with the PC1. The Second component (PC2) in much smaller degree explained all variability (12.8 %).

PC2 was correlated positively with variables X_3 and X_4. Then, PC1 identifies the most important pattern (aspect) of the LFA variation. It can be summarized as land use intensity, farm production amount and income level, distinguishing rural landscapes dominated by small inefficient farms generating rural poverty of older population from areas of moderate and relatively good rural economic efficiency and related better social-economic conditions.

PC2 revealed the second major pattern of the spatial

variation, summarized as the farm fragmentation and farmer professional skills (Fig. 1).

For grouping objects of similar kind into respective categories, the Ward method of cluster analysis can be applied [15]. In our research this method was used and five homogenous groups of the rural communes with respect to agriculture and socio-economics were identified (Fig. 2). Groups counts form 7 to 40 communes.

Patterns of their similarities and dissimilarities are visualized on the PC plot (Fig. 1.)

On the base of results in table 2, we can say that these groups were most different in respect of average values following variables: percentage of small (1-5ha) farms (X_2), percentage of farmers older than 65 years (X_5), and share of fallows area (X_6) percentage of households with pensions as the main source of income (X_9), percentage of self-supply farms (X_{10}). These variables were strongly correlated with first component (PC1). The variables which differ in small degree between clusters were productivity of agro-ecological environment (X_1), percentage of farm managers without agricultural education (X_4) – this variable is strongly correlated with second component (PC2).

The results obtained indicate distinct spatial variability at Podlasie province. On the base of spatial location of communes for different groups we can say that differentiation is mostly present in East-West direction and relatively small in North-South direction. Smaller values of first principle component are for communes which are nearer to eastern border of Poland (fig.. 2).

Multivariate grouping of spatial objects using cluster analysis very often reveal similarity between neighbouring objects and simultaneously differences between objects which are in bigger distance [2, 3]. In our case connections between neighbouring communes were very evident.

Interestingly, these differences are very often in large degree caused by features connected with human activity and in small degree are caused by natural environmental conditions [9, 16].

Values of variables X_2, X_5, X_6, X_9, X_{10} and X_{11}, which were negatively correlated with PC1 were bigger for communes which are nearer to eastern border of Podlasie province. It is the most distinct for share of fallows area (X_6), which for first group of communes (communes with black color on the map) is equal to 54% in average, so more than half of agricultural area in these communes is not used for agricultural production.

Quite big share of fallows area (X_6) is in communes which are in second group, too (communes with dark

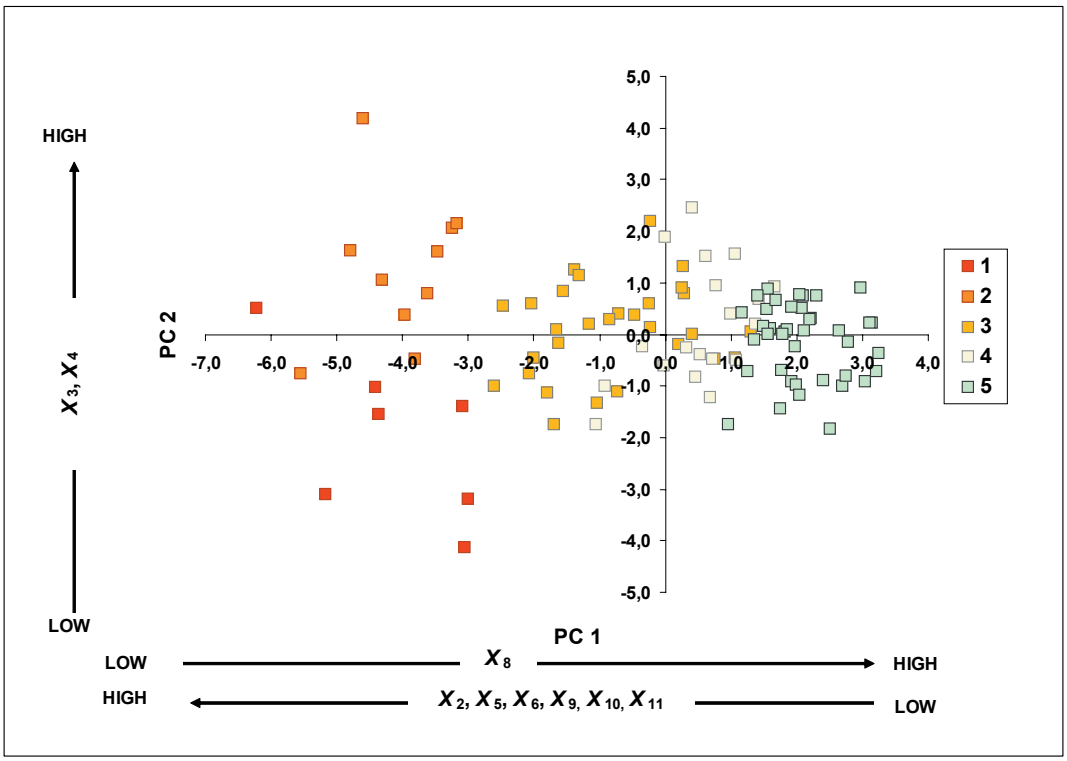

Figure 1. Plot of the first and second PC scores for the 105 rural communes in Podlasie province

grey color on the map). For these communes it is equal to 29% in average. The smallest percentage of fallows area is for communes which are in fifth group it is equal to 4%, so it is relatively small part of agricultural area. These communes are situated in western part of Podlasie province (communes with white color on the map).

The next variable which is very differentiated between separated groups of communes is percentage of small (1-5ha) farms (X_2), alike as share of fallows area this variable (X_2) has bigger values for communes which are nearer eastern border of Podlasie province. For first group of communes percentage of small (1-5ha) farms is very high, it is equal to 74%. For communes situated nearer to western border of province percentage of small farms is much smaller. Average value of this variable for communes from fifth group (23%) is three times smaller then for first group of communes. These results indicate that bigger percentage of small communes can be main cause of agricultural area eliminating from production because of low profitability of production. Confirmation of this hypothesis are values of percentage of self-supply farms (X_{10}). Communes from fifth group (situated near the eastern province border) have the biggest percentage of self-supply farms, it is equal to 19% while average for all province communes is equal to 5.6%. The smallest percentage of self-supply farms is for communes near the western border of Podlasie province.

In groups of communes characterized by big percentage of small (1-5ha) farms, share of fallows area and percentage of self-supply farms there is low livestock density (X_8). Livestock density per 100 ha for communes which are in first group (situated in eastern part of Podlasie province) was very low (22.7 per 100 ha) and was nearly four times smaller than average livestock density for fifth group of communes (81.4 per 100 ha) which are situated in the western part of Podlasie province.

The changes in average values in the most of variables strongly correlated with PC1 shows decrescent or growing trends, but communes which are in first group are sometimes exception. For instance percentage of farmers older than 65 years (X_5) is bigger for groups of communes which are nearer to eastern province border, the biggest value of this variable is for second group of communes (39.1%) while for first group the value is smaller (25.5%).

Percentage of farms selling their products for less than 3 000 EURO per year (X_{11}) is not the smallest for communes in first cluster, too. The smallest value of this variable is for communes in second group and average is equal to 57%. Communes in first group have bigger variability of these variables (X_5 and X_{11}); relative values of standard deviations are higher than in other groups.

Small differences between average values for groups of communes were for productivity of agro-ecological environment (X_1) and farm area per one tractor (X_7). These variables have small variability and their correlation with PC1 and PC2 was quite weak; absolute values of correlation coefficients between these variables and PC1 and PC2 are below 0.5.

Interestingly we do not prove big variability of productivity of agro-ecological environment (X_1), which would appear to have strong influence on agricultural productivity. So we can state that soil and weather conditions on the base which is estimated value of productivity of agro-ecological environment (X_1) are not a main cause of variability of rural communes in Podlasie province. Variables which were positively correlated with PC2 i.e. percentage of very fragmented farms (X_3) and percentage of farm managers without agricultural education (X_4) have relatively small influence on total variability of communes.

Differences between the values of these variables for groups of communes were small.

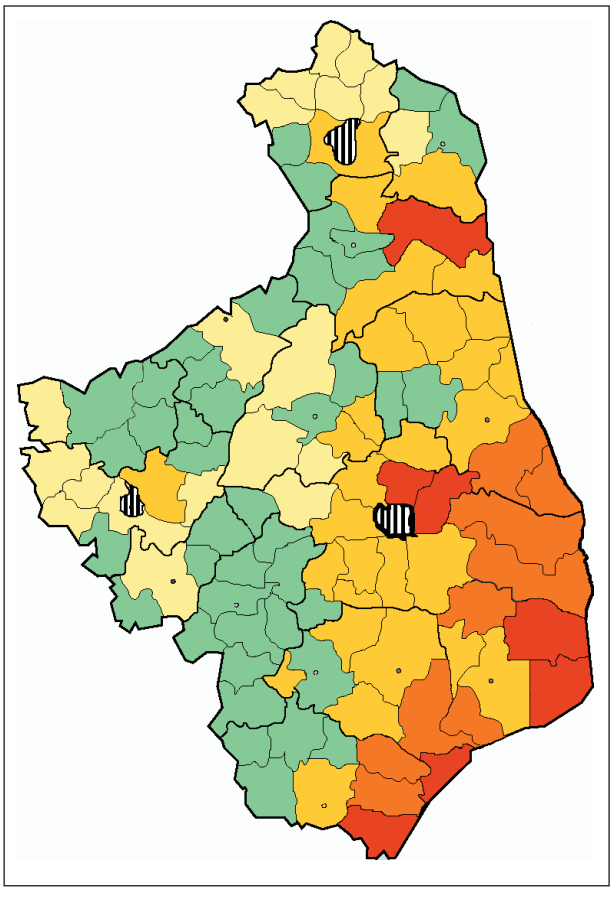

Figure 2. Map of Podlasie province with different groups of rural communes

Three of all communes are not clasified as LFAs (Czyżew, Juchnowiec Kościelny and Szepietowo). These communes were similar to others in their groups, so we can ascertain that LFA classification criteria are not fully proper in polish conditions.

CONCLUSIONS

Among the studied variables these showing farmer skills, land use, farm production intensity, activities of rural local populations and social-economic conditions were the major descriptors for adequate (sufficient) quantitative characterizing and discriminating the communes in Podlasie province, classifying them into clusters and identifying rural areas extremely threatened by poverty incidence. Quality of agro-ecological environment was not an important factor discriminating the rural LFAs. Major causes of occurring LFAs in Podlasie province included mostly historical, traditional and cultural human factors acting for a longer time, natural conditions affected much less efficiency of rural economy and spatial diversity. It is true in case of LFAs in Podlasie province that, less-favoured lands are less favoured either by man than by nature.

It shows strong connections between environmental and socio-economic conditions in LFAs, so careful survey of this region demands multivariable analyses which take into consideration variables characterized conditions the widest possible [1, 10, 20].

Applying various statistical methods allows indicate these characteristics of LFAs, which are very important in planning future activities for support of these areas.

Except of distinguishing these important variables another aim it is to indicate groups of subregions which are similar according many variables [3].

Cluster analysis can be a useful tool indicating the degree of proximity of economic activities in space. Collocation of communes similar according to studied variables in the area of Podlasie province shows distinct connection between geographical location and socio-economical conditions. These conditions are less favourable in communes located nearer the eastern border of Podlasie province and relatively more favoured in western part of this province (with some exceptions). It demonstrates strong spatial connections and shows mutual influence between neighbouring communes. For support of less developed communes it is necessary to create stronger economical connections between these subregions and subregions which are in better socio-economical situation by investing in infrastructure and human capital [9].

Connections or lack of connections between subregions are very important factor which enable LFAs development and can be limiting factor, too [16].

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