Landscape Changes in the Polish Carpathians as a result of agriculture marginalization in the mountains

Introduction

In the second half of the twentieth century on the majority of the Europe area regress started in the rural economy and can be observed till today (MacDonald et al., 2000, p. 47). It considers both the countries of the western and eastern part of the continent. In the seventies and eighties in ten countries of the European Community the arable land area decreased about 6 million hectares, what corresponds to the sixfold farmland area in the Polish Carpathians (Guzik, 1995, p. 239; Bouma et al., 1998, p. 105). In the Middle-East Europe after the rapid increase in the arable land area, which lasted to the forties, the decrease was observed. In Poland at the beginning of the restructuring period this decrease was significant (Bański, 1998, p. 10).

Instead of general tendency of decrease in the arable land area, the changes occurring in the rural landscape of Europe in the last decades have a bipolar character. On the one hand, they consist in rural production concentration in the most productive areas; on the other hand, in the areas marginal for agriculture the process of rural field abandonment takes place (Mander, Jongman, 1998, p. 150; Bouma et al., 1998, p. 113). It is observed mainly in the mountains, for example in the Alps and Carpathians, where as a response to the production intensification tendency the expansion of rural economy was stopped the earliest (Kozak, Troll, 2002, p. 73).

Study area

To the analysis of the directions and degree of rural landscape changes as a result of agriculture marginalization the Polish Carpathians were chosen. The total area is 21,637 km². In the northern part of the Polish Carpathians occurs a belt of highlands, defined as Foothills, which in the south borders to the higher mountainous part called Beskidy Mts. The Foothills belt is much narrower in the western part of the Carpathians than in the eastern part, in contrary to the Beskidy Mts., which in the west consist a zone more stretched to the meridian direction than in the east (Balon et al., 1995, p. 117).

The landscape of Carpathians during the centuries was subjected to numerous changes connected with the rural use in this mountain area. These changes were the result of rural production expansion and intensification periods and periods of agriculture regress and
marginalization. The rural progress in the Carpathians is connected with the settlement beginnings in the twelfth century. The reclaimed areas stretched primarily in the main river’s valleys, than in the Carpathians dales, in the foothills and in the lowest parts of the Beskidy Mts. Together with the population rate and as a result of economical regress of these areas in the times of farm-hand economy additional areas in the higher parts of the Beskidy Mts. with the worst and worst natural conditions were cultivated (Przyboś, 1995, p. 152).

The increase in the arable land area was impeded in the first half of the twentieth century by both world wars. As a result of accompanying destructions, the cultivation on the large area was discontinued. Although the previously arable land were reclaimed again after the Second World War and their area increased temporarily, already in the fifties a new decrease was observed. Even more of the arable land area declined in the sixties and seventies, what was caused by the increase in urban and reforested areas, particularly in the higher parts of the mountains. In the eighties the economical crisis, which caused the urbanization discontinuation, stopped the arable land decrease tendency (Bański, 1997, p. 38). Their area decreased slightly in the second half of eighties, mainly in the favour of pastures as a result of putting the Resolution in the matter of economical and social activation and agriculture development in the mountain areas, commonly called “The mountain resolution”, into effect in 1985 (Zabierowski, Czudec, 1991, p. 69).

The beginning of the restructuring process and introduction of the market economy rules at the beginning of the nineties caused that “The Mountain Resolution” and the subsidizing system of the rural production in the mountains were no longer in force. Further significant decrease in the arable land area was an effect of these changes. Such a direction of changes in the Carpathians landscape was strengthened by the Act of the 8th June 2001 about the reforestation of arable land. This direction depends as well on the aims of the Common Agricultural Policy of the European Union after Poland’s accession.

Materials and methods

To analyze the process of agriculture marginalization in the Polish Carpathians the Main Statistical Office’s statistical data were used. The data concerned the land use in the given communities in years 1985, 1995 and 2000. A digital administration map prepared in the GIS Laboratory of the Jagiellonian University served as an undercoat material. The analysis covered communes of the śląskie, małopolskie and podkarpackie voivodeships, which lie within the borders of the Polish Carpathians. It was decided that the commune location even in the small amount within the borders of this province classifies it as a Carpathian commune. Due to comparison of the data collected in the different periods, in which the area and the name of some communes changed, some units were merged and 215 communes were produced, which are comparable in the matter of possessing data.

It was decided that the measure of the arable land area is the best measure of the effective farmland and that measure was used to analyze the rural landscape changes in the Polish Carpathians, taking as a classification basis the percent of arable land area in the given commune. Furthermore, by the use of surface trend method the arable land use changeability in the horizontal dimension in the Polish Carpathians in the year 1985 and 2000 was described.
Results

During the last 15 years of the past century the arable land area in the Carpathians decreased from 798772 ha in 1985 to 685503 ha in 2000, what gives 113269 ha difference. The decrease took place mainly between 1995 and 2000 (Fig. 1).

In 1985 the mean arable land share in the land use structure in the Carpathians was about 42%. Nevertheless, in the individual Carpathian communes this share was considerably diverse, because its minimum value was 0,5%, however the maximum value reached almost 69%. In most cases, the arable land share in the communes was no smaller than 20% and no bigger than 60%. In more than a half of all the communes arable lands took 40–60% of the given commune’s area. Relatively small proportion of the communes was characterized by the share values, which differed significantly from the mean value for the Carpathians (Fig. 2).

In 2000 the mean arable land share in the Carpathians decreased about 5 percent points and was only 37%. The minimum value of this share did not even reached 0,5%, whereas the maximum value exceeded slightly 65%. There was a decrease in the number of communes in the range 0–20% and 20–40% of arable land share in the land use structure, while the number of communes in the range 40–60% and more than 60% increased (Fig. 2).

In 1985 communes, where more than 40% of the area were under rural use, were located mainly in the northern part of the Carpathians, particularly in the northern-east part, where they consisted a compact and widespread group of communes. In the northern-west part the arable area share in the land use structure was significantly smaller and in many communes did not exceed 40%. The smallest arable land area share (0–20%) was characteristic for the communes in the southern Carpathians. Generally, there are two regularities in the spatial dimension of the arable land share in the land structure in the Carpathians in 1985. This share was higher and higher going from south to north and from west to east (Fig. 3).

Meridian and parallel direction of the spatial dimension is typical for the arable land share in the land use structure in the Carpathians in 2000, as well. The area of the compact

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**Fig. 1.** Changes of the average arable land share in the land use structure in the Polish Carpathians in years 1985, 1995 and 2000

**Fig. 2.** Number of communes in the ranges of arable land shares in the Polish Carpathians in 1985 and 2000
zone with the highest arable land share in the northern-east part of the Carpathians were slightly smaller, because in some most southern communes this share decreased below 40%. Furthermore, the zone of the minimum arable land area (below 20%) shifted more to the north and increased its range by the communes located in the Beskidy Mts. (Fig. 4).

The arable land share in the area of the individual communes in the Carpathians decreased maximum about 26 percent points, whereas the highest noticed increase of this share was about 5 percent points. During the analysis of the spatial dimension of described changes, three areas different in the intensity and range of the arable land changes in the relation to the individual commune area were isolated: the eastern, middle and western part of the Carpathians.

In the eastern part of the Carpathians in the majority of the communes the minimal changes were dominant (–5 to 5 percent points). In the small amount of communes the decrease in the arable land share in the land use change reached 10 percent points. In the middle part of the mountains the process of arable land reduction was slightly more differentiated. In the majority of the communes the arable land share decreased about 5 to 10 percent points. In the remaining communes this change was minimal (–5 to 5 percent points), and in the small amount of communes the decrease reached 20 percent points. The western part of the Carpathians was distinguished by the highest values and the diversity of changes in the arable land area. In some communes the arable land share in the commune area decreased about 20 to 26 percent points. In the considerable part of the administrative units this decrease was from 5 to 15 percent points. The number of communes, in which the changes were very little and even not occurred at all, was significant as well.

The spatial dimension of the arable land share changes in the land use structure in the Carpathians in years 1985–2000, similarly as in the case of the arable land share dimen-

Fig. 3. Share of arable area in the land use structure in the Polish Carpathians in 1985
Ryc. 3. Udział gruntów ornych w strukturze użytkowania ziemi w Karpatach Polskich w roku 1985
In 1985 and in 2000, had meridian and parallel direction as well. The decrease values increased from north to south and from east to west (Fig. 5).

Due to the further analysis of the spatial dimension of the arable land share changes in the Carpathians the surface trend models for the spatial dimensions of that share in 1985

Fig. 4. Share of arable area in the land use structure in the Polish Carpathians in 2000

Ryc. 4. Udział gruntów ornych w strukturze użytkowania ziemi w Karpatach Polskich w roku 2000

Fig. 5. Changes of the arable land share in the land use structure in the Polish Carpathians between 1985 and 2000

Ryc. 5. Zmiany udziału gruntów ornych w strukturze użytkowania ziemi w Karpatach Polskich w latach 1985–2000
and 2000 were constructed. The goodness of fit for the cubic surfaces for the maps with the arable land share in 1985 was 70%, whereas for the map of 2000, 76%. The analysis of these models let to find that in 1985 the agriculture marginal zone, where the arable land share did not exceed 40%, embraced the southern part of the mountain chain, whereas in 2000 its range moved generally to the north, particularly in the northern-west direction (Fig. 6).

Conclusions

The results of the analysis carried out for the Polish Carpathians region, which indicate the arable land area decrease in these mountains in the last 15 years of the past century, prove that these changes are characteristic for the landscape changes in the mountains of Europe in last decades. The causative factor of these changes is the economical state and the national agricultural policy, whose influence in the Carpathians was evident particularly in the second half of nineties. The rapid decrease of arable land area observed in the study area in that time period was a result of agricultural policy liberalization and socio-economic changes comparing the political transformation.

![Fig. 6. Trend surface for arable area shares in the land use structure in 1985 and 2000](image)

Ryc. 6. Powierzchnie trendu dla udziału gruntów ornych w strukturze użytkowania ziemi w roku 1985 i 2000
Spatial dimension diversity of arable land share changes in the western and eastern part of the Carpathians found during the research may be caused by different environmental conditions in both regions. In the western part of the Carpathians Beskidy Mts. zone with the mountain landscape reaches further to the north than in the eastern part of the Carpathians, while in the east the range of the Foothills zone is wider in the southern direction. Environmental conditions in the Beskidy Mts. are generally less suitable for agricultural production than in the Foothills. Nevertheless, during the agriculture expansion in the Carpathians, these areas were cultivated as well, even though the majority of them probably never should be cultivated. It is acceptable that the agriculture in the western part of the Carpathians with regards to many factors (historical, demographical, cultural and economical) to a larger degree than in the eastern part developed on the areas unsuitable for the cultivation. That is why, as a result of political-economical changes, which occurred in Poland in the last 15 years of the past century, the process of arable land abandonment concerned the western part of the Carpathians to a larger degree.

The process of arable land abandonment causes the changes in the mountain landscape. These are changes of different type, largely depended on the time period, in which they are observed. When the cultivation is discontinued, the arable land becomes fallows. A different kind of change consist on the replacement of the arable land for the meadows and pastures, what does not mean the complete land abandonment, but only the change from more to less intense land use. In the longterm prospect the not cultivated arable land are subject to reforestation by the natural succession or artificial forestation. One of the effects of this process may be an increase in the landscape biodiversity (Ihse, 1995, p. 25). As a result of the natural succession on the abandonment fields, the groups of woods separate these fields, what causes the increase in the heterogeneity of the given area. The increase in the landscape heterogeneity is a well-seen phenomenon, but it is only a temporary landscape sate. Areas, on which the natural succession is long lasted, become again less heterogenous after some time, because of the woodland domination (Hunziker, 1995, p. 408).

Present national agricultural policy appoints the scenario of the further arable land abandonment in the Carpathians (Kozak, Troll, 2002, p. 78). The restraint of agriculture marginalization process in the mountains is possible only with the help of subsidies for the agricultural production (Hunziker, 1995, p. 400). The Common Agricultural Policy of the European Union after Poland’s succession may determine the further direction of the changes in the rural landscape of the Carpathians.