

# AGRICULTURE IN MOUNTAIN AREAS OF PODKARPACKIE VOIVODSHIP, POLAND: DEFINITION, CHARACTERISTICS, LIMITATIONS IN AGRICULTURAL PRODUCTION, DEFICITS AND DEVELOPMENT OPPORTUNITIES

Stanisław ZAJĄC<sup>1</sup>, Dariusz KUSZ<sup>2</sup>

<sup>1</sup>Podkarpackie Voivodship Office in Rzeszów, 15 Grunwaldzka St., 35-959 Rzeszów, Poland, Email: zajacstanislaw@op.pl

<sup>2</sup>Rzeszow University of Technology, The Faculty of Management, 12 Powstańców Warszawy Av. 35-959 Rzeszów, Poland, Email: dkusz@prz.edu.pl

**Corresponding author:** zajacstanislaw@op.pl

## Abstract

*Exogenous and endogenous factors influencing the condition of agriculture in mountain areas of Podkarpackie voivodeship were presented. The scope of the research includes the determination of characteristic features, limitations in agricultural production, deficits and development opportunities as well as ways of using/reinforcing existing trends in the agri-food sector in the aspect of mountain farming development in the areas of Podkarpackie voivodeship. Preservation of agricultural production in this valuable natural area is very important due to the numerous social, economic, environmental, but also cultural functions performed by agriculture and farms here. Departure of inhabitants from agriculture may cause irreversible negative phenomena resulting in reduction of landscape attractiveness and consequently tourist attractiveness. Mountain areas have development opportunities which should be utilised by coordinating actions at the regional and macro-regional level.*

**Key words:** mountain areas, foothill areas, less favoured areas (LFA), agriculture, farmstead, agricultural production, Podkarpackie region, Poland

## INTRODUCTION

Agriculture is one of the oldest and basic economic activities of man. Its primary function is to provide the food necessary for life and the development of human civilisation. However, over the last centuries, the economic importance of agriculture has significantly decreased. Although it still retains its key function it is now only one of many links in the economy [5].

However, it should be remembered that despite significant technical and technological progress and gradual elimination of economic differences between countries and regions, agricultural production is subject to many specific local conditions. The basic ones include natural conditions including: soil quality, agroclimate, topographic profile and water availability [3].

A characteristic feature of agricultural production is that natural conditions, factors

independent of the agricultural producer, largely determine the economic efficiency of production and the income earned by agricultural producers [4].

Agricultural production takes place under different natural environmental conditions more or less favourable to production. It is generally recognised that agricultural activity in mountainous areas is subject to various constraints.

Due to the specific climatic conditions of mountainous areas, i.e. the altitude floors, there are significant restrictions in the selection of crop species (and varieties) and their yields. The slope of the terrain also causes many limitations in the application of machine production technologies, especially plant production. The relief of the terrain makes soils susceptible to erosion, which may be reduced by an adequate structure of land use, especially including grasslands and forests. These and other conditions cause the

need for far-reaching adjustment processes, the frequent need to shape the proportions of production factors differently, and also contribute to increasing mechanisation costs, increasing labour intensity and increasing the total cost of agricultural production [6].

Mountainous and foot-hill areas, are territorially interesting subjects of agro-economic analyses, as due to topographical and climatic conditions there are numerous and specific limitations in agricultural production and farm organisation [5].

The deteriorating profitability of production in mountain areas over the last few years makes it necessary to identify the causes of this situation and to develop new regional and national tools to improve the current situation and create better and more effective development opportunities in the future.

The current forms of agricultural production support aimed only at these areas (LFA support, agricultural tax reliefs) seem to be insufficient and do not build competitive advantage, which makes the production potential of these areas unused.

In this context, the aim of the research was to analyse exogenous and endogenous factors influencing the condition of agriculture in mountain areas of the Podkarpackie voivodeship and to identify opportunities for its development. The scope of the research included the determination of characteristics, limitations in agricultural production, deficits and development opportunities, as well as ways of using/reinforcing existing trends in the agri-food sector in the aspect of mountain farming development in the areas of Podkarpackie voivodeship.

## **MATERIALS AND METHODS**

The work is primarily of a theoretical and empirical nature and concerns a review of the literature on the functioning of farms in mountainous areas.

The literature review will allow to determine directions of agriculture development in mountain areas of the Podkarpackie voivodeship. The choice of Podkarpackie voivodeship resulted from the fact of a significant share (as compared to Poland) of

mountain areas in the voivodship area and the specificity of agriculture in Podkarpackie voivodship as compared to Poland (significant agrarian fragmentation).

Expert method was applied to determine the barriers and opportunities for the development of mountain agriculture in the Podkarpackie voivodeship, It is a method which allows to forecast and solve complex tasks scientifically. The essence of this method consists in using data obtained as a result of a scientifically justified procedure of collecting, systematising and analysing information from specialists in a given field (experts) [12, 15].

A team of purposively selected experts was created: representatives of science in the field of agricultural economics, rural development, agricultural production technology, representatives of public administration and local government, and farmers from mountain areas.

The approach proposed by the Delphi method was used. The procedure of this method was as follows:

- (1)The conceptual phase, in which the methodological basis of the research is defined (setting up the research questions, designing the questionnaire).
- (2)Preparation for the Delphi research, which involved the selection of potential experts, compilation of the final list of experts,
- (3)Selection of session administrator.
- (4)Distribution of the first survey.
- (5)Forming initial proposals for solving the problem by presenting the experts' opinions in a questionnaire with reasons and returning the questionnaire.
- (6)Analysis of submitted responses.
- (7)The next round of the survey, in which the collated results are sent to participants along with an anonymous list of comments and justifications.
- (8)Modification of the solution proposal. After reviewing the submitted results, the experts presented their point of view.
- (9)Approximation of positions.
- (10)Final analysis of results.

The paper presents the final results agreed upon by the experts. The analysis was helpful in elaborating assumptions for the strategy of

agricultural and rural development in mountainous areas.

## RESULTS AND DISCUSSIONS

### Definition and criteria for delimitation of mountain areas in the context of agricultural production

Individual EU countries have their own definitions of mountain areas. For the purposes of delimiting LFAs, it has been assumed, in accordance with Regulation (EU) No 1305/2013 of the European Parliament and of the Council [8], that mountain areas are areas where communes and cadastral sections account for more than half of the agricultural land located above 500 m above sea level. Irrespective of the criteria used, mountain areas in the context of agricultural production are areas where agricultural production is hampered due to unfavourable topographical and climatic conditions.

Mountainous areas, i.e. mountainous and foothill areas, in Poland constitute a relatively small and differently delimited area of the country, which consists of two mountain ranges, i.e. the Carpathians and the Sudetes. Moreover, the geologically oldest mountains, the Świętokrzyskie Mountains, are often included in the mountains. Due to the relatively high denivelations, the problem areas, delimited according to topographic criteria, i.e. on the basis of criteria adequate for mountains, may also include the Krakow-Częstochowa Upland, which, however, is not a mountain range, and several geodesic districts of Roztocze [5].

The definition of mountainous areas and the criteria for their designation have changed over recent years. Article 13b of the Act on Agricultural Tax of 15 November 1984 defines that localities situated in mountainous and foothill areas are those where at least 50% of the agricultural land is situated above 350 metres above sea level. A list of such localities in a given voivodship is determined by the voivodship assembly. A measurable benefit for the farmer is a lower agricultural tax. Agricultural tax on land located in foothill and mountain areas is reduced by 30% for land in bonitation classes I, II, IIIa, III and

IIIb and by 60% for land in classes IVa, IV and IVb [1].

According to the Agricultural Tax Act of 15 November 1984, a farmer is entitled to relief on account of the location of land in foothill and mountain areas. According to the Ordinance of the Council of Ministers of 12 September 2012 on soil classification, land classes are determined on the basis of the soil classification determining the quality of soil in terms of its use value.

Due to the structural changes in Polish agriculture in the last decade or so, the current LFA mountain type and LFA specific type (foothill) ranges have been updated in 2019. The revision of the LFA delimitation in the 2014-2020 Rural Development Programme programming period is based on the application of uniform EU-wide biophysical criteria for climate (length of the growing season, temperature during the growing season, lack of water), soil (poor soil permeability, soil grain size and stoniness, root zone depth, poor chemical properties), soil and climate (excessive soil moisture) and terrain profile. The list and description of the biophysical criteria for the designation of LFAs with natural constraints are included in Annex III of EU Regulation 1305/2013 [8].

The Institute of Soil Science and Plant Cultivation – State research institute (IUNG-PIB) and the Ministry of Agriculture and Rural Development (MRiRW) in cooperation with marshal offices (of southern provinces) assessed the consistency of the lists of villages situated in mountainous and foothill areas, the results of spatial analyses (DEM) and the provisions of the MRiRW Regulation on LFA. In the course of these analyses it was assumed that the LFA specific type includes communes and cadastral precincts of the foothill areas:

-where at least 50% of the agricultural area is above 350 m above sea level, i.e. areas which have been designated for the purposes of the Agricultural Tax Act of 15 November 1984, or

-which, according to the numerical terrain model (DEM), meet the condition "at least 50% of the agricultural area is above 350 m above sea level".

In Poland, mountain areas covered by LFA support include communes and cadastral districts in which more than half of the agricultural land is located at an altitude above 500 m above sea level.

Under the new LFA delimitation in force from 2019, the area of mountain areas in Poland eligible for payments amounts to 308.9 thousand hectares of UAA.

Irrespective of the criteria used, mountain areas in the context of agricultural production are areas where agricultural production is hampered by unfavourable topographical conditions (high altitude and steep slopes) and climatic conditions (changeable weather, decreasing temperature with increasing altitude, higher precipitation), as well as a shorter vegetation period (170 - 200 days).



Map 1. LFA areas with specific constraints.

Source: IUNG-PIB [2].

### Characteristics of mountain farming in Podkarpackie Voivodeship

Apart from the tourist and recreational functions and forest management, agriculture plays an important role in the mountain areas of Podkarpackie voivodeship. It provides agricultural products, creates jobs and gives a living to the people who live here. To a large

extent agricultural production here is carried out in a traditional way, and due to the terrain and harsh climate it is difficult and requires increased expenditure. Apart from social farms (oriented mainly on subsistence farming, often their owners are bi-professionals and the agricultural equipment on the farms is so-called "self-made") there

are also market farms equipped with modern agricultural equipment.

In addition to the production of agricultural products, the role of agriculture here is to preserve unique cultural, natural and landscape values. Agriculture in the region is also important for the preservation of biodiversity.

Hidden unemployment, low level of modernity of the applied production technologies, monofunctionality, high share of marginal land in the total area of agricultural land, underdevelopment of infrastructure are recorded in the mountain agriculture of the region. The phenomenon of depopulation is recorded in towns that are not very attractive to tourists. Due to the terrain, there is a phenomenon of erosion in the mountain region. Therefore, in the mountains, anti-erosion tillage and special agricultural machines are used on arable fields [14]. Climatic conditions prevent or limit the cultivation of many crop species. The yields of cultivated plants are low. Farms are small and divided into remote plots. Hence, farmers are looking for alternative or additional sources of income, such as: agrotourism, organic products, beekeeping, trout farming, wickerwork, handicrafts, etc. Significant area of the mountain regions is occupied by permanent grassland and animal production such as rearing of cattle, sheep or goats is connected with it. Damage caused by game and legally protected animals is frequent, hence the need to pay numerous compensations [13]. The above has the effect of discouraging farmers from cultivating crops. A significant part of the mountain region is subject to various forms of nature protection, which in turn limits the possibility of developing intensive agricultural production technologies. Another factor specific to mountain areas is usually the considerable remoteness from markets and supply of means of production.

The state of agriculture in mountain areas is influenced by the general situation of agriculture in Podkarpackie. It should be noted that the volume of agricultural production from 1 ha of agricultural land in Podkarpackie is the lowest among all

voivodeships. The dynamics of agricultural production growth is also important. Analysing its value in the period 2012-2019 it can be noticed that it was one of the lowest. The main driver of this state is the large number of small farms. The small area of farms limits the possibility of achieving economies of scale and largely restricts the development of agriculture to intensive animal husbandry.

One of the reasons for the declining productive role of mountain farming is its low competitiveness, due to the difficult natural conditions. As altitude increases, snow cover lasts longer, the growing season shortens, precipitation is higher and wind speeds are greater. In the mountains there are higher relative humidity indices and greater intensity of solar radiation. The soil cover also shows great variability. As the slope increases, erosion processes (especially water erosion) intensify. The cultivation of many plant species is impossible or risky.

It is more difficult for farmers to adapt to changing market conditions or to modernise their farms. The increased costs of agricultural production in mountain areas at free market prices result in the low profitability of many crops. The remoteness of some areas makes access to markets difficult. Some farmers have abandoned agricultural production and, in addition, a significant proportion of farms have no successors.

Due to soil and climatic constraints in mountain areas, the farms in operation mostly produce cattle, sheep or keep horses. The unit profitability of these lines of production is steadily decreasing. This forces increasing the scale of production or abandoning it. A very important limitation reported by farmers who want to enlarge their farms is actually the lack of possibility to acquire (purchase or long-term lease) agricultural land, despite the fact that the vast majority of landowners do not conduct any agricultural activity. The main reasons for this state of affairs are the social insurance system for farmers and the system of area payments.

Paradoxically, abandoning agricultural production, especially livestock production, and switching to maintaining permanent

grassland for the purpose of obtaining area subsidies, generates more income for the farm than any livestock production. This causes a drastic decrease in the number of animals and consolidation of the unfavourable agrarian structure.

In livestock production, especially sheep production, wolf damage is a major constraint. In fact, the inability to effectively protect flocks from these predators discourages farmers from continuing to keep sheep.

In the Podkarpacie region, there are breeding centres, operating within the Polish system of research and development units, which keep mountain breeds of animals. Thanks to many years of activity and cooperation with farmers, these centres have become authentic, in fact the only, leaders in breeding in Podkarpacie. Unfortunately, deprived of any investment support, including support under RDP, with limited area payments (degressivity), they lose the ability to remain leaders to the detriment of the whole mountain agriculture. This is all the more unfavourable in a situation where universities, agricultural schools, agricultural environment institutions do not have their own farms and cooperate with breeders to a very limited extent.

The lack of systemic support for mountain farming by science and agricultural consultancy should be noted. Scientific research in this area is practically non-existent, and the participation of science in shaping the agricultural policy of mountain areas, which are so different from lowland areas, is marginal.

A new phenomenon is the negative perception of any agricultural activity, especially related to animal husbandry, by people living in the countryside, who more and more often have nothing to do with agriculture. This is connected with migrations and the attractiveness of rural areas as places to settle down for city dwellers.

Agreeing on the characteristics of mountain farming, the following development deficits affecting the development of mountain farming can be distinguished in Podkarpackie voivodeship:

-limited possibilities to change the production profile on the basis of market information, as natural conditions dictate the use of agricultural land, which in turn affects the direction of animal husbandry or the choice of crops,

-ageing of the population with simultaneous migration of young people, lack of successors to farm. The depopulated parts of the mountains are becoming less attractive for tourists. Homesteads are becoming empty, and the meadows and pastures that were tended until recently are rapidly becoming overgrown with bushes, and later forests. The depopulation of mountain areas and the disappearance of agricultural production make it impossible to fulfil the basic functions of mountain areas associated with water management, forestry, tourism and agricultural production,

-a permanent income disparity of mountain farming in comparison with lowland farming, which results in a difficult accumulation of capital in mountain farms and is the cause of increasing developmental disproportions between mountain farming and other areas,

-lack of developed marketing strategies for food products and agricultural raw materials from mountain areas,

-a small number of local processing plants buying up raw materials and agricultural produce produced by agricultural producers,

-lack of efficient food distribution chains that bring together farmers, agri-food processing, trade and catering, allowing quality products to reach discerning consumers,

-underdevelopment of the infrastructure surrounding agriculture (technical infrastructure, agricultural advisory services, economic infrastructure, service infrastructure, etc.) limiting the possibilities for farmers to cooperate and develop their farms,

-a defective area structure of agricultural holdings and an improperly shaped distribution of holdings hindering improvement of farming efficiency,

-unregulated property relations limiting the flow of land from decommissioned farms to potentially developing farms,

-water shortages, lack of water supply, exploited water drainage system.

### **Development opportunities in the context of mountain agriculture in the Podkarpackie Region**

Among the development opportunities for mountain agriculture in the Podkarpackie region were listed:

-growing demand, both at home and abroad, for food products characterised by specific and unique taste and geo-cultural values,

-growing public awareness of the functions of mountain areas and the role of agriculture in fulfilling them. The following closely related and interacting functions of mountain areas can be distinguished:

-the possibility of providing agri-environmental services linked to agricultural production (e.g. protection of the value of the mountain landscape, protection of the natural environment through agri-environmental programmes, water protection),

-the possibility of activating the non-agricultural functions of mountain areas by correctly defining the place and role of agriculture in the possibility of developing other branches of economic activity in mountain areas (water management, forestry, tourism),

-providing support for mountain farming e.g. through a special instrument - a measure within the Common Agricultural Policy aimed directly at comprehensive development of mountain farming. This type of measure should be implemented regionally with the possibility of modification on the voivodship level and selection of the most desirable support areas in the given region. The measure should be implemented by voivodship self-governments in the scheme developed so far under successive RDP perspectives. The voivodship local governments implementing the voivodship development strategies would act as implementing entities which could decide on the implementation of the schemes (under this measure) which are most needed due to the regional conditions. This type of measure would be a centrally managed instrument, implemented regionally,

-productive use of grassland through the rearing of grazing livestock. Financial gratification for 1 ha of grazed grassland or for 1 livestock unit (LU) of grazed animals should be an impulse to undertake such production. An example of such a solution, tested in practice, is the Podkarpacki Naturalny Wypas programme implemented by the Podkarpackie Voivodeship Local Government [10, 11]. This programme - the only one in the country and of great interest - could become a national programme. Its main objective is the conservation, protection and restoration of the biodiversity of the characteristic landscape, as well as the protection of the natural environment based on grazing in a landscape and tourist attractive area. Financial support is aimed, inter alia, at maintaining and initiating the rearing of grassland animals (including Simmental cattle) with a view to producing a high-quality natural regional product, including an organic one,

-creating branded products specific to the Podkarpackie voivodship, such as 'Podkarpacka Wołowina'/ Beef of Podkarpackie Region. The geographical and natural conditions of Podkarpackie are favourable to the use of Simmental cattle for dairy and meat production. High-quality beef may be obtained from natural fattening of Simmental cattle on meadows and pastures rich in health-promoting plants in the Beskid Niski and Bieszczady mountains. Beef production can be based on natural resources, which is important for customers who pay attention to ethical, health and animal welfare aspects. A product obtained in this way is meat with great potential, giving consumers great culinary and taste satisfaction. The needs and directions of development of production of high quality regional beef under the brand "Podkarpacka Wołowina" will be determined by consumers [9].

-rich biodiversity of Carpathian meadows and pastures, which is a source of rich fodder resources and creates a unique mountain landscape attractive for tourists. Numerous plant species, including herbs, can be a raw material base for plants processing and packaging herbs,

-organic farming as a farming system with balanced crop and livestock production, organic production should combine environmentally friendly farming practices, support a high level of biodiversity, exploit natural processes and ensure adequate animal welfare,

-periodic events, agricultural events promoting the region and its mountain agriculture, e.g. Regional Breeding Animals Exhibition organised by Podkarpacki Agriculture Advisory Centre in Boguchwała, Agrobieszczady in Lesko, Horse Fair in Lutowska, Farewell to Summer Holidays in Rudawka Rymanowska including the National Simmental Cattle Exhibition, Regional Hucul Horse Championship and Native Breeds Exhibition, which are visited by tens of thousands of people every year.

#### **Ways to use/reinforce existing trends in the agri-food sector in terms of developing mountain agriculture**

The proposed solutions are:

-changes in the agrarian structure so that the fragmentation and spatial dispersion of land does not lead to its abandonment for agricultural use,

-promotion through coordinated marketing actions of the assets of mountain areas,

-raising awareness of food production and good nutrition through education of children, young people and consumers,

-improving the 'Podkarpackie Natural Grazing' programme implemented by the Podkarpackie Voivodship Self-government, which could become a government programme,

-the creation of a national programme to eradicate Sosnowsky's hogweed in municipal areas,

-development of niche directions in agricultural production and small-scale agri-food processing (fish farming, beekeeping, cheese-making, local food directly from farms, herbalism, rabbits and others) combined with agro-tourism,

-raising consumer awareness of food choices (local, regional, traditional, organic food, often purchased directly from the farmer, not only offers particular health benefits, but also maintains agricultural production),

-the equal distribution of added value along the food chain to prevent the capture of added value by non-agricultural agribusiness links,

-supporting various forms of organisation of agricultural producers, allowing for benefits in both production and trade. This concerns in particular the creation of a professional wholesale market and the promotion of cooperatives and producer groups as well as all activities aimed at the activation and cooperation of agricultural producers,

-supporting farmers' entrepreneurship in the field of processing, trade and catering and the use of the Internet as a tool for distributing agricultural raw materials and food products,

-supporting the marketing and promotion of quality food and the participation of producers in the system of producing high quality, guaranteed food such as: regional, traditional and local products as well as products of organic farming and integrated production,

-development of rural infrastructure that boosts the development of rural areas,

supporting the process of modernisation of agricultural holdings using innovative technical, technological, biological and organisational solutions while respecting the principles of sustainable development of agriculture,

-promoting and developing organic farming,

-development of small and medium-sized entities in the field of agri-food processing aimed at producing high-quality food products with a specific taste.

#### **CONCLUSIONS**

Taking into account the specific character of the Podkarpackie voivodship there is a need to include in both national and local development strategies objectives, measures and development programmes for mountain areas, creating conditions for faster development of those regions on the basis of possessed resources (natural, cultural, social, economic), simultaneously ensuring cohesion in the social, economic and spatial dimension. Alongside the tourism, recreation and forestry functions, mountain areas play an important role in agriculture, providing jobs and livelihoods for the people living here.



Agricultural production here is largely carried out in the traditional way, and due to the terrain and the harsh climate, it is difficult and requires increased expenditure. The role of agriculture, apart from the production of crops, is to preserve the unique cultural, natural and landscape values. Agriculture in the region is also important for the preservation of biodiversity.

The abandonment of agriculture by the inhabitants may cause irreversible negative phenomena (impoverishment of biodiversity, reduction of soil organic matter content) resulting in a decrease in the attractiveness of the landscape (overgrown meadows and pastures, lack of animals, nuisance and invasive plants – Sosnowsky's hogweed etc.) and consequently tourist attractiveness.

Mountain areas have development opportunities that should be used by coordinated action at the macro-regional level. There is currently a lack of action aimed at developing such areas. The need for the development of these areas is evidenced by the growing demand, both in Poland and abroad, for food products characterised by specific, unique taste and geo-cultural values. Efforts should be made to maintain mountain preferences in agricultural policy, and to regionalise the common agricultural policy in order to better adapt support instruments to regional and even local needs.

The development of a special new support system to sustain agricultural land use, adequate to the environmental conditions in areas covered by various forms of nature conservation, including mountainous areas, requires consideration [7].

## REFERENCES

- [1] Act of November 15, 1984 on agricultural tax, Journal Of Laws of 1984, No. 52, item 268. (Ustawa z dnia 15 listopada 1984 r. o podatku rolnym Dz. U. 1984 Nr 52 poz. 268 ( In Polish).
- [2] Institute of Soil Science and Plant Cultivation, National Research Institute, IUNG-PIB.
- [3] Kusz, D., 2012, Exogenous and endogenous conditions of the agricultural modernization process. Annals of Agricultural Economics and Rural Development, vol. 99, issue 2, Polish Academy of Sciences Faculty of Humanities and Social Sciences - Committee for Agricultural Economics and Rural Development, Faculty of Economic Sciences, Warsaw University of Life Sciences - SGGW (Egzogeniczne i endogeniczne uwarunkowania procesu modernizacji rolnictwa. Roczniki Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich, t. 99, z. 2, PAN Wydział Nauk Humanistycznych i Społecznych – Komitet Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich, Wydział Nauk Ekonomicznych SGGW w Warszawie)(In Polish), Vol.99(2), 53-67.
- [4] Kutkowska, B., Berbeka, T., 2014, Supporting agriculture in less-favored areas (LFA) on the example of agriculture in the Sudetes. Scientific Annals of Agricultural Economics and Rural Development (Wspieranie rolnictwa na obszarach o niekorzystnych warunkach gospodarowania (ONW) na przykładzie rolnictwa Sudetów. Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich) (In Polish), Vol.101(2).
- [5] Matyka, M. (red.), 2013, Agriculture in specific areas. GUS. Warsaw (Rolnictwo na obszarach specyficznych. GUS. Warszawa)(In Polish).
- [6] Musiał, W, Sroka, W., 2018, The current state and the possibilities of sustainable development of rural and submontane areas based on agricultural policy instruments in the new financial perspective. Typescript, Ministry of Agriculture and Rural Development (Stan obecny oraz możliwości zrównoważonego rozwoju obszarów wiejskich i podgórskich w oparciu o instrumenty polityki rolnej w nowej perspektywie finansowej. Maszynopis, MRiRW)(In Polish).
- [7] Musiał W., 2018, Natural, economic and social conditions of changes in agriculture in mountainous areas on the example of the Polish Carpathians. Expertise under the project of the Society of Polish Economists and the European Fund for the Development of Polish Villages on the subject of "Problems of Polish agriculture and food economy". (Przyrodnicze, ekonomiczne i społeczne uwarunkowania przemian w rolnictwie obszarów górzystych na przykładzie polskich Karpat. Ekspertyza w ramach projektu Towarzystwa Ekonomistów Polskich i Europejskiego Funduszu Rozwoju Wsi Polskiej na temat „Problemy polskiego rolnictwa i gospodarki żywnościowej”)(In Polish).
- [8] Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD). (Rozporządzenie Parlamentu Europejskiego i Rady (UE) nr 1305/2013 z dnia 17 grudnia 2013 r. w sprawie wsparcia rozwoju obszarów wiejskich przez Europejski Fundusz Rolny na rzecz Rozwoju Obszarów Wiejskich (EFRROW).
- [9] Ruda, M., Kilar, J., Kilar, M., Zając, S., 2016, Subcarpathian beef. Consumers' tastes and preferences. Ed. State Higher Vocational School S. Pigonia in Krosno (Podkarpacka wołowina. Gusty i preferencje konsumentów. Wyd. Państwowa Wyższa Szkoła Zawodowa im. S. Pigonia w Krośnie, (In Polish), 1-112.

[10]Ruda, M., Kilar, J., Rózański, H., 2012, The Nature monitoring report "The program of economic and tourist activation of the Podkarpackie Voivodeship through the promotion of valuable nature and landscape areas of meadows and pastures, preserving biodiversity based on natural grazing" - Rzeszów (Raport Monitoring przyrodniczy „Program aktywizacji gospodarczo-turystycznej województwa podkarpackiego poprzez promocję cennych przyrodniczo i krajobrazowo wskazanych terenów łąkowo-pastwiskowych z zachowaniem bioróżnorodności w oparciu o naturalny wypas” – Rzeszów). (In Polish), 1-80.

[11]Ruda, M., Kilar, J., Zając, S., Kilar, M., Szymbara, M., Lejtnar, A., 2016, The "Podkarpackie Natural Pasture" program as a factor in the protection of biodiversity. 3rd International Conference Herbal Plants, Natural Cosmetics and Functional Food. Food and feed safety. Iloom (Program „Podkarpacki Naturalny Wypas” jako czynnik ochrony bioróżnorodności. III Międzynarodowa konferencja Rośliny zielarskie, kosmetyki naturalne i żywność funkcjonalna. Bezpieczeństwo żywności i pasz. Krosno), (In Polish), 86-88.

[12]Skudlarski, J., 2002, Influence of technical and operational parameters on the work efficiency of farm tractors. Dissertation. Faculty of Production Engineering, SGGW, Warsaw. (Wpływ parametrów techniczno-eksploatacyjnych na efektywność pracy ciągników rolniczych. Rozprawa doktorska. Wydział Inżynierii Produkcji, SGGW, Warszawa).(In Polish).

[13]Statistical Yearbook of Forestry (Rocznik Statystyczny Leśnictwa), 2018, Central Statistical Office. Warsaw (Główny Urząd Statystyczny. Warszawa), (In Polish), 164.

[14]Zając, S., 2009, Mechanization in agriculture in mountainous areas. [In:] M. Ruda, S. Stec (ed.), Plant production. Scientific and Didactic Works of the University of Applied Sciences in Krosno, Z. 33, 143-149. (Mechanizacja w rolnictwie obszarów górzystych. [W:] M. Ruda, S. Stec (red.), Produkcja roślinna. Prace Naukowo-Dydaktyczne PWSZ w Krońcu, Z. 33, 143-149). (In Polish).

[15]Zając, S., 2010, Economic and organizational consequences of failure of agricultural tractors, Doctoral dissertation. Faculty of Economic Sciences, SGGW, Warsaw. (Ekonomiczno-organizacyjne skutki awarii ciągników rolniczych, Rozprawa doktorska. Wydział Nauk Ekonomicznych, SGGW, Warszawa).(In Polish).