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**MAREK ZIELIŃSKI, JOLANTA SOBIERAJEWSKA**

Institute of Agricultural and Food Economics – National Research Institute, Poland

## **THE IMPORTANCE OF AGRICULTURE FROM AREAS WITH ESPECIALLY UNFAVORABLE NATURAL CONDITIONS IN POLAND IN THE CONTEXT OF THE EUROPEAN GREEN DEAL<sup>1</sup>**

Key words: index for the Valorization of the Agricultural Production Area (VAPA), soil quality, commune, farm, economic situation, Polish Farm Accountancy Data Network (FADN)

**ABSTRACT.** The aim of the study is to characterize agriculture in areas (communes) with particularly unfavorable natural conditions for farming, as well as to assess the production potential, organization of production and economic situation of farms from such areas in Poland. The first part of the study describes the characteristics of agriculture in communes with particularly unfavorable natural conditions. For this purpose, data from the Institute of Soil Science and Plant Cultivation in Puławy, on the average value of the index of Valorization of Agricultural Production Area (VAPA) in communes in Poland, was used. Communes with particularly unfavorable natural conditions were those with an average VAPA index below 52 points out of 120 possible points. The organizational and economic assessment of farms according to production types was also carried out: field crops, grazing animals, and farms with mixed plant-animal production in communes with an average VAPA index lower than 52 points against a background of similar farms from other communes that have continuously kept accounting for Polish FADN in 2017-2019. It was found that communes with unfavorable natural conditions, compared to other communes, were distinguished by a smaller average utilized agricultural area (UAA) on farms, a smaller share of arable land and a greater permanent grassland in UAA, as well as e.g., a lower share of wheat and rape in total and higher total rye in the crop structure. They had, however, a greater share of land used ecologically in total UAA. They also had a higher density of livestock per 1 ha of UAA. In turn, farms from these areas – regardless of the analyzed production type, as compared to other farms, were characterized by a smaller UAA, incurred lower labor input per farm, and had a lower capital value. They also had significantly lower land and labor productivity as well as income per 1 FWU.

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## INTRODUCTION

European Union (EU) agriculture is one of the economic sectors facing increasingly ambitious environmental and climate protection challenges. This is reported in the guidelines of the European Commission (EC) included, *inter alia*, in the EU Biodiversity Strategy 2030. Bringing Nature Back into Our Lives (2020), the Farm to Fork Strategy (2020) and the New Climate Adaptation Strategy (2021), currently the three basic elements of the EU's European Green Deal Strategy to 2050 [EC 2019 (COM 2019) 640, EC 2020a (COM 2020) 380, EC 2020b (COM 2020) 381, EC 2021 (COM 2021) 82]. The strategies emphasize the need for taking additional measures to improve the state of the EU's natural resources, including those primarily related to agriculture. In agriculture, the necessity of sustainable management of agricultural soils was emphasized by, *inc.* increasing the content of organic matter in them, which can improve fertility, reducing the phenomenon of erosion, and enabling the accumulation (sequestering) of additional organic carbon. It should be noted that this type of action – primarily – is necessary in areas with low-quality land and low organic matter content, where the effects of soil erosion and organic carbon loss are often very quickly visible.

However, the EU's demands for agricultural activities to improve the condition of agricultural soils by increasing the content of organic matter in them are neither new nor unique. Considerations on the importance of land as a production factor and the impact of its quality and care for it in the context of agricultural utility and environmental protection have long been an important subject of interest in economic and agricultural literature. Albrecht Thaer [1858], Stefan Moszczeński [1920], Harold Hotteling [1931], Michał Oczapowski [1848] and Arkadiusz Musierowicz [1956] wrote about it many years ago. It should be emphasized that the views of the authors are also confirmed in later literature. The opinion of Ryszard Manteuffel [1964] and Augustyn Woś [1993] is part of a similar trend. They emphasized that care for soil fertility is important for increasing the level of farm production – especially on low-quality soils. Whereas Jan Kuś *et al.* [Kuś *et al.* 2008, Kuś 2011] pointed out that the basic measure of the correct management of soils with unfavorable natural conditions is the maintenance of well-balanced organic matter. In this context, an important opinion was also presented by Józef S. Zegar [2012]. He stated that agriculture, while performing an environmental function, also produces effects that should be considered as public goods, since they are used or can be used by everyone. The author distinguishes care for soil fertility, functionality, and biodiversity as well as climate stabilization. The statement is also related to the opinion of Antoni Faber *et al.* [2012], who states that the sequestration of organic carbon in soil is one of the basic undertakings that can halt current climate change.

A noticeable share of area with extremely unfavorable natural conditions for agricultural production, as compared to agriculture in other EU countries, is currently an important weakness of Polish agriculture. In Poland, the average value of the Index of Valorisation of the Agricultural Production Area (VAPA) is 66.6 points out of 120 points achievable [Krasowicz et al. 2011]. It is worth adding that 58.4% of communes in Poland are characterized by an average VAPA index lower than the average for our country, including 32.2% of which are communes with a VAPA index below 52 points. The importance of communes with an average VAPA index below 52 points for domestic agriculture is shown due to the fact that 1.89 million ha of UAA were used in the communes in 2020, including 1.05 million ha of arable land [ARiMR 2021]. It is also worth adding that the areas are generally of high natural value [Jadczyszyn, Zieliński 2020].

Considering the above, the aim of the study was (1) to determine selected features of Polish agriculture in areas (communes) with particularly unfavorable natural conditions for agricultural production and (2) to assess the functioning of farms in the areas, as compared to farms in other areas.

## RESEARCH MATERIAL AND METHODS

To achieve the first goal of the study, data from the Institute of Soil Science and Plant Cultivation – the State Research Institute (IUNG-PIB) in Puławy was used, concerning the average VAPA index value in communes in Poland. It should be emphasized that IUNG-PIB has established this index for each commune and registration area in Poland. In its structure, the VAPA index considers such components as: the soil quality, agroclimate, water conditions and land relief, and the weight of each of them is proportional to its impact on crop yield. Soil quality was assigned a maximum of 95 points, agroclimate – 15 points, while relief and water conditions – 5 points each [Krasowicz et al. 2011]. This means that the VAPA index covers a maximum of 120 points. It should be added that the index is currently used to differentiate compensation payment rates, depending on the degree of natural constraints within separated areas with natural constraints and or other specific constraints (LFA support) under the current CAP [ARiMR 2021].

In this analysis, agriculture in areas with particularly unfavorable natural conditions was considered as communes with an average VAPA index below 52 points, and therefore in areas with extremely unfavorable soil graining, land relief, unfavorable climate, and low nutrient abundance. It is worth adding that they are currently areas classified as areas with natural constraints in zone II, in areas with specific difficulties in zone II or in mountain areas as part of the current delimitation of LFA areas in Poland [ARiMR 2021]. There are also areas that are often endangered, e.g., with wind erosion. In the communes, the average

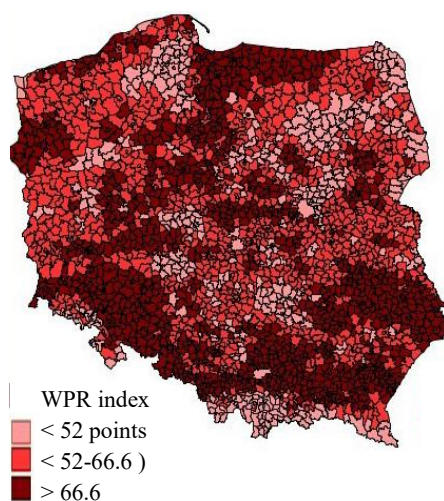


Figure 1. The average VAPA index value by communes in Poland

Source: own study based on data from IUNG-PIB and [Józefaciuk et al. 2018]

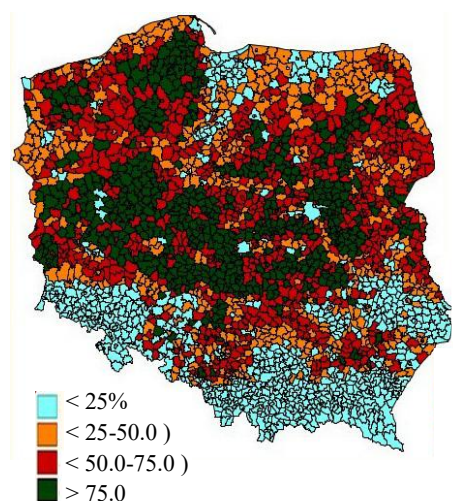


Figure 2. Share of UAA strongly endangered by wind erosion in total UAA in Poland by communes

Source: own study based on data from IUNG-PIB and [Józefaciuk et al. 2018]

share of UAA strongly threatened by wind erosion amounts to 65.7%, while in Poland the average share of these areas amounts to 51.8% [Józefaciuk et al. 2018] (Figures 1 and 2)<sup>2</sup>.

To determine selected features characterizing agriculture in the areas, the most recent data of the Agency for Restructuring and Modernization of Agriculture (ARMA) was used, generated as based on applications from the beneficiaries of the current Common Agricultural Policy for granting direct payments in the 2020 campaign. The data concerned, inter alia, the number of farms and the UAA, including arable land and permanent grassland, as well as the area of selected agricultural crops and ecologically used land by all communes in Poland. It should be added that the data also allowed to determine the average stock density of farm animals, including the stock density of grazing animals per 1 ha of UAA.

To achieve the second goal of the analysis, accounting data from 7,868 farms keeping continuous accounting for Polish FADN in 2017-2019 was used. The analysis covered production-type farms: field crops (type 1), grazing animals (type 5 and 6) and mixed plant

<sup>2</sup> UAA strongly endangered with wind erosion in Poland was established by Anna Józefaciuk et al. [2018]. They concerned agricultural land endangered by wind erosion to be at least at a level of 3 on a 6-point scale.

and animal production (type 8) from communes with an average VAPA index below 52 points, <52-66.6 points) and at least 66.6 points. It should be emphasized that the analysis distinguishes the production types that are currently the most important in the structure of farms in Poland [GUS 2017]. The analysis considered information about their:

- production potential: (1) utilized agricultural area (UAA) expressed in ha, including: own land, land leased for one year or longer, land used on the basis of participation in harvesting with the owner, as well as fallow and set-asides, (2) total labor inputs per farm, including total human labor inputs as part of the operating activity of a farm, specified in the Annual Work Unit (AWU) and (3) the average value of capital in thousand PLN,
- organization of production: (1) the share of arable land in utilized agricultural area (%), (2) livestock density expressed in units per 1 ha of UAA (LU/ha of UAA),
- production intensity, productivity, economic situation, and investment opportunities: (1) total costs including direct costs, general economic costs, and external factors per 1 ha of UAA (PLN thousand/ha of UAA), (2) land productivity (PLN thousand)/ha of UAA) determined as the ratio of the total production value on the farm and the utilized agricultural area, (3) labor productivity (PLN thousand/AWU) determined as the ratio of the total production value and the number of full-time employees, (4) farm income per 1 Family Work Unit (FWU) (PLN thousand/FWU) and (5) net investment rate, defined as the ratio of net investment and the depreciation amount (%).

## CHARACTERISTICS OF AGRICULTURE IN COMMUNES WITH PARTICULARLY UNFAVORABLE NATURAL CONDITIONS IN POLAND

The communes characterized by particularly unfavorable conditions for agricultural production significantly strengthen the production potential of domestic agriculture. According to ARMA data for 2020, 1.89 million ha of UAA, 1.05 million ha of arable land and 0.75 million ha of permanent grassland are currently utilized in the communes, which is respectively 13.3, 10.0 and 28.6% of their total area. There is a significant area of crops with fewer soil requirements in the communes, i.e., buckwheat, spring rye and winter rye, grasses, oats, and cereal mixtures. In the communes, the total cultivation area in the country amounts to 30.2, 21.6, 20.7, 19.8 and 18.7%, respectively (Table 1).

According to the data in Table 2, in communes with an average VAPA index below 52 points, as compared to communes with better natural conditions for agricultural production, the average UAA on farms was smaller. In the communes it was lower by 31.7% (Table 2, Figure 3). It was also lower than the average for Poland, currently amounting to 11.1 ha of UAA in 2020 [GUS 2021]. In the communes there was a smaller share of arable land and a greater share of permanent grassland. Unfavorable natural conditions also



Table 1. UAA, arable land, permanent grassland, and selected crops in communes, as their share in the total area of communes in Poland

Variable	UAA	Arable land	Permanent grassland	Spring and winter rye	Grain mixture	Grasses in field cultivation	Oat	Buckwheat
Area in communes with a VAPA index below 52 points [million ha]	1.895	1.053	0.749	0.155	0.133	0.113	0.080	0.016
Share in the total area of them in the country [%]	13.3	10.0	28.6	21.6	18.7	20.7	19.8	30.3

Source: own study based on [ARiMR 2021]

Table 2. Selected characteristics for communes with a VAPA index below 52 points, as compared to other communes in Poland in 2020

Variables	unit	Communes with a VAPA index below 52 points	Other communes
Average UAA in farms	ha	9.7	14.2
Share of arable land in UAA	%	55.6	76.2
Share of wheat in total arable land	%	3.7	20.8
Share of rape in total arable land	%	1.2	9.4
Total rye share in arable land	%	14.3	5.7
Share of permanent grassland in UAA	%	39.5	15.2
Stock density of animals per 1 ha of UAA	LU/ha	0.58	0.43
Share of ecological UAA in total UAA	%	4.9	3.1

Source: own study based on [ARiMR 2021]

resulted in a lower share of wheat and rape in total, and a greater total rye in the structure of arable land. A higher average stock density of 0.58 LU/ha of UAA (Table 2, Figure 4) was also a characteristic feature of the communes, as compared to other communes. This is understandable, as keeping livestock is one of the important conditions for profitable agricultural production in UAA with difficult natural conditions. It should also be added that in such areas – with light soils and low organic matter content – it is particularly important

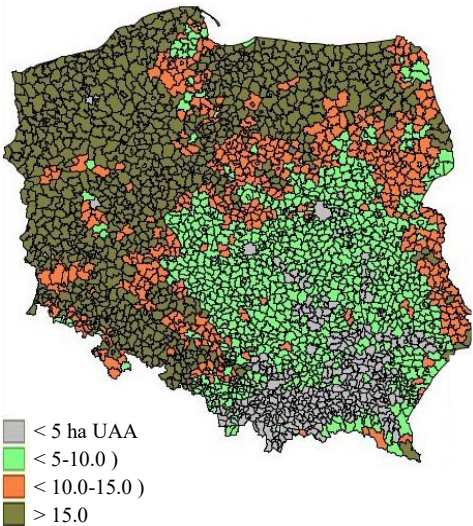


Figure 3. Average area of UAA in communes in Poland in 2020  
Source: own study based on [ARiMR 2021]

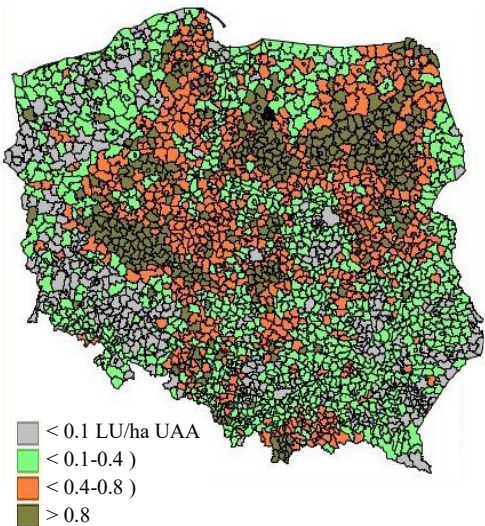


Figure 4. Stock density in LU per 1 ha of UAA in communes in Poland in 2020  
Source: own study based on [ARiMR 2021]

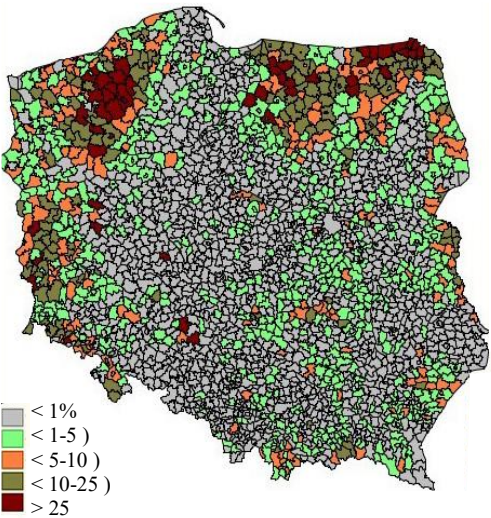


Figure 5. Share of ecological land in total UAA by communes in Poland in 2020  
Source: own study based on [ARiMR 2021]

to use natural fertilizers that increase the amount of organic matter in the soil. The greater share of organic crops in total UAA than in other communes is also an advantage of the communes. In 2020, in the communes, it amounted to 4.9%, while in the remaining communes it amounted to 3.1% (Table 2, Figure 5). It is worth adding that, in the communes, in the overall structure of ecological UAA, permanent grassland (31.8%), cereal mixes (22.4%), spring and winter rye in total (14.7%), oats (6, 5%) red clover (5.9%), buckwheat (5.4%) and narrow-leaved lupine (4.8%) were of greatest significance (Figure 6).



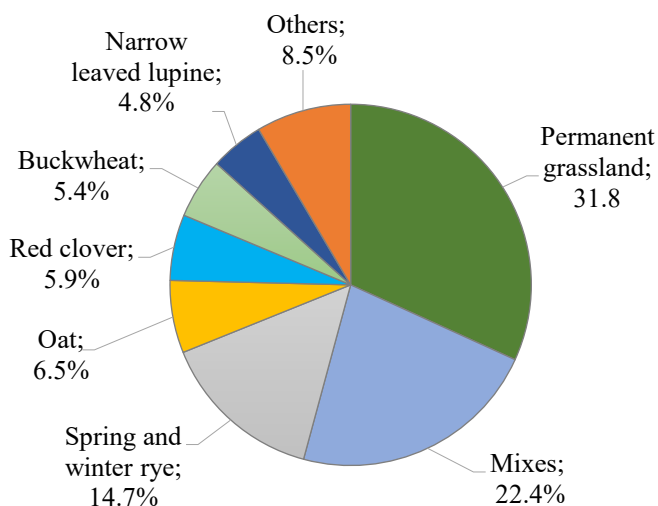


Figure 6. Share of organic crops in total organic UAA by communes with VAPA index below 52 points

Source: own study based on [ARiMR 2021]

#### ASSESSMENT OF THE FUNCTIONING OF FARMS IN AREAS WITH PARTICULARLY UNFAVORABLE FARMING CONDITIONS BASED ON POLISH FADN DATA FOR 2017-2019

An analysis of the numbers in Table 3 shows that the number of farms from communes with an average VAPA index below 52 points, specializing in field crops and mixed plant-animal production, was much lower than in communes with an index totalling at least 52 points. This is probably caused by particularly unfavorable soil conditions, generally limiting the profitability of plant production. In the production type with grazing animals, the number of farms in separate groups was more even. Farms in all analyzed production types from communes with a low VAPA index, as compared to farms from other communes, had a smaller UAA. It was similar in the case of other factors of production, as they had smaller labor resources and average value of capital. Moreover, arable land was less important in the structure of UAA on the farms. However, they were characterized by a higher share of permanent grassland in UAA, as compared to farms from other communes. The other data in Table 3 shows that farms from communes with a VAPA index below 52 points, as compared to farms from other communes, were characterized by a clearly lower productivity of factors of production. This situation was mainly related to a clearly

Table 3. Production potential and economic possibilities of farms from communes with a low VAPA index (below 52 points) and farms from other communes on the basis of Polish FADN (average from 2017-2019)

Variable	Production-type farms:								
	field crops			grazing animals			mixed		
	from communes with an average VAPA index [points]:								
	< 52	52-66.6	≥ 66.6	< 52	52-66.6	≥ 66.6	< 52	52-66.6	≥ 66.6
Number of farms	138	903	1993	734	1,100	672	341	935	1,052
VAPA index	48.2	60.4	80.2	47.5	59.1	74.0	47.1	59.3	76.7
UAA [ha]	34.4	44.3	51.6	29.4	33.5	31.0	25.3	30.4	33.3
Labor inputs [AWU/farm]	1.44	1.66	1.72	1.89	1.90	1.96	1.66	1.72	1.76
Capital value [PLN thousand/farm]	356.6	539.9	680.9	690.8	812.6	869.0	439.3	544.3	645.5
Share of arable area in UAA [%]	86.6	92.1	97.3	54.4	63.0	75.2	80.6	85.8	91.6
Share of permanent grassland in UAA [%]	11.9	6.5	2.5	45.5	37.0	24.8	18.7	3.9	8.4
Total costs [PLN/ha]	2,844	3,429	4,067	5,339	5,937	7,232	4,690	5,185	6,059
Land productivity [PLN/ha]	2,918	3,776	4,955	7,184	8,191	10,218	4,914	5,715	7,232
Labor productivity [PLN/AWU]	69.7	100.8	148.7	111.7	144.4	161.6	74.9	101.0	136.8
Income [PLN/FWU]	38.7	51.5	71.5	55.5	68.9	74.2	27.1	35.0	49.9
Net investment rate [%]	-10.5	-16.6	2.6	19.5	30.4	38.0	0	12.3	12.6

Source: own study based on Polish FADN data for 2017-2019

lower value of production realized on the farms. The economic situation of the researched farms was assessed with the use of farm income per 1 FWU. On farms from communes with a low VAPA index, as compared to other farms, it was clearly lower. As a result, on the farms, their worse economic situation limited their investment possibilities. The net investment rate for farms with field crops was negative, for farms with mixed production it was 0. It was only positive and amounted to 19.5% for farms with grazing animals.

## SUMMARY AND CONCLUSIONS

In 2019, the EU announced the EGD Strategy, a roadmap to transform its economy with a net-zero greenhouse gas emissions goal of 2050 and its economic growth decoupled from the use of natural resources. The postulates contained in the EGD strategy were specified in the “EU strategy for biodiversity 2030. Bringing Nature Back into Our Lives”, “Farm to Fork Strategy” and “A New Strategy for Adaptation to Climate Change”. It should be noted that the EU plans to implement them by strengthening the current contribution to, inter alia, soil protection, among others, by limiting erosion and increasing the content of organic matter, which in turn will lead to an increase in organic carbon sequestration in them. First, it should be noted that remedial actions are particularly urgent in areas with low-quality soils and a low natural content of organic matter. The effects of erosion and the consequent loss of organic carbon are very quickly visible.-

It was found that communes with an average VAPA index below 52 points, as compared to other communes, were distinguished by a smaller average UAA of farms, a smaller share of arable land and a greater permanent grassland in UAA, as well as a smaller share of crops with higher soil requirements, i.e., incl. wheat and rape in the structure of arable land. The strength of the areas, as compared to other areas, was the greater share of ecologically used land in total UAA. They also had a higher density of livestock per 1 ha of UAA, which is beneficial from the point of view of improving soil conditions. Whereas farms from the areas – regardless of the analyzed production type – as compared to other farms, were characterized by a smaller area of UAA, incurred lower labor inputs per farm, and had a clearly lower value of capital. They also had lower land and labor productivity and income per 1 FWU. As a result, being in a worse economic situation, they limited investments. It should be added that on farms with field crops, investments were so small that they did not enable preventing depreciation of their fixed assets.

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## ZNACZENIE ROLNICTWA Z OBSZARÓW O SZCZEGÓLNIE TRUDNYCH WARUNKACH PRZYRODNICZYCH W POLSCE W KONTEKSCIE EUROPEJSKIEGO ZIELONEGO ŁADU

Słowa kluczowe: wskaźnik waloryzacji rolniczej przestrzeni produkcyjnej (WRPP), jakość gleb, gmina, gospodarstwa rolne, sytuacja ekonomiczna, Polski FADN

### ABSTRAKT

Celem opracowania jest charakterystyka rolnictwa z obszarów (gmin) o szczególnie trudnych przyrodniczych warunkach do gospodarowania, a także ocena potencjału produkcyjnego, organizacji produkcji oraz sytuacji ekonomicznej gospodarstw rolnych z tych terenów w Polsce. Do charakterystyki rolnictwa z gmin o szczególnie trudnych warunkach przyrodniczych wykorzystano dane Instytutu Uprawy Nawożenia i Gleboznawstwa – PIB w Puławach, dotyczące przeciętnej wielkości wskaźnika Waloryzacji Rolniczej Przestrzeni Produkcyjnej (WRPP) w gminach w Polsce. Za gminy ze szczególnie trudnymi warunkami przyrodniczymi uznano te o przeciętnym wskaźniku WRPP poniżej 52 pkt na 120 pkt możliwych do osiągnięcia. Dokonano także oceny organizacyjno-ekonomicznej gospodarstw rolnych według typów produkcyjnych: uprawy polowe, zwierzęta żywione paszami objętościowymi i z produkcją mieszaną roślinno-zwierzęcą z gmin o przeciętnym wskaźniku WRPP mniejszym od 52 pkt, na tle analogicznych gospodarstw z pozostałych gmin, które prowadziły nieprzerwanie rachunkowość dla Polskiego FADN w latach 2017-2019. Ustalono, że gminy z trudnymi przyrodniczymi warunkami na tle pozostałych gmin wyróżniały się m.in. mniejszą przeciętną powierzchnią użytków rolnych (UR) w gospodarstwach rolnych, mniejszym udziałem gruntów ornych i większym trwałych użytków zielonych w UR, a także większym udziałem gruntów użytkowanych ekologicznie w UR. Cechowały się również większą obsadą zwierząt gospodarskich w przeliczeniu na 1 ha UR. Gospodarstwa z tych obszarów, bez względu na analizowany typ produkcyjny, na tle pozostałych gospodarstw charakteryzowały się mniejszą powierzchnią UR, ponosiły mniejsze nakłady pracy w przeliczeniu na gospodarstwo, a także miały mniejszą wartość kapitału. Miały również wyraźnie mniejszą produktywność ziemi i pracy oraz dochód w przeliczeniu na 1 FWU.

### AUTHORS

MAREK ZIELIŃSKI, PHD ING.

ORCID:0000-0002-6686-5539

Institute of Agricultural and Food Economics – National Research Institute  
Department of Economics of Agricultural and Horticultural Holdings  
20 Świętokrzyska St., 00-002 Warszawa, Poland  
e-mail: marek.zielinski@ierigz.waw.pl

JOLANTA SOBIERAJEWSKA, MSC

ORCID: 0000-0002-5161-696X

Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej – PIB  
Department of Economics of Agricultural and Horticultural Holdings  
20 Świętokrzyska St., 00-002 Warszawa, Poland