

# Sustainable Development of Agriculture in Poland – Towards Organization and Biodiversity Improvement?

By Wioletta Wrzaszcz<sup>1</sup>, Marek Zieliński<sup>1</sup>

## Abstract

Presently, the sustainable development of agriculture is the priority for nations, organizations and generally for the world. Different aspects are considered in the issue of sustainability of agriculture. In agriculture sustainability evaluation, holistic approach is needed, that determine the selection of different indicators and important farms' group for the assessment. Environmentally sustainable agriculture is the state, that should be characterized by proper farms' organization, as well as biodiversity conservation. Taking into account the need of sustainability, the its evaluation gaining the importance. The aim of the paper is to present the scope of progress in environmental agriculture sustainability in Poland. Using public statistics for 2005, 2007 and 2016 of Statistics Poland and data about areas with high nature value farmlands (HNVfs), the direction in which tends Polish agriculture was indicated, putting particular attention to agriculture production organization and biodiversity protection. There was used a set of indicators that enable to evaluate the analyzed phenomenon, based on uniform, national data and legal documents. Research results indicated that Poland has a great potential of valuable natural farming areas. Environmental development of agriculture is observed.

*Keywords: agriculture sustainability evaluation, farms' sustainability, Statistics Poland data, indicators, biodiversity protection, high nature value farmlands, HNVfs*

## 1. Introduction

The sustainable development issue is based on preservation of the environment and natural resources for the upcoming generations in a state that is not worse than it was for the present generation. This idea implementation needs changes in the consumption designs and in the system of human values to introduce such principles where the impact of human activity on the environment does not exceed its capacity (World Commission on Environment and Development, 1987). This idea considers diverse economy sectors and dimensions. The basic dimensions - environmental, economic, as well as social - are frequently indicated. The application of sustainable development values is predominantly important to agriculture, because management of significant part of nature resources. Agriculture specificity are externalities of conducted production, which are both positive and negative ones, and they are not included in market mechanism (Cooper et al. 2009). In the case of external costs of agricultural production, some of them can result in permanent degradation of valuable natural capitals, including decrease or damage of soil productive potential (Parikh, James 2012).

The policy of EU and nation, varying consumer choices and rising ecological society awareness underlined the need of agricultural activity assessment in the context of

<sup>1</sup>Institute of Agricultural and Food Economics – National Research Institute, 00-002 Warsaw, Świętokrzyska 20, Poland

sustainability (Jonsson 1980). Agricultural practices can be evaluated at different levels of the sector, e.g. regional, farm or even the field. Each level of evaluation is similarly significant and effects created at one level are reflected in another (Loon et al., 2005). The way in which farms are organized mainly defines agricultural sector sustainability. According to the idea of sustainable development, every unit should feel obliged to take care of nature and conduct activity according safe rules for the environment (van Huylenbroeck et al. 2004). Practices are unfortunately different. Externalities of human production usually are not taken into account in the microeconomic approach of farmers. Therefore, this leads to a divergence between goals defined by the economic unit – e.g. farmer and society (Zegar, 2010).

Evaluation of farms' environmental sustainability requires defining and specifying the scope of research, based on the research premises as well as policy needs (formal requirements) (Lankoski, Thiem 2020; Pacini et al. 2015). Organization of agricultural production is particularly important for farm's environmental sustainability. The phenomenon is differently defined and next variously measured by researches. Based on the previous research on farms' environmental sustainability, we can summarize, that the main requirement of sustainable farm is soil potential maintaining (it is elementary basis of agricultural production conducting and important element of the nature), while the leading principle of production is appropriate use of crop rotation and fertilization, properly to the resident conditions of the environment (Wrzaszcz 2018a).

The environmental sustainability of farm is described by activities directed to biodiversity conservation as well. Agricultural practices determine the state of biodiversity (Cooper et al. 2009). It should be emphasized that agriculture is one of the main threats to biodiversity in the EU, in particular as a result of intensification and land abandonment on less favored soils (Henle et al. 2008; EEA 2019). The continuing decline of many natural habitats related to agriculture indicates the need for greater efforts to preserve and enhance biodiversity on these areas. For the protection and enrichment of biodiversity, the role of farms conducting extensive agricultural production surrounded by valuable components of the natural environment is particularly important (Jadczyzyn, Zieliński 2020). Legal rules of the EU underline the importance of agricultural areas for the environment protection. The example of these areas are High Nature Value farmlands (HNVfs), which have particular impact on stopping biodiversity losses in the EU (Strohbach et al.2016). HNVfs are areas where extensive agriculture production is associated with a high share of natural and structural features of landscape, e.g. permanent grasslands, agricultural wastelands, water reservoirs, forests, schrubs, wetlands and the occurrence rare of flora and fauna species in the scale of Europe and the world (Parrachini et al.2008). It should be noted that the HNVfs indicator is expressed as the share of Utilized Agriculture Areas (UAA) with high nature value in total UAA (sector level), that is one of 32 agro-environmental indicators. Those indicators were developed by EUROSTAT. HNVf indicator is one of 45 context indicators to monitor environmental actions effects under the current CAP (2014-2020) (Zomeni et al. 2018; EC 2017a i EC 2017b).

The accession of Poland to the EU in 2004, resulted in preparation of programs supporting

agriculture development<sup>1</sup>. Many instruments were prepared to improve agriculture environmental (and not only environmental) sustainability. New law, adjusted to European circumstances, promoted farms' reorganization towards sustainability, in the form of restrictions, bans, dictates and finally financial stimulus as the remuneration for beneficial practices. All those activities aimed also to the improvement of farmers' economic situation, that determines their competitiveness (Ministry of Agriculture and Rural Development, 2018). In scope of pro-environmental organization of farms, the role of agri-environmental-climatic measures, support to organic production and biodiversity protection in especially valuable areas e.g. HNVfs or included in the international network of Nature 2000 was emphasized.

The next period of the Common Agricultural Policy (CAP) programming is going on. Each Member State is preparing the measures of agriculture development. The new period of agriculture support, 2020+, according to European Commission should be more ambition and effective in the scope of environment protection. The future CAP will play a important role in rising agriculture sustainability, while the environmental measures, climate change action and rural viability improvement will be particularly important to ensure safe and high quality food (EC, 2019). The Strategy of European Green Deal indicates precise purposes that should be mainly achieved in the perspective 2030 per each Member State (EU 2019a). Taking into consideration social needed, growing environmental awareness of society and policy support of agricultural production – past and the planned policy focused on respect to the environment and biodiversity, there is the need of identification and evaluation of the achievements to date, including the effects of farms' sustainability concerning their production organization development and assessment of agricultural areas with high biodiversity protection expressed in the current area of HNVfs in Poland.

To state in which way agriculture aims, the environmental sustainability measurement should be precise. Agriculture sustainability measurement is very composite. Many attempts in this field, using a diversified approaches have not resulted in uniform indicator set to sustainability measurement<sup>2</sup>, including agricultural sector<sup>3</sup>. The problem is connected with different and not comparable data sources, very often not representative and prepared according different assumptions. This question validates a need to familiarize the theoretical deliberations with unified national data to suggest the methodology enabling international comparisons of agriculture, including different dimensions of agriculture sustainability.

The aim is to present the range of progress in environmental agriculture sustainability, which an important effect is the state of HNVfs in Poland. Using public statistics of Statistics Poland and data about domestic areas with high nature value, the course in which

---

<sup>1</sup> Rural Development Plan 2004-2006, Rural Development Programme 2007-2013 and Rural Development Programme 2014-2020 (Ministry of Agriculture and Rural Development, 2019).

<sup>2</sup> See e.g. (van Huylenbroeck, Durand (eds.), 2003; The Royal Society, 2009, van Loon et al. 2005; Toczyński et al., 2009; Wrzaszcz, 2014). The general indicators of sustainable development measurement are useful in agricultural sector evaluation in this scope, but the methodology requires adaptation to specificity of the analysed sector (e.g. OECD, 1999; CEC, 2000; EC, 2008).

<sup>3</sup> The sustainability of agriculture is described by the farms, sustainability, although the latter does not exhaust the first.

agriculture tends was designated, putting attention to agriculture production organization and biodiversity protection.

## 2. Research Method

In the research there were used statistical, public data of Statistics Poland accumulated after Farm Structure Survey. The Farm Structure survey was organized in 2005, 2007 and next in 2016. During the indicated statistical research, uniform methodology was used. It is particularly important issues, because the uniform methodology enable to conduct comparable analyzes in the longer period. In the case of sustainability evaluation, the direction of environmental development of agricultural production were indicated. The research covered the population of active individual farms with 1 ha or more of agricultural land maintained in GAEC rules, e.g. good agricultural and environmental condition<sup>4</sup>.

FSS research are carried out in each EU countries. The statistic results are aggregated in EUROSTAT data sources. The presented approach to FSS data use in evaluation of farms' environmental sustainability can be repeated in EU countries to comparable analysis preparation<sup>5</sup>. The used data bases allow to analyzed the whole sector<sup>6</sup>. The used data allowed for calculation the main important indicators informing about agriculture sustainability on the basis of agricultural holdings' population. Environmental sustainability of farms was measured using indicators corresponding with environmental production organization and biodiversity protection. The data scope, besides many positives, does not consume the scientific considerations. The average values of indicators for the agricultural sector were presented and farms' layout in this scope. The indicators used in the research<sup>7</sup>:

- Crops that deplete and reproduce soil in crop structure (% of arable land), putting attention to cereals and legumes crops – informs about crop rotation correctness and agronomic diversity.
- Winter vegetation cover (% of arable land) is the indicator of land protection assessment in winter period.
- Livestock density on agricultural land (Livestock Units/ha)<sup>8</sup> – informs about livestock intensity; indicates environmental pressure derived from natural fertilization.
- Soil organic matter (t/ha of arable lane) – the balance, the is the effect of crop diversity and fertilization. Possessive values informs about regular improvement of the soil in humus.

---

<sup>4</sup> Farms with legal personality were eliminated from the research. More than 4 thousand farms in Poland owned to legal persons in 2016. Those farms cultivated 1,249 thousand ha, e.g. almost 9% of all agricultural land). Legal farms produced 2,314 million EUR of standard output, e.g. almost 10% of total value of the sector.

<sup>5</sup> Economic sustainability of Polish agriculture was the subject of research (see: Wrzaszcz, 2018).

<sup>6</sup> In 2020 the Agricultural Census was conducted, but the first data will be available at the end of the 2021.

<sup>7</sup> Detailed description and significance description in the context of environmental sustainability was presented in: e.g. (Toczyński et al., 2013; Harasim, 2014; Wrzaszcz, 2014; Wrzaszcz 2018a).

<sup>8</sup> 1 LU is a conventional unit of farm animals with a mass of 500 kg. Tables with coefficients are presented in: (Toczyński et al., 2013).

- Macroelement balance (NPK kg/ha) - precise information on the intensity of agricultural production and potential threats to the environment.
- The specialized and mixed farms structure (applied the General Types of Farming, GTF classification, based on standard output (EUR thousand)<sup>9</sup>, that reflects farm's production and specialization orientation.

In this paper, the current state of HNVfs in Poland was indicated to determine the effects of changes taking place in agriculture in the context of sustainability. The concept of establishing HNVfs in the EU as an element of biodiversity and environmental protection on rural areas has been developed since the 90s of the last century (Andersen et al. 2003; Baldock et al. 1993; Paraccini et al.2008). The current HNVfs in Poland were designated in accordance to the EU guidelines contained in the document entitled: Working document. Practices to identify, monitor and assess HNV farming in Rural Development Plan 2014-2020 were the result of this concept (EC 2017a). According to the EU guidelines, a key feature of agriculture under HNVfs in Poland is extensive agriculture production, that is defined by low livestock density, the presence of permanent grasslands and a low share of cereals in arable lands. Moreover, characteristic feature of HNVfs is high variety of land cover, including the presence of agricultural wastelands, water reservoirs, shrubs, wetlands and forests which are often ecological corridors for wild animals (Paraccini et al.2008). In Poland, when designating these areas, the national natural conditions in rural areas were also taken into account (Fig.1).

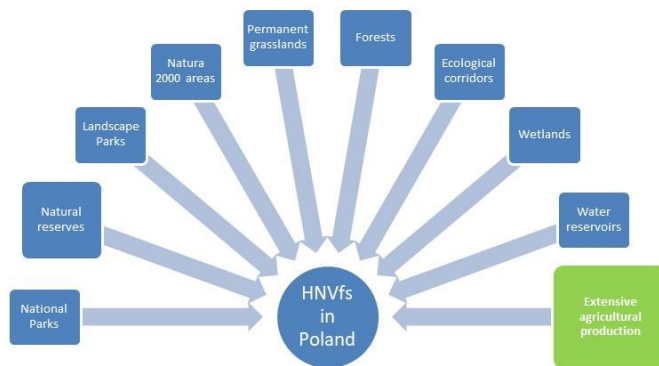


Fig. 1. Components of HNVfs in Poland

Source: own study based on (Jadczyński, Zieliński 2020)

In the first step, in order to designate HNVfs in Poland, the areas of Poland with extensive agricultural production were delimited at the level of gmina<sup>10</sup>. In the second step, on the basis of findings of national agri-environmental experts appointed by the Ministry of Agriculture and Rural Development, the environmental components were indicated (Fig.

<sup>9</sup> Total standard production of farms is the sum of the values obtained for each agricultural activity on the farm by multiplying the coefficients of the standard output for a given activity and the number of hectares or number of animals; see (Goraj et al., 2012). Standard output is the mean of 5 years of production value that correspond with the region average situation.

<sup>10</sup> In Poland there are currently 2477 gminas (The Statistics Poland 2021).

1). Experts' weights - from 3 to 10 points - were assigned to each environmental component, that corresponded to their status and function in keeping biodiversity in rural spaces (Matyka et al. 2019; Jadczyzsyn, Zieliński 2020; Zieliński, Sobierajewska 2020). Then, in the third step, HNVfs were designated on the basis of areas indicated in the first and second step.

In Poland, three zones of HNVfs have been designated depending on the value of the environmental components located in the vicinity of extensive agriculture production. The analysis covered zones of HNVfs with the weight of the natural components in the range of 3-10; 3.5-10 and 4-10 points, named as HNVfs with moderate, high and exceptionally high nature value (Jadczyzsyn; Zieliński 2020) (figure 2).

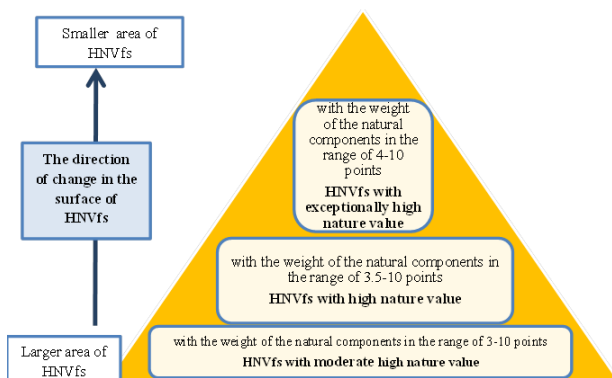


Fig. 2. Diagram of HNVfs zones in Poland depending on the value of the environmental components located in the vicinity of extensive agriculture production

Source: own study based on (Matyka et al. 2019; Jadczyzsyn, Zieliński 2020; Zieliński, Sobierajewska 2020)

It should be added that in Poland, the methodological approach of designating HNVfs is close to approach used in Germany. In Germany, these areas are also divided into three zones with (1) exceptionally high natural value, (2) very high natural value, and (3) moderate natural value (Hünig, Benzler 2017; Benzler 2017).

In this paper, selected features of agriculture, including farms, were analyzed in areas (gminas) with high share (over 75%) of moderate, high and exceptionally high natural value of HNVfs in their total UAA, in comparison to gminas without these areas in Poland. For this purpose, data for 2017 and 2019 was used. There was used agricultural database of the Agency for Restructuring and Modernization of Agriculture (ARMA), which includes statistics for farms taking part in measures defined by the CAP 2014-2020. Besides, there was used data of the Institute of Soil Science and Plant Cultivation – State Research Institute in Pulawy (Poland) for 2017, concerning environmental aspect of agricultural production.

### 3. Research Results

#### 3.1 Environmental farms' sustainability - organizational aspect

Organization of crop and livestock production determine farms' environmental effects. The significance of organization of agricultural production is connected with the

soil management, as well as water and air pressure. The direct relation between agriculture and the state of environmental components is in principle the result of crop structure, livestock heads and density, fertilizers management, including the source (organic, natural or mineral) of selected macroelements. The main macroelements, that determine the agriculture productivity are: nitrogen, phosphorus and potassium (abbreviation: NPK). All those elements of farms' production organization corresponds with farms' specialization profile.

Sowings area in total, that was presented on the Fig. 3., was comparable in 2005 and 2016 – about 9,600 thousand ha was used in crop production. Taking into consideration crop influence on the soil organic matter, the most desirable are soil improving crops cultivated as the main crop (e.g. pulses for grain: edible and fodder, pulses mixes, fodder crops – papilionaceous, pulses, grasses, mixes, other), as well as catch crops (winter and spring ones). In the case of the first one crop group, the significant increase in the total surface of sowings was observed, above 50% during the period 2005-2016, but still it is the niche crop group in the sowing structure (c.a. 9% in 2016). Similar tendencies are observed in the case of catch crops, that surface was almost fourfold increased, but still the crops cover only 12% of sowing area of arable land. In the group of crops degrading the soil matter are included: root crops, vegetables, cereals, industrial crops. Cereals are the dominant crop group (78% in sowings), with the starting tendency to decrease. It is worth to add, that about the half of the surface of cereals and industrial crops are winter varieties, that provide winter cover and protection against e.g. erosion.

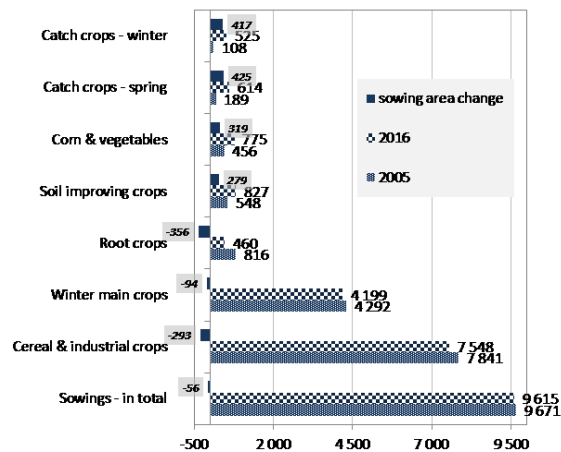


Fig. 3. Crop sowings (in thousands of ha) according to the soil organic matter impact  
Source: own calculations based on Statistics Poland 2005 and 2016 of FSS research.

Next to crop production, livestock production direction determines relations between agriculture and environment. Taking into account the considered years, there was observed a reduction in animal population by 8%. Livestock population decreased from 6.4 to 5.9 million LU. At the same time, many farms removed animal production. About 43% of agricultural holdings withdrew from livestock activity. The observed tendencies can result in environmental components state because of natural fertilization reduction and the advanced dependency on chemical and mineral means of production, that determine



agriculture productivity. Presently the half of farms in Poland is focused only on crop production, that informs about the scale of described problem.

The dominant livestock activity is cattle rearing (with small increase in heads – 4%). On the second place in livestock population are pigs, but in this sector significant decrease took place in the period 2005-2016 (reduction of population about 46% of LU). Poultry, although is the third livestock sector, dynamically grows, that is the effect of industrial farms development (33% increase of poultry population, Fig. 4). Other sectors, such as goats, sheep and horses practically become extinct, although their environmental and landscape values. Selected indicators of environmental sustainability of agricultural sector and farms inform about the progress in the scope of soil protected based on the improvement of the average values of such indicator as: winter vegetation cover, crop diversity that is correlated with cereals decrease, balance of the soil organic matter (Wrzaszcz 2018a). The problematic issue is decreasing livestock density and very low values of P and K balances, that indicate the soil depletion in accumulated macroelements (Table 3). The main reason of such results is natural fertilization decrease. The other question is farms structure according to the fulfilment the recommended levels of analyzed indicators. The positive observation is that more farms is characterized by crop diversity and above zero soil organic matter balance. On the other hand, in the analyzed period was observed decreasing population of farms with proper winter vegetation cover and optimal NPK balances, that are still the challenge for the farms.

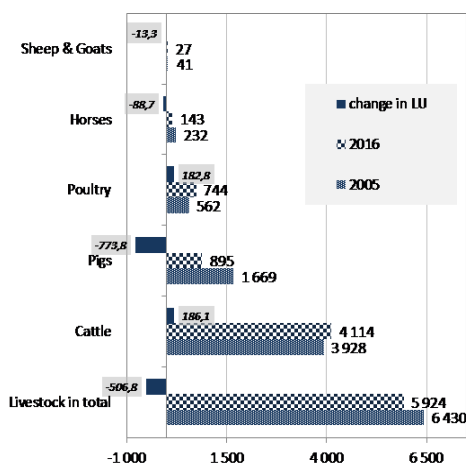


Fig. 4. Livestock population (in thousands of Livestock Units, LU)

Source: own calculations based on Statistics Poland 2005 and 2016 of FSS research.

Tab. 3. Environmental indicators of agricultural production – the average values for agricultural sector and percentage of farms with recommended values of indicators<sup>1</sup>

No.	Indicator	Average values of indicators		Change in average indicator value (%)	Sustainable farms percentage <sup>2</sup>	
		2005/2007 <sup>3</sup>	2016		2005	2016
1	Winter vegetation cover (%)	49.00	53.00	8.16	65.25	61.08
2	Cereals in crop structure (%)	76.95	70.44	-8.47	27.67	29.92
3	Livestock density (LU/ha)	0.49	0.45	-8.72	98.72	97.76
4	Balance of organic matter (tone/ha)	0.09	0.23	155.56	55.08	71.76



No.	Indicator	Average values of indicators		Change in average indicator value (%)	Sustainable farms percentage <sup>2</sup>	
		2005/2007 <sup>3</sup>	2016		2005	2016
5	Nitrogen (N) balance (kg/ha) <sup>3</sup>	43.78	32.97	-24.69	8.52	5.46
6	Phosphorus (P) balance (kg/ha) <sup>3</sup>	5.73	-0.38	-106.63	9.66	7.14
7	Potassium (K) balance (kg/ha) <sup>3</sup>	8.24	-0.45	-105.46	3.73	2.45

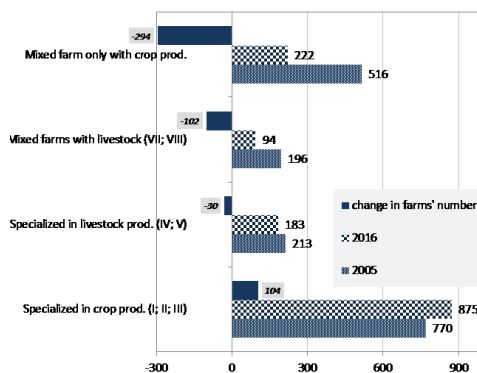
<sup>1</sup> Recommended values for indicator 1:  $\geq 33\%$  of arable land; 2:  $\leq 66\%$ , 3:  $\leq 2$ LU/ha agricultural land; 4:  $\geq 0$  t/ha of arable land; 5,6,7. Diversified in regional dimension (kg/ha).

<sup>2</sup> 100% - all farms with field crops (concerned indicator no 1, 2, 4), with agricultural land (3, 5, 6, 7).

<sup>3</sup> Nutrient management was included in the FSS research in 2007 and 2016.

Source: own calculations based on Statistics Poland 2005, 2007<sup>3</sup> and 2016 of FSS research; Wrzaszcz 2018a.

Organization of farms determines their typology, that is the effect of structure and the level of agricultural standard output possible to obtain from all conducted activities (Bocian, Cholewa, Tarasiuk 2013). The Fig. 5 indicates the specialization of Polish farm in crop production. This type of farms is more and more popular (in 2016 – 64% all farms were specialized in crop production). Narrow specialization in production of crops needs substantial activities to ensure the designated environmental sustainability. The examples of such practices are as following: organic fertilizer use such as cereal straw; as well as cultivation of crops that improve organic matter). At the same time, mixed farms, especially with livestock production, as well as specialized in livestock production are not numerous groups, additionally reduced over the analyzed period (in 2016 – appropriately 20% and 14% of total farms were qualified to those farming types). In the case of mixed farms with crop production, the number decreases, that informs about the process of farms' specialization, which indicates agricultural production simplification at the farm level. The consequences of such processes can be observed in fertilizers economy, that goes towards mineral fertilizers market because of limitation of natural fertilization of livestock origin.



\* EU farms typology; specialized in: I. field crops, II. horticulture, III. permanent crops, IV. rearing grazing livestock, V. rearing granivores, non-specialized with mixed: VI. crops, VII. livestock, VIII. crops and livestock.

Fig. 5. Farms' typology\* – specialization scope and direction (number of farms in thousands)

Source: own calculations based on Statistics Poland 2005 and 2016 of FSS research.

### 3.2 Biodiversity protection as a determinant of agriculture sustainability

According to current findings of the European Commission, the EU will continue to strengthen future contribution of agriculture to landscape and biodiversity protection. In the first place, it is announced by “A farm to fork strategy for a fair, healthy and environmentally – friendly food system” and „EU Biodiversity Strategy for 2030”, which are the part of the European Green Deal strategy (EC 2020a; EC 2020b). In this context, the role of the EU agriculture in protecting landscape and biodiversity of rural areas with particularly high natural value (HNVfs) becomes especially important. Poland currently has a significant potential of HNVfs. Depending on the value of the environmental components located in vicinity of areas with extensive agriculture production, the area of all HNVfs ranges from 1.9 to 4.1 million ha of UAA and contains from 12.5 to 27.1% of UAA in Poland (table 4).

**Table 4. Area and share of HNVfs in total UAA in Poland**

HNVfs in Poland with natural value:	HNVfs in millions ha	share of HNVfs in total area of UAA
moderate	4.1	27.1
high	2.4	16.0
exceptionally high	1.9	12.5

*Source: own study based on (Jadczyszyn, Zieliński 2020) and (Matyka et al. 2019).*

From the Polish agriculture sustainability point of view, establishing selected features of gminas with high share and degree of value of HNVfs is extremely important. Taking into account above, selected characteristics of gminas with share over 75% of HNVfs in UAA were presented, in the division of three separate zones, due to different degree of their environmental value. Those data were analyzed in comparison to characteristics of gminas without HNVfs (table 5).

In gminas with high share of HNVfs, with increase of their value, the average area of farms' UAA increase. It should be added, that in the case of gminas with a high and exceptionally high nature value, average area of farms' UAA is higher than in gminas without HNVfs, while the Index of Valorization of Agricultural Production Space is lower<sup>11</sup>.

In gminas with a high share of HNVfs, compared to gminas without such areas, there is a much greater share of three basic components of the natural environment: permanent grasslands, forests and water reservoirs. In gminas with high share of exceptionally high nature value, share of forests and water reservoirs in total area is the highest. Different situation is in permanent grasslands – their share in UAA is the highest in gminas with high share of high nature value, then in gminas with high share of exceptionally high nature value, and the lowest in gminas with high share of moderate nature value of HNVfs. However, it should be emphasized that permanent grasslands – next to forests and waters reservoirs – also fulfill many valuable natural functions. They are a habitat for a variety of flora and numerous bird species, play an important role in protecting against erosion and retain water in the soil profile, and they also reduce greenhouse gas emissions from

<sup>11</sup> The Index of Valorization of Agricultural Production Space is a domestic index that is used to measure environmental conditions of agricultural areas in Poland (Jadczyszyn et al. 2013).

agriculture through carbon sequestration in the soil.

In addition to presence of value components of the natural environment, an important criterion of delimitation of HNVfs in Poland - in accordance to the EU guidelines – is presence of extensive agriculture production, which an important element is low stocking density per 1 ha of UAA. It turned out that in gminas with increase value of HNVfs, stocking density decrease from 0.45 to 0.34 LU/ha of UAA. Stocking density in gminas without HNVfs is higher and amount to 0.48 LU/ha of UAA (table 5).

**Table 5. Selected characteristics of gminas depending on natural value of HNVfs zones in Poland for 2017 and 2019 year**

	Gminas Without HNVfs	Gminas with HNVfs over 75% in UAA:		
		Moderate Nature value	High Nature value	Exceptionally high nature value
Index of Valorisation of Agricultural Production Space (points) <sup>1</sup>	69.9	57.1	56.6	56.3
Average UAA per farm (ha) <sup>2</sup>	11.6	9.5	12.1	12.3
Permanent grasslands in potential UAA (%) <sup>3</sup>	15.5	33.9	37.3	34.8
Forests in total area (%) <sup>4</sup>	17.5	42.2	50.7	52.3
Water reservoirs in total area (%) <sup>5</sup>	1.6	2.9	4.6	4.9
Stocking density (LU/1 ha of UAA) <sup>6</sup>	0.48	0.45	0.37	0.34

*Source* <sup>1); 3); 4); 5)</sup> data for 2017 from *The Institute of Soil Science and Plant Cultivation – State Research Institute in Pulawy (Poland)*; <sup>2)</sup> data for 2017 from *ARMA*; <sup>5)</sup> data for 2019 from *ARMA*.

#### 4. Conclusions

Agriculture environmental sustainability is very important and current problem. It can be evaluated in different ways, that are strongly connected with the purpose of such evaluation and data access. Taking into consideration data quality, it is particularly important to propose such sectoral evaluation that are based on national statistics, representative for the whole sector and the methodology can be adjusted to the specificity of different countries. In this paper, there was focus on organizational aspect of agricultural production and legal protection of environmentally valuable areas.

The article presented the scope of progress in environmental agriculture sustainability in Poland. Using public statistics for 2005, 2007 and 2016 of Statistics Poland and data about HNVfs, the direction in which tends Polish agriculture was indicated, putting particular attention to agriculture production organization and biodiversity protection. In order to analyze selected characteristics of areas (gminas) with HNVfs, data of the Agency for Restructuring and Modernization of Agriculture (for 2017 and 2019) and the Institute of Soil Science and Plant Cultivation – State Research Institute in Pulawy (for 2017) was used. There was used a set of indicators that enable to evaluate the analyzed phenomenon, based on uniform, national data and legal documents. The main conclusions are as follow:

- Presented changes in the crop structure are moving towards greater protection of soil on the level of farms. Taking into consideration the dominating cereals in sowings on arable land, additional practices, such as catch crops increase and organic fertilization (straw,

green manure), are recommended.

- During the analyzed period, there was observed decreasing trend in the number of livestock agricultural holdings and livestock population (particularly pigs, goats and sheep) which proved getting weaker relation of crop and animal production in farms, then reduced natural fertilizers delivered to the soil. Such processes will strengthen the need of mineral fertilization and potentially generate environmental threats.
- Environmental sustainability of the farm is described by proportions and relations of crop and animal production. Farm environmental sustainability in Poland partly improved, which essentially resulted from the improvement of organic matter in the soil and structure of the crops. Taking into account environmental sustainability, there is problematic inadequate diversification of crops and decrease in livestock production. Those elements of agricultural production are translated into improper macroelement balance in the soil.
- The presented statistics proved simplification of production at the farm level, in other words, narrowing types of agricultural activities. The problematic issue is farms' withdrawal from livestock production, that is observed in dynamic increase of non-livestock farms' number. This processes potentially bring environmental costs. Due to the high share of farms specialized in field crops in the Polish agriculture, their organization and applied agricultural practices will mainly contribute to the environmental sustainability of the agricultural sector.
- From the point of view of the sustainability of Polish agriculture, his contribution to the protection of biodiversity is especially important. Therefore, it is important to indicate share of areas with agriculture that complies with the EU HNVfs requirements. According to the EU guidelines, an important feature of HNVfs is extensive agricultural production and presence of natural and structural elements in the landscape.
- In Poland, share of HNVfs in UAA is even 27,1%, of which 12,5% are agricultural areas with particularly high nature value. It should be emphasized, that gminas with high saturation of HNVfs are characterized by a large share of i.a. permanent grasslands in UAA and forest and water reservoirs in total area. These are also areas where is extensive agricultural production, which is mainly characterized by a small stocking density per 1 ha of UAA.

Summing up, research results indicated that Poland has a great potential of valuable natural farming areas. Environmental development of agriculture is observed, but still there are observed problematic aspects of production organization that create the potential threat to the environment.

## References

- Andersen, E.; Baldock, D.; Bennett, H.; Beaufoy, G.; Bignal, E.; Brouwer, F.; Elbersen, B.; Eiden, G.; Godeschalk, F.; Jones, G.; McCracken, D.; Nieuwenhuizen, W., van Eupen, M., Hennekens, S. and Zervas, G. (2003). *Developing a High Nature Value Farming area indicator*. Internal report for the European Environment Agency. IEEP, 2007.
- Baldock, D., Beaufoy, G., Bennett, G., Clark, J.(1993). *Nature conservation and new directions in the Common Agricultural Policy*. IEEP, London.
- Benzler A.(2017). *Drawing on national experience for identifying HNV farmland at European scale: HNV farmland monitoring in Germany*, Vienna, 12th June 2017, Expert workshop "Revising the JRC/EEA EU-level HNV Farmland methodology.

- Bocian, M., Cholewa, I., Tarasiuk, R. (2017). *Współczynniki Standardowej Produkcji "2013" dla celów Wspólnotowej Typologii Gospodarstw Rolnych*. IERiGŻ-PIB, Warszawa.
- Commission of the European Communities (CEC). (2000). Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy. *Communications from the Commission to the Council and the European Parliament*. COM(2000). Brussels.
- Cooper, T., Hart, K. Baldock, D. (2009) *The Provision of Public Goods Through Agriculture in the European Union, Report Prepared for DG Agriculture and Rural Development*. Contract No 30-CE-0233091/00-28, IEEP, London.
- European Commission (EC). (2008). *Streamlining of environmental indicators, project summary*. Task force on the ESEA meeting of 9-10 April 2008, Eurostat.
- European Commission (EC) (2017a). *Working document. Practices to identify, monitor and assess HNV farming in RDPs 2014-2020*. EC 2017.
- European Commission (EC) (2017b). *Technical handbook on the monitoring and evaluation framework of the Common Agricultural Policy 2014-2020*, EC 2017.
- European Commission (EC) (2019). *The environmental objectives of the future CAP*, [https://ec.europa.eu/info/news/environmental-care-and-climate-change-objectives-future-cap-2019-jan-25\\_en](https://ec.europa.eu/info/news/environmental-care-and-climate-change-objectives-future-cap-2019-jan-25_en), access on: 10.03.2021
- European Commission (EC) (2019a). *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, European Green Deal*, COM(2019) 640 final, 11.12.2019.
- European Commission (EC) (2020a). *Communication from the commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions. A farm to fork Strategy for a fair, healthy and environmentally-friendly food system*. COM (2020) 381 final.
- European Commission (EC) (2020b). *Communication from the commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions. EU Biodiversity Strategy for 2030*. COM(2020)380 final
- Goraj, L., Bocian, M., Cholewa, I., Nachtman, G., Tarasiuk, R. (2012). *Współczynniki Standardowej Produkcji „2007” dla celów Wspólnotowej Typologii Gospodarstw Rolnych*. IERiGŻ-PIB, Warszawa.
- Harasim, A. (2014). *Przewodnik do oceny zrównoważenia rolnictwa na różnych poziomach zarządzania*. IUNG-PIB, Puławy.
- Henle, K., Alard, D., Clitherow, J., Cobb, P., Firbank, L., Kull, T., McCracken, D., Moritz, R.F.A., Niemela, J., Rebane, M., Wascher, D., Watt, A., Young, J. (2008). *Identifying and managing the conflicts between agriculture and biodiversity conservation in Europe - A review*. Agriculture, Ecosystems and Environment, vol 124.
- Huylenbroeck, G. van, Durand, G. (eds.). (2003). *Multifunctional Agriculture. A New Paradigm for European Agriculture and Rural Development*, Ashgate, Hampshire-Burlington.
- Hünig, C., Benzler, A. (2017). *Das Monitoring der Landwirtschaftsflächen mit hohem Naturwert in Deutschland*. BfN-Skripten 476.
- Jadczyzsyn J., Kopiński J., Kuś J., Łopatka A., Madej A., Matyka M., Musiał W., Siebielec G. (2013) *Rolnictwo na obszarach specyficznych*. Powszechny Spis Rolny 2010, GUS, Warszawa.
- Jadczyzsyn J., Zieliński M. (2020). *Assessment of farms from High Nature Value Farmland areas in Poland*, Annals PAAAE, vol.XXII,no.3.
- Johnson V. O.I (1980). Relevance of environmental education and training in agriculture. *Environment International*, 4, 1, 69-73.
- Lankoski, J., Thiem, A., (2020). Linkages between agricultural policies, productivity and environmental sustainability. *Ecological Economics*, 178, 1-9.
- Loon, G. W. van, Patil, S. G., Hugar, L. B. (2005), *Agricultural Sustainability. Strategies for Assessment*. SAGE Publications, New Delhi/Thousand Oaks/London.
- Matyka M., Jugowar J.L., Kowalczyk A., Kozyra J., Łopatka A., Piórkowski H., Radzikowski P., Siebielec G., (2019). *Ocena rezultatów wdrażania Programu Rozwoju Obszarów Wiejskich na lata 2014-2020 w latach 2014-2018. Zadanie II-środowisko i klimat. Raport końcowy*. MRiRW, Warszawa.
- Ministry of Agriculture and Rural Development. (2018). *Wsparcie Rolnictwa*, <http://www.minrol.gov.pl/Wsparcie-rolnictwa>, access on: 08.03.2021.
- Ministry of Agriculture and Rural Development. (2019). *Reports and publications*, [www.gov.pl/web/agriculture/reports-and-publications](http://www.gov.pl/web/agriculture/reports-and-publications), access on: 08.03.2021.

- Pacini, G. C., Merantea, P., Lazzarina, G., Van Passel, S., (2015). Increasing the cost-effectiveness of EU agri-environment policy measures through evaluation of farm and field-level environmental and economic performance. *Agricultural Systems*, 136, 70-78.
- Paracchini M.L., Petersen J.E., Hoogeveen Y., Bamps C., Burfield I., Swaay C.(2008). *High Nature Value Farmland in Europe. An estimate of the distribution patterns on the basis of land cover and biodiversity data*. JRC Scientific and Technical reports. EEA, EUR 23480 EN.
- Parikh, S. J., James, B. R. (2012). Soil: The Foundation of Agriculture. *Nature Education Knowledge*, 3(10), 2.
- Pretty, J. (2008). *Agricultural Sustainability: Concepts, Principles and Evidence*. Philosophical Transactions of the Royal Society B. No. 363. pp. 447-465, [rstb.royalsocietypublishing.org](http://rstb.royalsocietypublishing.org).
- Report from The Commission to the European Parliament and the Council. The mid-term review of the EU Biodiversity Strategy to 2020. COM(2015) 478 final.
- Strohbach M.W., Kohler M.L., Dauber J., Klimek S. (2016). *High Nature Value farming: From indication to conservation*, Ecological Indicators, vol.57.
- The European environment –state and outlook 2020. Knowledge for transition to a sustainable Europe, EEA 2019.
- The Royal Society. (2009). *Reaping the Benefits: Science and the Sustainable Intensification of Global Agriculture*. London.
- Toczyński, T. Wrzaszcz, W., Zegar J.St. (2013). *Zrównoważenie polskiego rolnictwa. Powszechny Spis Rolny 2010*. GUS. Warszawa.
- World Commission on Environment and Development. (1987). *Our Common Future*. The World Commission on Environment and Development, Oxford University Press, 1987.
- Wrzaszcz, W. (2014). *Sustainability of Agricultural Holdings in Poland*. IERiGŻ-PIB. Studia i Monografie. No. 161. Warszawa.
- Wrzaszcz, W. (2018). Changes in Farms' Economic Sustainability: The Picture of Polish Farms in the Last Decade. *European Journal of Sustainable Development*, 7, 4, 179-190.
- Wrzaszcz, W., (2018a). Changes in farm environmental sustainability in Poland – Progress or regress? *AgBioForum*, 2, 21/2, 107-126.
- Zegar, J.St. (2010). Ekonomia rolnictwa versus ekonomia agrarna. In: S. Sokolowska, A. Bisaga (eds.), *Wież i rolnictwo w procesie zmian. Rolnictwo w nowym otoczeniu rynkowym i instytucjonalnym*, Opole, 13-24.
- Zieliński M., Sobierajewska J. 2020. Gospodarstwa rolne z obszarów o dużej cenności przyrodniczej w Polsce. Referat na seminarium Instytutu Ekonomiki Rolnictwa i Gospodarki Żywnościowej – PIB, 14.02.2020 r., <https://www.ierigz.waw.pl/aktualnosci/seminaria-i-konferencje/23538,45,3,0,1581677201.html>
- Zomeni M., Martinou A.F., Stavrinides M.C., Vogiatzakis I.N.( 2018). *High nature value farmlands: challenges in identification and interpretation using Cyprus as a case study*. Nature Conservation vol. 31. <https://stat.gov.pl/en/regional-statistics/classification-of-territorial-units/administrative-division-of-poland/>