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## REGIONAL CHANGES IN THE PIG POPULATION IN POLAND IN 2010-2022

Key words: pigs, stock, sows stock, population, powiat, ASF

**ABSTRACT.** The aim of the study was to assess regional changes in pig and sow population in 2010-2022. The analysis was carried out at the voivodship level for the entire period under study, while changes in pig and sow population in poviats were based on agricultural census data for 2010 and 2020. The analysis showed a progressive regional concentration of pig and sow stock in Poland, as indicated by an increase in the share of the 62 and 93 poviats with the highest stock and the poviats with the highest density of pigs and sows using 20% and 30% of agricultural land in Poland by about 9 percentage points. However, there was no correlation of the level of pig and sow stocking in 2010 in individual poviats with changes in stocking rates by 2020. A large increase in stocking rates associated with the construction of industrial piggeries was recorded in a dozen poviats located mainly in the western and northern voivodships, where the largest number of State Agricultural Farms were located.

## INTRODUCTION

The pork livestock market in Poland has been in permanent crisis since 2008, as indicated primarily by the steadily declining sow population. In June 2022, there were 606,000 sows in Poland, 66% fewer than in June 2007. In the case of total pigs, thanks to the increased importance of piglet imports and the development of contract fattening, a stabilization of the stock was apparent in 2012-2021. Data from December 2021 and June 2022 suggest the emergence of a new downward wave in the total pig population,

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which could lead to a decline in the stock to the level of 6-8 million head, especially since, according to the Agency for Restructuring and Modernization of Agriculture (ARMA), in October 2022 the pig population was already only 9.4 million head, and the number of herds decreased to 59.2 thousand [TopAgrar.pl 2022]. In addition, the increase in pork livestock prices observed in 2022, unfortunately, did not fully compensate for the increase in feed, fuel and energy prices, which is a strong argument for a further reduction in the pig and sow population in Poland. Among the reasons for the decline in the herd are also mentioned: social (e.g., low levels of competence and learning) and structural factors (e.g. too much fragmentation of production), low production efficiency (especially too low fertility of sows), underinvestment, low degree of vertical and horizontal integration, real decline in pork livestock prices and deteriorating relation of pig prices to prices of grains, feed materials and piglets [Blicharski 2011, Ziętara 2012, Hamulczuk, Stańko 2013, Pepliński et al. 2013, Blicharski, Hammermaister 2013, Stępień 2017].

However, the decline in pig and sow populations has not been uniform. The return of the market economy after 1990 caused polarization processes in agriculture to intensify again, taking into account the 19th-century borders from the partitions of Poland, which became particularly evident in the case of the pork sector [Pepliński 2019]. The next agricultural census, conducted in 2020, provided new data on the population of pigs and sows in poviats in Poland. The last survey at this level was for 2010 [Pepliński 2017]. Therefore, the purpose of this study is to evaluate regional changes in the pig and sow population. The analysis was carried out at the voivodship level in 2010 – June 2022 and in poviats in Poland in 2020 in relation to 2010.

## MATERIAL AND METHODS

Data for the analyses on were obtained from the Local Data Bank [BDL 2022], from the 2010 and 2020 Censuses of Agriculture by farm residence, i.e. the location of the farm habitat declared by the user, i.e. residential buildings and farm buildings and equipment for agricultural production. The study of changes in total swine and sow populations was carried out at two levels: voivodeship for 2010-June 2022, and poviats for 2010 and 2020. The study omits cities with poviat rights, where the acreage of AL is small, so that even a small animal population can result in high stocking rates and distort the results of the analyses. In addition, analyses will be carried out on changes in the share of 62 and 93 poviats (i.e., 20 and 30% of the units analyzed) with the highest stocking rates, as well as poviats with the highest pig and sow stocking rates utilizing 20% of the country's AL and 30% of the country's AL, which makes it possible to exclude inequality in potential due to the different size of poviats. In order to determine whether the level of stocking density in individual poviats has an impact on population changes, we calculated average population

changes in the following 10% of counties ranked according to the level of total pig and sow stocking density in 2010, and a Pearson correlation analysis of the level of pig and sow stocking rates in 2010 with relative changes in stocking rates between 2010 and 2020.

## RESULTS OF THE STUDY

Changes in the stock of pigs and sows did not proceed evenly during the period under review. Throughout the entire period under study, the stock of both groups of animals decreased in individual voivodships, except that in the case of total pigs from 11.2% in the Mazowieckie Voivodship to 71.0% in the Małopolskie Voivodship, and in the case of sows from 28.9% to 74.0% with the national average of 35.0% and 54.3%, respectively. In the three sub-periods delineated in Table 1, only between 2015 and 2020 was there some stabilization of herd size nationally, but there were large regional differences. The decrease in stock observed in the last two years applies to all voivodships except for Dolnośląskie and, to a lesser extent, Pomorskie, i.e. voivodships where more than 50% of the pig and sow population is in development herds. However, the next two voivodships with the best herd structure in 2016, i.e. Lubuskie and Zachodniopomorskie [Pepliński 2019], experienced a systematic decline in herds in all sub-periods, which probably means that not only small herds, but also large industrial farms were liquidated. A systematic decline in herds in all sub-periods also occurred in the voivodships with the most fragmented herd structure, i.e. from southeastern Poland and Kujawsko-Pomorskie voivodship. This may mean that in these voivodships, farmers largely definitively end pig production and do not return to it even in periods of upturn, with the smallest producers confining themselves to subsistence livestock. In addition, the scale of production abandonment is so large that it is not compensated for by newly established industrial farms and the development of a small number of family farms. A 20-25% decrease in livestock in 2020-2022 in the Wielkopolskie and Łódzkie voivodships is also worrying, but this is due, on the one hand, to the falling out of the market of the smallest farms, and on the other hand, to the introduction of ASF red zones in several poviats with the highest pig density in Poland, which caused an acceleration of the abandonment of pig production, mainly of smaller farms, which did not find it profitable to introduce strict bio-insurance rules, further tightened in November 2021.

There is also a systematic increase in the share of the 3 voivodships with the highest population in the national population, which in 2022 amounted to 57.7% for pigs and 50.7% for sows, an increase of 6.4 and 1.2 percentage points (p.p.), respectively, compared to 2010. In the coming years, regional polarization of the herd is expected to deepen, and by 2030, with current trends, these shares are likely to exceed 60% and 54%. In each year, the group included in each case the Wielkopolska Voivodship and interchangeably

Table 1. Changes in the size of pig and sow populations in Poland and voivodships in 2010, June 2022

| Specification       | Pigs [base year = 100%] |               |               |               | Sows [base year = 100%] |               |               |               |
|---------------------|-------------------------|---------------|---------------|---------------|-------------------------|---------------|---------------|---------------|
|                     | 2015/<br>2010           | 2020/<br>2015 | 2022/<br>2020 | 2022/<br>2010 | 2015/<br>2010           | 2020/<br>2015 | 2022/<br>2020 | 2022/<br>2010 |
| Poland              | 71.7                    | 110.7         | 82.0          | 65.0          | 61.3                    | 100.1         | 74.4          | 45.7          |
| Dolnośląskie        | 53.8                    | 86.6          | 100.6         | 46.9          | 73.3                    | 78.5          | 111.4         | 64.2          |
| Kujawsko-pomorskie  | 65.2                    | 98.5          | 78.5          | 50.4          | 53.8                    | 95.7          | 63.9          | 32.9          |
| Lubelskie           | 54.1                    | 91.8          | 83.7          | 41.6          | 52.5                    | 70.4          | 81.0          | 29.9          |
| Lubuskie            | 86.8                    | 73.2          | 77.7          | 49.4          | 72.8                    | 75.0          | 69.7          | 38.1          |
| Łódzkie             | 70.3                    | 132.4         | 75.4          | 70.3          | 58.5                    | 110.3         | 69.3          | 44.7          |
| Małopolskie         | 53.4                    | 86.7          | 62.7          | 29.0          | 53.2                    | 83.8          | 58.3          | 26.0          |
| Mazowieckie         | 65.0                    | 147.0         | 93.0          | 88.8          | 50.0                    | 104.5         | 81.3          | 42.4          |
| Opolskie            | 56.9                    | 87.9          | 89.9          | 45.0          | 52.8                    | 107.3         | 76.1          | 43.1          |
| Podkarpackie        | 72.6                    | 88.4          | 54.9          | 35.2          | 72.6                    | 89.5          | 55.3          | 35.9          |
| Podlaskie           | 58.5                    | 110.4         | 84.9          | 54.9          | 50.9                    | 102.3         | 84.8          | 44.2          |
| Pomorskie           | 78.0                    | 118.5         | 92.3          | 85.3          | 74.5                    | 105.8         | 90.2          | 71.1          |
| Śląskie             | 57.3                    | 111.0         | 83.5          | 53.0          | 55.6                    | 107.8         | 85.4          | 51.2          |
| Świętokrzyskie      | 53.6                    | 93.7          | 72.0          | 36.2          | 55.3                    | 99.1          | 63.9          | 35.0          |
| Warmińsko-mazurskie | 67.2                    | 127.5         | 80.8          | 69.2          | 64.8                    | 99.2          | 75.8          | 48.7          |
| Wielkopolskie       | 88.0                    | 109.8         | 80.1          | 77.4          | 68.9                    | 108.0         | 69.9          | 52.0          |
| Zachodniopomorskie  | 80.6                    | 84.3          | 74.4          | 50.5          | 77.4                    | 87.2          | 80.5          | 54.3          |

Source: own calculations based on BDL data

the Kujawsko-Pomorskie, Łódzkie, Mazowieckie and, in the case of sows, Pomorskie, indicating that piglet and pork livestock production is concentrated in the central voivodships, while marginal and constantly declining importance is given to production in the voivodships of southern and eastern Poland.

This is reflected in the distribution of pig and sow populations in the poviats. Figures 2 and 4 present the stocking density per 100 hectares of AL, thus eliminating the aspect of the different size of poviats and the area of farmland, which are important determinants of the production capacity of individual regions. Although this importance is diminishing due to the possibility of using industrial feed in feeding pigs, the Nitrates Directive requires that 70% of organic fertilizer be managed on one's own farm, find fertilizer area outside one's own farm, or provide excess fertilizer to an agricultural biogas plant [Pepliński et al. 2019]. With the high cost of transporting organic fertilizer and the small number of

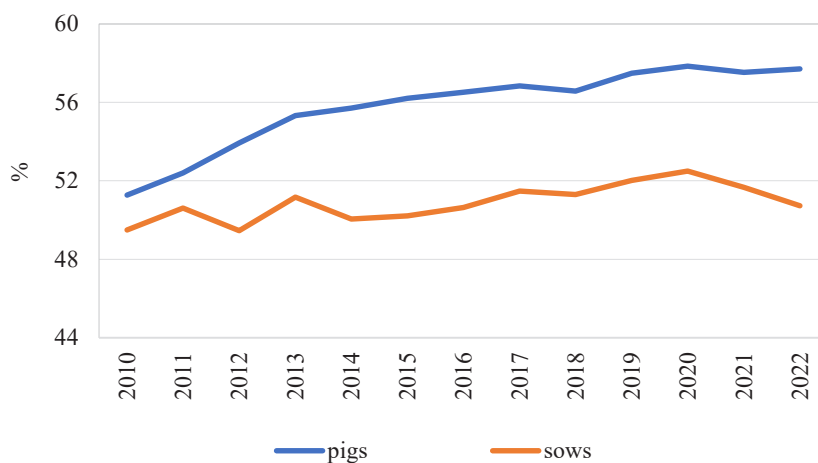


Figure 1. Share of the three voivodships with the highest pig and sow populations in 2010-2020  
Source: own calculations based on BDL data

biogas plants in Poland, the importance of AL near industrial farms is still crucial to the profitability of production.

The inclusion of stocking rate as a measure partially verifies the importance of individual voivodships. This includes the Mazowieckie Voivodeship, which, apart from the northeastern part of the voivodship, is characterized by not very high pig stocking rates. In the case of Kujawsko-Pomorskie, Łódzkie, Pomorskie and Wielkopolskie voivodships, in most districts the stocking density exceeds 75 pigs per 100 ha of AL. A stocking density of less than 10 head occurred in as many as 87 poviats (27.7% of those analyzed) compared to 19 such poviats in 2010. In as many as 18 of them there were no analyzed animals or the number of farms did not allow statistical secrecy. The largest share of such poviats was in Dolnośląskie Voivodship, the southern part of Małopolskie and Podkarpackie voivodships, and in poviats around Warsaw. The stocking density of more than 200 animals was in 28 poviats, of which more than 300 animals were in only 8 units located in the central voivodships.

Changes in the level of stock in individual poviats in 2010-2020 indicate a decrease in stock in most poviats with the highest stock in 2020 from the Kujawsko-Pomorskie and Wielkopolskie voivodships (Figure 3). Of the 314 poviats, only 41 of them saw an increase in herds, and 9 saw at least a doubling of the herd. Against the national background, the poviats of Wałecki and Gołdapski stood out in particular, where the herd increased more than 5 times, and Nidzicki with a 13-fold increase in the herd. However, in absolute terms, the largest increase in livestock occurred in Żurominski powiat (+372,000 head and a 2.3-fold increase in livestock), while in Nidzicki, Gołdapski and Piotrkowski poviats the

Figure 2.  
Pig stocking density  
in poviats in Poland  
in 2020

Source: own  
calculations based  
on BDL data

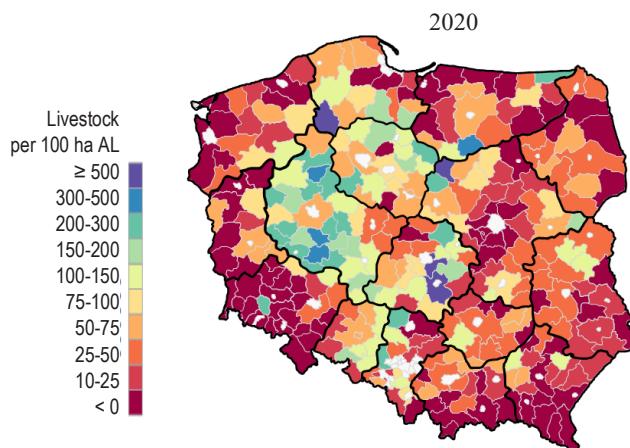
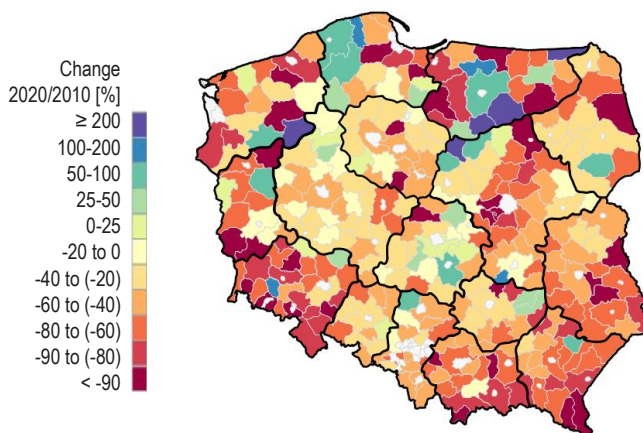


Figure 3.  
Changes in the  
pig population in  
poviats in Poland  
in 2010-2020

Source: own  
calculations based  
on BDL data



increase in livestock was 175,000 head, 136,000 head and 135,000 head, respectively. In the case of Wałecki powiat, it was only an additional 43,500 head, which was the 8th result. Of the poviats in which the herd was reduced in as many as 159 poviats, i.e. every second powiat analyzed, at least 50% of the herd was lost, of which 70 units lost 75% of the herd. These were located primarily in southwestern and southeastern Poland. In the voivodships with the highest stocking rates, declines in stocking rates usually reached up to 40%, while poviats with at least a 50% increase in stocking rates were scattered throughout the country with the exception of 7 poviats located on the border of the Mazowieckie and Warmińsko-Mazurskie voivodships.

The sow population is distributed similarly to the pig population, as poviats with the highest stocking rates are mainly located in the Kujawsko-Pomorskie and Wielkopolskie voivodships, but poviats with stocking rates exceeding 15 sows were located in a total

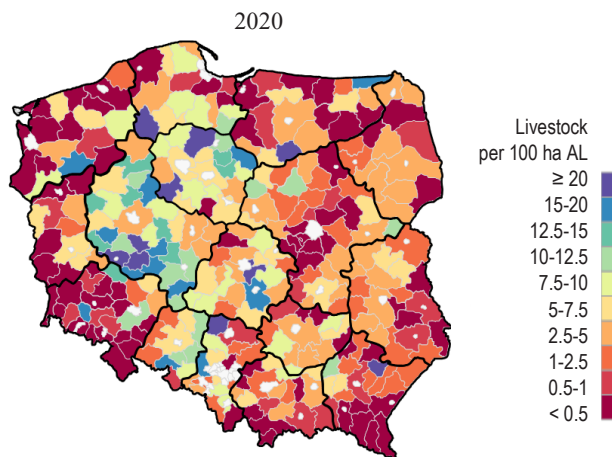


Figure 4.  
Sow stocking rate  
in poviats in Poland  
in 2020

Source: own  
calculations based  
on BDL data

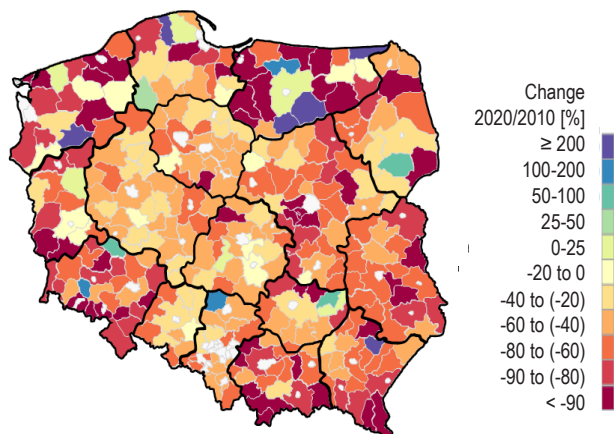


Figure 5.  
Changes in the  
population of sows  
in counties in  
Poland in 2010-  
2020

Source: own  
calculations based  
on BDL data

of 10 voivodships. Stocking rates lower than 1 sow per 100 hectares of AL were in 1/3 of the poviats located mainly in border poviats and around Warsaw (Figure 4).

The rate of decline in stocking rates in the second decade of the 21st century varied (Figure 5). Only 19 poviats saw an increase in herds, including an increase of more than 200% in six poviats. A nearly sixfold increase was recorded in Nidzicki powiat (by 9.2 thousand sows to 10.8 thousand sows), a nearly fivefold increase in Leżajski powiat (by 4.3 thousand sows to 5.2 thousand), and a more than threefold increase in Szczycieniecki powiat meant an increase in the number of sows from 363 to 1,522. In addition, an increase in the sow population of 6.8-8.2 thousand sows occurred in Kłobucki, Człuchowski, Gołdapski and Choszczeński poviats. At the opposite pole were the poviats of Drawski, Iławski, Nowomiejski and Bialski, where the number of sows decreased from 26.4 to 10.0 thousand. No sows were recorded in 21 poviats, despite the fact that 10 years earlier

they had been there, in another 75 poviats the population decreased by more than 75%, and in another 110 poviats by 50-75%. As in the case of pigs in general, the share of poviats with the greatest reduction in stock was highest in the voivodships of southern and eastern Poland and around Warsaw.

Spatial concentration processes are also evident in the results in Figure 6. The dynamics of share growth during the period under study was similar in most of the groups of poviats adopted for analysis, ranging from 7.9 p.p. to 9.7 p.p. The exceptions were the poviats with the highest stocking density using 20% of AL, where the share of the national stocking increased by as much as 14.1 p.p. over the decade. The differences in concentration levels among groups of poviats also leveled out, ranging from 1.9 to 3.2 p.p. in 2020.

The analysis of the impact of the level of stocking density in 2010 on changes in stocking rates in 2010-2020 does not provide a clear answer. Admittedly, according to the results in Figure 6, one would have expected a smaller decrease in livestock in poviats with the highest stocking rates, which was indeed confirmed by the results in Table 2, but two groups of poviats with average stocking rates each recorded the smallest decrease in livestock in 2010. The conjecture that poviats that already had negligible pig and sow populations in 2010 experienced the greatest depopulation of herds was also confirmed.

Confirmation of the lack of a clear effect of the level of stocking rates in the surveyed poviats in 2010 on the magnitude of changes in the herd by 2020 is the very weak positive correlation of 0.044 for pigs and 0.142 for sows'.

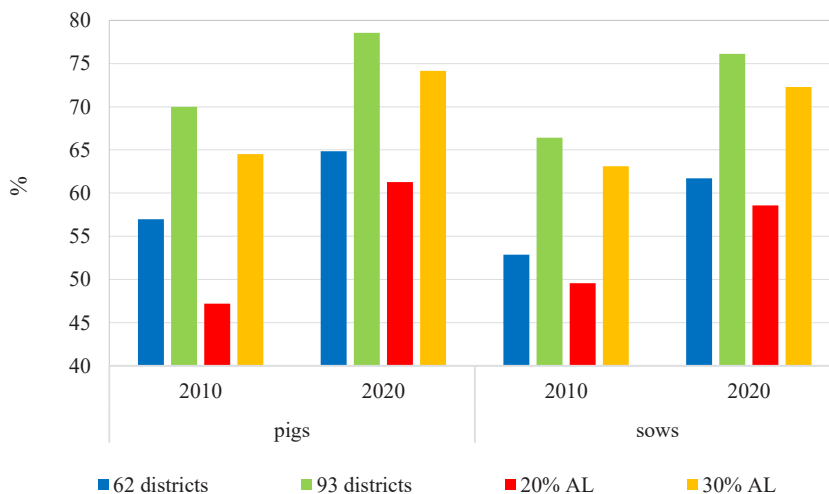


Figure 6. Share of 62 and 93 poviats with the highest stock of pigs and sows, and poviats with the highest stock of pigs and sows using 20% of AL and 30% of AL in Poland in 2010 and 2020

Source: own elaboration based on BDL data



Table 2. Changes in the stock of pigs and sows in 2020 relative to 2010 in the poviats in Poland ranked from the highest level of stocking of pigs and sows in 2010

| No. of poviat | Pigs [pcs] |            |             | Sows [pcs] |         |             |
|---------------|------------|------------|-------------|------------|---------|-------------|
|               | 2010       | 2020       | 2010 = 100% | 2010       | 2020    | 2010 = 100% |
| Poland        | 15,179,935 | 10,911,741 | 71.9        | 1,415,410  | 779,095 | 55.0        |
| 1-31          | 5,339,820  | 3,988,618  | 74.7        | 432,682    | 252,655 | 58.4        |
| 32-62         | 2,780,640  | 2,111,580  | 75.9        | 260,904    | 143,424 | 55.0        |
| 63-93         | 1,917,179  | 1,374,097  | 71.7        | 177,575    | 98,998  | 55.7        |
| 94-125        | 1,653,166  | 937,542    | 56.7        | 174,659    | 98,822  | 56.6        |
| 126-156       | 1,188,793  | 988,963    | 83.2        | 136,796    | 61,359  | 44.9        |
| 157-188       | 923,484    | 595,947    | 64.5        | 96,202     | 58,156  | 60.5        |
| 189-219       | 651,635    | 564,705    | 86.7        | 67,719     | 43,606  | 64.4        |
| 220-251       | 375,561    | 186,379    | 49.6        | 37,030     | 12,290  | 33.2        |
| 252-282       | 232,233    | 129,095    | 55.6        | 24,163     | 7,149   | 29.6        |
| 283-314       | 1,174,247  | 34,815     | 29.6        | 7,680      | 2636    | 34.3        |

Source: own calculations based on BDL data

## DISCUSSION

The declining trend in pig and sow populations is indisputable, and the new wave of population decline that has begun may only end at around 6-8 million pigs. In the case of sows, new population minima are regularly set, so in the perspective of 2030 it may decrease even to less than 400,000 head, i.e. by 1/3. One of the most frequently raised reasons for the decline in the population is the poor structure of the herd and the resulting too low share of animals in development herds, which should already include herds of at least 1000 head of pigs and 100-200 sows. ARMA data published by Gobarto [Food Fakty 2022] shows that 33,500 farms were lost in 2021 and another 11,000 by October 10, 2022. As herd size increases, the percentage loss of producers is smaller, but unfortunately 124 (6%) farms keeping more than 1,000 animals also lost in 2021. A number of factors contributed to this, but undoubtedly these dates indicate that the profitability swing in piglet and fattening pig production observed since 2020 does not guarantee the maintenance of production even in the largest herds. This is reflected, among other things, in the drastic reduction of herds in several poviats (including Drawski and Novomiejski), which were

among the 10 poviats with the highest stocking rates in 2010. On the other hand, large industrial farms, mostly based on overlay fattening, were established between 2010 and 2020, which were located not only in regions with high stocking densities, but also in poviats where pork production was no longer important.

The impact of ASF on livestock changes is difficult to clearly determine. The need to incur costs to ensure proper bio-insurance is driving the smallest farms out of business. In addition, in regions that have been placed in the red zone, there is an increase in the abandonment of pig rearing (especially in the first three months in some poviats up to one-third of the farms abandoned pig production), which, in addition to the lower price than the market [Augustyńska 2017], is influenced by the long term of remaining in the red zone, which in most cases lasts more than a year. This is not helped by appeals from producers and agricultural associations to Provincial Veterinarians, who hide behind European Commission guidelines. According to it, in the case of one ASF outbreak on a farm, an application for a red zone change can be submitted after a full three months without another ASF outbreak on farms in the region, and with at least two cases, the deadline is extended to at least twelve months, which should be considered too long. In the author's opinion, regardless of the number of ASF outbreaks on farms, a three-month grace period from the last case would suffice, especially since ASF is not an airborne disease. As of 2018, farms from at least 20 poviats were in the red zone, but in 2021, due to the emergence of the virus in the west of the country, ASF outbreaks from the last 12 months (rolling) approached 40 poviats, and the virus is already present in about 1/3 of Poland [PKO BP 2021]. ARMA data clearly shows that in regions where ASF was present, the rate of reduction of pig herds since 2018 is about two-thirds higher than in virus-free areas (Figure 7). Unfortunately, the spread of ASF to more regions of the country will accelerate the process of herd reduction. On the other hand, however, ASF has not had a limiting effect on the development of the overlay system in the areas of its occurrence, as may be indicated, among other things, by changes in herds in Podlaskie and Warmińsko-Mazurskie voivodships and in some poviats from the first of the voivodship. Unfortunately, even the largest farms are unable to protect themselves against ASF, as indicated by outbreaks also occurring in herds of several thousand pigs. Of concern is the higher proportion of ASF cases on the largest farms than is apparent from the herd structure [Szymańska, Dziwulaki 2022], which indicated that producers paid too little attention to bioassurance. The reduction in the number of outbreaks in swine herds from 124 in 2021 to 14 in 2022 [GIW 2023] may indicate the high effectiveness of veterinary inspections and bioassurance activities undertaken on farms. Nevertheless, it is necessary to further increase efforts and make the necessary changes in the fight against ASF, which will effectively eliminate the virus from the environment. Without this, the problem of entering the red zone, additional bureaucratic obligations and unnecessary costs for producers and the economy will not be solved.

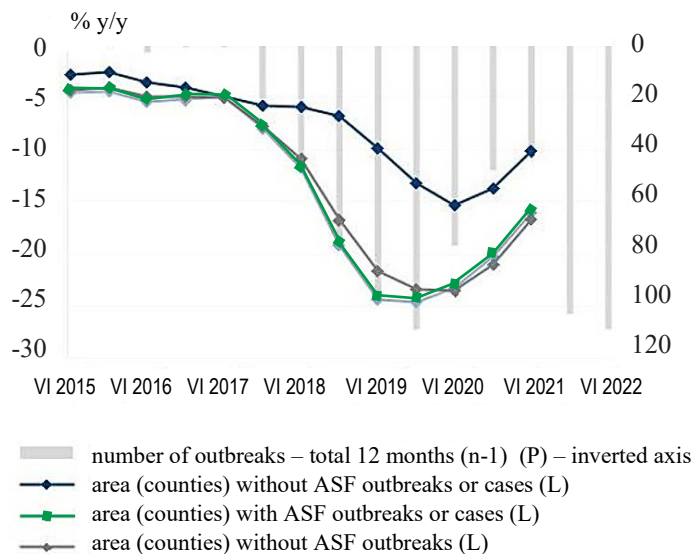


Figure 7. Change in the number of pig herds in Poland

Source: [PKO BP 2021]

In order to stabilize the pig and sow population with the still large share of small herds, it is necessary to build new large-scale piggeries, but their establishment is significantly hampered on the one hand by lengthy formal procedures, high capital intensity, and on the other hand, most investments are protested by neighbours, so that the waiting time for the construction of piggeries can take up to a dozen years and ultimately discourage investment. A complicating factor in this case is the frequent lack of zoning plans in municipalities. A certain solution could be the designation of settlement zones that take into account especially the long-term development of suburban settlement around Polish metropolises and cities; buffer zones where settlement and agricultural, economic activities would not be possible; and zones where nuisance economic activities and medium- and large-scale animal production could be carried out.

Also negative is the state policy on the restoration of the swine population in Poland, or basically the lack thereof. Subsidizing small-scale production in the context of the law of economies of scale has not and will not work, especially in the context of the incoming European Green Deal, which is likely to increase costs. It is necessary to focus support on high-cow farms and the development of medium-sized farms with high efficiency, but not covered by overlay fattening, which can count on capital from an integrator.

## CONCLUSIONS

The analysis made it possible to formulate the following conclusions:

1. After 2010, the processes of spatial concentration of pig and sow populations at both provincial and district levels continue.
2. The process of depopulation of livestock in the voivodships of Eastern and Southern Poland continues to be the fastest.
3. The level of pig and sow stocking density in 2010 did not have a significant impact on changes in the stock of these groups of animals until 2020, although it was shown that in districts with the highest stocking density the rate of depopulation of the stock was lower than the national average, and in districts with the lowest stocking density the decrease in the stock was the greatest.
4. There is an acceleration of the depopulation of pig herds in ASF-affected regions, but at the same time new large-scale industrial farms are being built in these areas, which in some poviats have led to a significant increase in pig and sow populations. It is therefore necessary to effectively eliminate ASF from the environment.
5. It is necessary to support the development of high-cow and high-efficiency farms and provide farmers with investment land for the construction of livestock buildings.

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## REGIONALNE ZMIANY POGŁOWIA TRZODY CHLEWNEJ W POLSCE W LATACH 2010-2020

Słowa kluczowe: trzoda chlewna, lochy, obsada, pogłowie, powiaty ASF

ABSTRAKT. Celem badań była ocena regionalnych zmian pogłowia trzody chlewnej i loch w latach 2010-2022. Analizę przeprowadzono na poziomie wojewódzkim dla całego badanego okresu, natomiast zmiany pogłowia trzody chlewnej i loch w powiatach na podstawie danych spisów rolnych w latach 2010 i 2020. Analiza wykazała postępującą regionalną koncentrację pogłowia trzody chlewnej i loch w Polsce. Wskazuje na to wzrost udziału o około 9 punktów procentowych 62 i 93 powiatów o najwyższym pogłowie oraz powiatów o najwyższej obsadzie trzody chlewnej i loch, użytkujących 20% i 30% użytków rolnych w Polsce. Nie wykazano natomiast korelacji poziomu obsady trzody chlewnej i loch w 2010 roku w poszczególnych powiatach ze zmianami pogłowia do 2020 roku. Duży wzrost pogłowia związany z budową przemysłowych chlewni odnotowano w kilkunastu powiatach, zlokalizowanych głównie w województwach zachodnich i północnych, w których zlokalizowanych było najwięcej państwowych gospodarstw rolnych.

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