Praca oryginalna *Original paper*

Economic costs of 11 years of African swine fever in Poland

BENEDYKT PEPLIŃSKI[1], JANUSZ WOJTCZAK[2], ZYGMUNT PEJSAK[3], GRZEGORZ WOŹNIAKOWSKI[4]

[1]Department of Law and Enterprise Management in Agribusiness, Poznań University of Life Sciences, Wojska Polskiego 28, 60-637 Poznań, Poland
[2]Department of Animal Breeding and Product Quality Assessment, Poznań University of Life Sciences, Złotniki, Słoneczna 1, 62-002 Suchy Las, Poland
[3]University Veterinary Medicine Centre UJ-UR, University of Agriculture, al. Mickiewicza 21, 31-120 Kraków, Poland
[4]Department of Infectious, Invasive Diseases and Veterinary Administration, Institute of Veterinary Medicine, Faculty of Biological and Veterinary Sciences, Nicolaus Copernicus University in Toruń, Lwowska 1, 87-100 Toruń, Poland

Received 15.04.2025 *Accepted 21.05.2025*

Pepliński B., Wojtczak J., Pejsak Z., Woźniakowski G.

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Summary

African swine fever (ASF) has been present in Poland in wild boar and pig populations for more than 11 years. The main cause of the long-distance spread of ASF is human error, especially the lack of biosecurity awareness in noncommercial farms. The potential risk of ASF endemicity in Poland and the Baltic states remains a serious concern. The enormous impact of ASF can be seen in the domestic production of pigs during the successive years of the epizootic. Due to ineffective biosecurity measures implemented in backyard, family or noncommercial farms, this sector of pig production remains the most susceptible to the ASF virus (ASFV). Also, commercial producers are affected by spontaneous ASFV outbreaks, which are usually difficult to explain during epizootic investigations. The data presented show the current knowledge on the economic impact of ASF in Poland since its introduction. The aim of this study was to estimate the costs to the farming sector and the national budget during the 11 years of ASF presence in Poland. This study used both statistical and dynamic methods of data analysis. The analysis included eight direct and indirect costs generating losses in agriculture. Profits lost by the meat industry and expenses from the state budget were also estimated. The analysis shows that over those 11 years, pig producers lost PLN 10.0-11.3 billion ($ 2.5-2.8 bn), of which the state compensated in various forms less than PLN 2.0 billion ($ 0.5 bn). Each disease outbreak accounted for PLN 0.53-0.63 million ($ 0.13-0.16 mln) of direct costs to farmers. The state budget spent at least PLN 9.4 billion ($ 2.3 bn) on the fight against ASF, as well as on subsidies for farmers and interest on additional public debt, while the meat industry lost PLN 300 million ($ 75 mln). The geographic expansion of ASF makes the costs of ASF increase every year. The loss of export markets is another cost to the Polish economy, with $ 5.5 bn of pork exports not realized.

Keywords: economic impact, direct and indirect costs, loss in pig production, 'red zone'

African Swine Fever (ASF) is a viral contagious disease with high mortality that primarily affects pigs, wild boar, and other species of free-ranging pigs. By 2015, ASF had been diagnosed in 15 EU countries, with Belgium and Sweden successfully eradicating outbreaks among wild boars. In the Czech Republic, ASF outbreaks were successfully eradicated in 2018, but as of 2023 there are outbreaks in regions bordering Poland. ASF was introduced into Poland in February 2014. For more than 11 years, it has spread from the northeast to the southern and western parts of the country, with two spillovers more than 100 kilometers from its closest outbreaks. The most probable but unverified cause of this long-distance transmission is human activity (18). During that period, more than 20.000 ASF outbreaks have been detected in wild boar (approximately more than 30.000 animals affected). The highest number of ASF cases were detected in 2020, when 4156 ASF outbreaks were reported. Although ASF has spread to new areas, the number of outbreaks among wild boar has decreased in the following years. Nevertheless, there is still no reason for optimism, as the outbreaks are distributed throughout the infected area. The expansion of ASF seems to be slowing down in areas where ASF has been present for the longest time. There is also a considerable risk that ASF in

Poland will become endemic in the wild boar population, with restricted mortality and clinical signs, as it is in the Baltic states (8, 17). This risk increases along with the increasing presence of the ASF virus in the forest environment (3, 11). To date, the endemicity of ASF in Poland has not been unequivocally confirmed, but data indicate that the number of feral pigs with specific ASFV antibodies is steadily increasing, which may indicate the beginning of ASF endemicity in Poland (9).

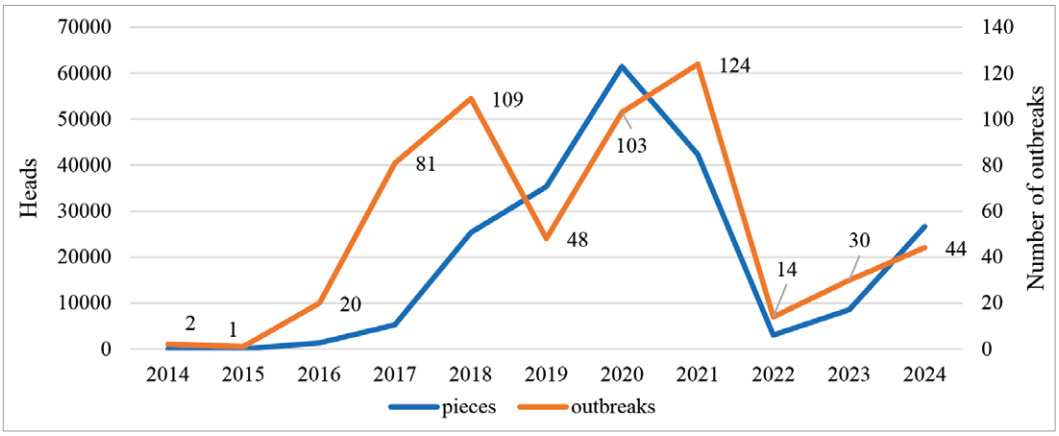

Fig. 1. The number of ASF outbreaks and pigs slaughtered in Poland in 2014-2020 according to the General Veterinary Inspectorate (GVI)

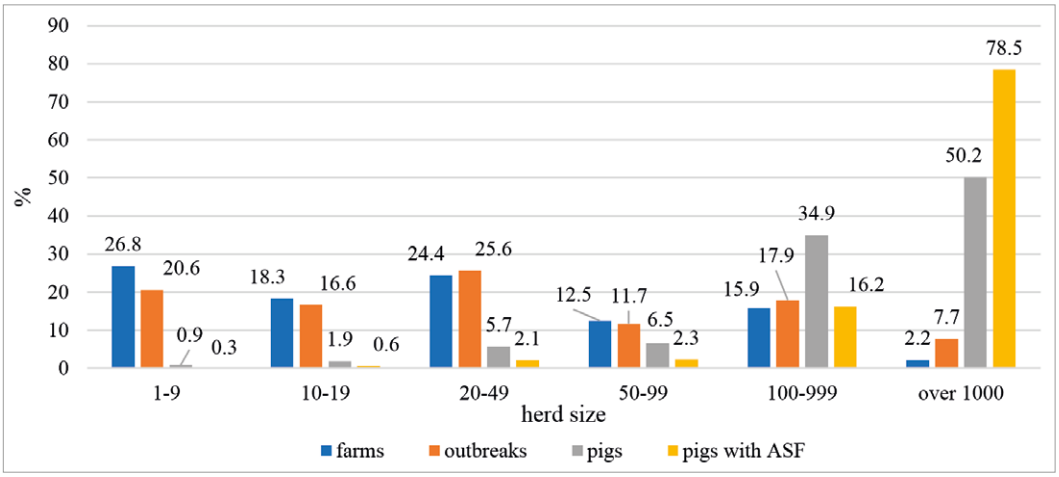

Fig. 2. The structure of farms with ASF outbreaks, ASF outbreaks, pigs kept, and pigs slaughtered according to the herd size (data on the structure of farms and herds for 2020)

However, the main issue from the economic perspective are the still numerous outbreaks in pig farms (Fig. 1). There were 574 outbreaks between 2014 and 2024, with more than 100 in 2018, 2020, and 2021. The smaller number of outbreaks in 2022 was not confirmed by a further decrease in outbreaks in subsequent years. This suggests that Polish farmers face considerable problems in protecting their pig farms against ASF.

The structure of the farms affected by ASF (Fig. 2) shows that, contrary to expectations, the largest stocks are most effectively protected. Over the 11 years, 7.7% of outbreaks were recorded in herds holding more than 1,000 pigs, which account for only 2.2% of the overall number of farms keeping pigs. This may be due to the relatively large number of operational and logistic tasks performed on large farms. The relatively low number of outbreaks occurred in herds ranging from 1 to 9 pigs, but these were responsible for 20.6% of ASF outbreaks, probably due to lack of awareness of pig farmers. The percentage of pigs slaughtered in the largest herds was also above average, as 78.5% of the 209,360 pigs slaughtered belonged to herds with more than 1,000 pigs (Fig. 2).

This resulted in losses not only for specific farmers, but also for the entire pork livestock sector, including the feeding sector as well as farrowing and fattening production. The national budget also spends considerable sums on the fight against ASF. Partial data concerning various costs are published in trade journals and the scientific literature, but no comprehensive calculations of the costs due to ASF in Poland have been made. Few comprehensive calculations are also available for other ASF-affected countries, and they mostly concern single outbreaks. Therefore, the objective of this study was to estimate the costs incurred by the agriculture industry and the national budget during the 11 years of ASF presence in Poland.

Material and methods

Data for cost estimation were obtained from the General Veterinary Inspectorate (GVI), the Local Data Bank (LBD), Central Statistical Office (CSO), Agriculture Restructurisation and Modernisation Agency (ARMA) and the literature on the topic. Because of information gaps, it was necessary in some analyses to use values estimated on the basis of partial data or the authors' knowledge. This included the number of animals forcibly slaughtered in outbreaks and contact farms, the cost of bio-assurance, feed consumption, the number of animals sold in the period immediately after 'red zone' designation and in class C due to overweight. Efforts were also made to estimate the value of financial support provided to farmers by the Polish government. In estimating the costs in agriculture, average national purchase prices of fattening pigs and average selling weights of fattening pigs were used. Stock loss in individual districts was

determined on the basis of the pig population in 2020, and the number of animals in the so-called 'red zone' (part III) was determined based on the proportion of the number of municipalities in the zone to the total number of municipalities in the district. If a part of a municipality was included in the zone, half of the municipality was assumed to be in the zone. It was also assumed that the municipalities were in the 'red zone' for an average of 14 months. Information on the difference between the purchase prices of pigs in the 'red zone' and prices outside the 'red zone' was obtained from a review of agricultural magazines.

Results and discussion

The presence of ASF causes losses to agriculture for a number of reasons, and the current study identified and estimated eight types of these losses. The first consists of losses associated with stumping out a herd due to the ASF outbreak on the farm itself or on contact farms where the pigs were officially slaughtered. Between 2014 and 2024, the value of pigs slaughtered on farms where ASF outbreaks were diagnosed was estimated at PLN 106.5 million (Tab. 1). Data on the number of slaughtered pigs, compensation paid in 2021 and 2024 and recalculated at average purchase prices of fattening pigs. To this should be added the value of herds stamped out in contact farms. For example, in 2021 there were 124 outbreaks with 19,857 pigs and as many as 33,652 pigs in 383 contact farms. Between 2014 and 2017, there were 213 and 358 ASF-affected farms, respectively. Therefore, it is possible to estimate the value of pigs slaughtered in contact farms at 150-200% of the value of pigs from liquidated outbreaks, i.e. 160-213 million PLN.

Tab. 1. Estimated value of pigs slaughtered in outbreak and contact herds from 2014 to 2024

Year	Number of pigs	Price (in PLN/kg)	Value (in thousands of PLN)
2014	9	4.30	3
2015	7	4.30	3
2016	1,333	4.68	562
2017	5,311	5.05	2,410
2018	25,395	4.48	10,418
2019	35,360	5.39	17,603
2020	61,464	5.13	29,712
2021	42,248	4.79	18,863
2022	3,064	6.73	1,914
2023	8,505	8.35	6,935
2024	26,664	7.15	18,061
Total	209,360	x	106,484

Source: The authors' calculation based on LBD and GVI

GVI data show that between 2014 and 2022, PLN 69.05 million of compensation were paid to over 1,000 farms in 502 outbreaks. The value of compensation per pig from an outbreak varied widely, ranging from PLN 242 to PLN 674/pig (Tab. 2). However, it should be noted that this calculation does not include animals from contact farms. After adding them and assuming that they had similar average stocking rates, the compensation (at average purchase prices) was equivalent to only 40 kg of pig weight, while the 2021 data indicate that it was equivalent to 94 kg. This indicates that the compensations did not fully cover the lost value of the pigs, so that farmers whose herds were liquidated made a net loss of approximately PLN 175-229 million. Included in this amount is PLN 58.7 million, which is the estimated value of compensation denied by PLW's decision. In total, compensation was denied to around 200 farms, that is, approximately 16% of farms where animals were disposed.

The second type of direct cost is loss due to herd liquidation with mandatory disinfection and quarantine (minimum 40 days), leading to a 2- to 3-month break in production and an even longer break in sales. In an

Tab. 2. Value of compensation paid and compensation denied 2014-2024

Year	Number of pigs in outbreaks	Pig holdings which received compensation	Compensation for pigs (in thousands of PLN)	For feed and equipment, as well as and compensation for pig holdings (in thousands of PLN)	Pig holdings which have not received compensation	Compensation denied (in thousands of PLN)
	1	2	3	4	5	6
2014-2016	1,349	n.a.	2,667	220*	n.a.	1,707*
2017	5,311	25	3,000	335*	56	6,720*
2018	25,395	179	9,808	2,036	34	1,863*
2019	35,360	44	13,345	911	25	7,582*
2020	61,464	241	14,886	1,322	26	27,618
2021	42,248	507	23,278	2,236	34	10,691
2022	3,064	16	2,066	562	5	110
Mean 2014-2022						
2023	8,505	n.a.	5,679*	633*	n.a.	655*
2024	26,664	104	15,246*	1,700*	about 12	1,759*
In total	209,360	1116	89,975	9,956	192	58,705

Explanation: * Estimates based on the data in Tab. 2

open cycle, the interruption lasts about six months, but in a closed cycle it will last more than a year. The loss to farmers is the lost agricultural income, which is estimated at 25% of the value of production (14, 16). Assuming a production shortfall of 2.5 months, the agricultural income lost during the 11 years of ASF presence in Poland was estimated at PLN 36.6-44.0 million, the highest in 2020 and 2024. Therefore, the total direct costs to farmers amounted to PLN 303-363 million, assuming PLN 0.53-0.63 million ($ 131,000-158,000) per outbreak and PLN 1,445-1,733 ($ 361-433) per pig disposed of due to an outbreak. On the other hand, the cost per outbreak was estimated at $ 842 in Vietnam, $ 3,222 in the Philippines (1), and $ 260,000 in Bulgaria (for a herd of 250 sows and 1,000 fattening pigs) (7), whereas the cost per pig in China was estimated at $ 298 (19).

Another source of losses to pig producers is the introduction of animal movement restrictions, which are particularly acute in the 'red zone'. According to farmers, purchase prices in the 'red zone' were lower than those in the other zones by an average of 0.714 PLN/kg (from 0.20 to 1.50 PLN/kg). Therefore, it is not surprising that buyers usually did post purchase prices in 'red zone's on their websites. One exception was a meat-processing plant which in 2022 offered a price for the 'red zone' that was lower by 0.45 PLN/kg. It should be assumed that other operators required larger discounts. However, in the case of larger producers of fattening pigs, the price disproportions were not so considerable. It is reasonable to assume a lower price difference than 0.714 PLN/kg as a more probable one – for example, 50% of that value (i.e. 0.357 PLN/kg) or 75% of that value (i.e. 0.535 PLN/kg). The former is close to an estimate by the Polish Association of Independent Pig Producers (40 PLN per fattening pig). The latter is based on information from the media and farmers. With such differences in purchase prices, the income (profits) of swine producers lost over those 11 years amounted to PLN 2.2-3.2 billion. The highest losses were suffered by farmers from Wielkopolskie Voivodeship, which accounted for 44% of all losses (despite only 4.5 years of ASF presence in that voivodeship) because outbreaks occurred in a zone with the highest concentration of pigs in Poland (13). It was followed by Warmińsko-Mazurskie Voivodeship, which suffered 21.2% of all losses, and Lubelskie Voivodeship, with 17.0% of losses. Farmers in the pink zone also suffered losses, although these were smaller per fattening pig and, except for the first years analyzed, are difficult to capture statistically.

Delays in the sale of fattening pigs and losses resulting from the sale of overgrown pigs are due to the establishment of 'red zone's. The prices of piglets, which are high and continue to rise relative to the prices of fattening pigs (12), force farmers to increase the weight of fattening pigs sold. It increased from about 120 to 130 kg of live weight during the period under review. The inability to sell porkers for 3 weeks means that most porkers that were at a sale weight when a 'red zone' was established will become outgrown and will therefore be classified in class C and sold at a price lower by 1.0-2.0 PLN/kg (an average of 1.5 PLN/kg). The number of fattening pigs overgrown in 'red zone's' throughout the period under review was estimated at 346.2 thousand, resulting in a loss to farmers of around PLN 72.7 million. As a result of the extension of the fattening period, more than 22 thousand tons of additional feed worth nearly PLN 30 million were used. However, it cannot be treated as a cost, as fattening pigs increased their weight during this time. On the other hand, another cost which is difficult to estimate are losses due to the overcrowding of piggeries and the deterioration of welfare resulting from the inability to sell fattening pigs.

The economy and agriculture also suffer losses due to the abandonment of pig production. It has many causes, but the emergence of ASF in Poland accelerated the loss of pig farms from 63.6% in 2002-2013 to 82.4% in 2013-2024. This was influenced by concerns about the emergence of ASF on farms, the excessive cost of complying with biosecurity requirements, and the development of the associated bureaucracy. This is also confirmed by a report from PKO BP (2), which shows that the rate of herd reduction in ASF outbreak areas than in other areas, e.g. in June 2019 the loss was –22% and –10% respectively compared to the previous year, and in two years –16% and –10% respectively with an average rate of decline between 2014 and 2020 of 12.8% and 7.6% respectively. The changes in the pig population reached –1.2% and +0.1%, respectively (2), as most farms that kept a small number of pigs permanently ceased production. Assuming similar trends in subsequent years (1.3%), the ASF-induced decline in the pig population over the 11 years would amount to 14.3%. As the areas affected by ASF expanded gradually, an average annual loss of 7.15% can be assumed. At the beginning of 2025, there were more than 190 districts in the pink and 'red zone's' with approximately 4.3 million pigs, that is, 38.7% of the population. This represents about 25% level of agricultural income and an average loss of 7.15% of the herd over the 11 years. the estimated value of lost agricultural income was 49.1 million PLN per year and 540 million PLN over 11 years. As ASF spreads to new areas, these losses will increase, as they already amounted to around PLN 125 million in 2024. In addition, lower consumption of domestic cereals due to the shrinking pig population forces domestic cereal producers to sell their produce abroad, frequently at lower prices, which reduces their incomes (15).

A major cost for pig producers was the implementation of biosecurity rules. The expenditure ranged from several thousand to several hundred thousand PLN per farm, depending, among other things, on the size, modernity, and level of security of the farm. The

value of co-funding for biosecurity measures from ARMA to farmers keeping at least 50 pigs suggests that until 2022 an average cost incurred by farmers must have amounted to PLN 82 thousand, but in 2024 it was nearly PLN 95 thousand zlotys. Not all farmers benefited from these subsidies – for example, because they used up the entire de minimis aid limit or did some of the work themselves. The actual average expenditure on biosecurity was probably at least PLN 100 thousand per farm. For the 30 thousand farms that keep more than 50 pigs, this meant an additional expenditure of at least PLN 3.0 billion. On the other hand, 36 thousand farms that keep 10-50 pigs spent on biosecurity an average of 5000-10000 PLN each, that is, another 180-360 million PLN in total. To the above costs one should add the ongoing expenditure on protective and disinfection equipment. Assuming PLN 2000 per year in larger farms and PLN 500 in smaller ones, over the course of the 11 years, these costs would have amounted to PLN 860 million. The estimated total biosecurity expenditure was therefore PLN 4.04-4.22 billion ($ 1.0-1.05 bn), of which less than one fifth was financed by subsidies.

With successive ASF eradication programs, the associated bureaucracy has grown, burdening both farmers and government offices. According to interviews with farmers, it takes them about 60 hours per year to complete and provide extensive documentation. Additionally, they spend at least 20 hours preparing for at least 2 veterinary inspections per year. With a valuation of the farmers' work according to a parity wage of PLN 40/h, for 66,000 farms, this is a cost of at least PLN 200 million ($ 50 mln) per year and PLN 2.2 billion ($ 0.55 bn) over the 11 years.

In addition, the cost of pig health certificates and notifications of animal movements introduced due to ASF has increased. The former is valid for 10 days (2 days in the 'red zone') and costs at least PLN 50 (as of 2022), which is particularly expensive for small producers. The increase in veterinary remuneration is explained by the need to verify the health of animals. A notification of animal movements costs PLN 10. Assuming an average of 20 pigs are involved, 1 million documents are issued each year, so farmers pay more than PLN 70 million a year, compared to around PLN 20 million previously.

The reduction in the scale of investments in the swine sector, which is related to the higher risk of investments in the ASF environment, also generates alternative losses, which may be similar to those resulting from the permanent cessation of production, i.e. currently about PLN 50 million per year and about PLN 275 million over the whole period analyzed.

Losses and costs are also borne by the agri-food industry and are related to the additional costs of adapting the plant to the new legal requirements related to the transport and handling of live pigs sourced from different zones, primarily the 'red zone'. These costs have been the main argument for lowering the purchase price of live pigs sourced from the 'red zone', so the processing plants have certainly not suffered a net loss on this account and have even made a profit, as they have passed the costs onto the farmers. Another cause of losses is a reduction in the supply of live pigs due to the slaughtering of pigs in outbreaks and contact farms (approximately 0.5 million pigs over the 11 years) and due to the reduction in the pig population in Poland. This explains the underutilization of the existing production capacity (higher fixed costs per unit) and unrealized production profits. Assuming the average EBIDTA profitability of the meat sector in Poland (6%) for the entire period under review, the sector earned about PLN 130 million less (nearly PLN 12 million less per year), including about PLN 30 million less in 2024. A third type of losses that are directly related to the agri-food industry and indirectly to the rest of the pork sector, is the loss of export markets. This concerned primarily the particularly price-attractive Japanese and South Korean markets, the Chinese and Ukrainian markets, where cheaper products dominated (in the case of China, as well as the Russian, Belarusian, and Kazakh markets, which were also price-attractive. A total of $ 0.55 billion worth of pork products were exported to these countries in 2013, accounting for up to 45% of Polish exports of the Polish pork sector, excluding Russia $ 0.4 billion, a loss and at least $ 4.5 billion over 11 years. Since these were also the fastest-growing export markets (notably China, Japan, and South Korea, where pork products were exported for a total of only $ 0.4 mln in 2004), it is likely that the value of exports to these countries could have doubled by 2024 (this would have been an additional approximately $ 1.0 bn over the 11 years in total). Assuming an EBITDA of 6%, the meat sector lost at least another PLN 120 million ($ 30 mln) by losing these markets. This has also resulted in lower purchase prices for pigs in Poland. The difference is statistically elusive, but 0.01 PLN of difference means about PLN 25 million of losses per year for farmers.

The fight against ASF also generates costs and losses for the state budget. Analysis of expenditures on ASF eradication and compensation for farmers recorded in the state budget as a special-purpose reserve item 12 in parts 83 and 85 ("budgets of voivodes"), section 010 ("agriculture and hunting"), chapter 01022, reveals that PLN 6.35 billion was spent for these purposes in the years 2011-2023, whereas PLN 0.93 billion and PLN 0.92 billion were reserved for 2024 and 2025, respectively (Fig. 3). This amounts to a total of PLN 8.2 billion ($ 2.05 bn), including more than PLN 1.6 billion spent on testing samples for ASF by the end of 2023 and at least PLN 1.0 billion spent on wild boar hunting, of which approximately PLN 526 million was paid to hunters between 2019 and 2023. Other important expenses were compensations of biosecurity expenses and costs of stumping out of ASF-affected

pigs. Financial support for offset the amount of income due to ASF eradication (over PLN 0.7 billion each) and to cover the difference in interest on loans to farmers (PLN 0.3 billion).

In addition to the costs incurred, the Polish state also suffers losses due to lower revenues from CIT, lower pork export revenues, and lower employment. Given the permanent budget deficit, government spending increases public debt, on which interest has to be paid. Assuming a mere 4% interest rate on government bonds, some PLN 1.2 billion ($ 0.3 bn) has already been spent over the 11 years on the servicing of additional public debt due to ASF.

The emergence of ASF in Poland has slightly accelerated concentration processes, mainly because of the permanent cessation of production by the smallest producers and increased awareness of disinfection and biosecurity among farmers. However, the simplification of biosecurity requirements for small farms is slowing down the concentration processes in Poland. According to data from Romania, where domestic pig production is dominant, 69.4% of domestic pig herds with ASF were infected by other domestic pig herds while 20.4% (11.2-33.8%) were infected by wild boars (20). Furthermore, the lack of viable support is causing both small and larger farms to abandon pig production, which is particularly evident in piglet farms. Between 2016 and 2022, the number of farms with at least 100 sows decreased by 47% to 247 farms. Meanwhile, in China, for example, the number of farms with up to 500 pigs decreased by 40% between 2018 and 2019, the peak of the ASF epidemic (20). The subsidization of large farms has accelerated the increase in the number of farms keeping more than 50,000 pigs and the share of industrial farms in the pig population (4-6, 10). The introduction of very strict requirements after the outbreak of FMD in South Korea resulted in the elimination of the smallest and least efficient pig producers within a few years.

In summary, during the 11 years of the presence of ASF in Poland, losses to the Polish economy have already exceeded PLN 20 billion ($ 5.0 bn). The highest losses were suffered by farmers. They are estimated at PLN 10.0-11.3 billion ($ 2.5-2.8 bn), of which the state compensated in various forms less than PLN 2.0 billion ($ 0.5 bn). Each outbreak accounted for PLN 0.53-0.63 million ($ 0.13-0.16 mln) of direct costs to farmers. The state budget spent at least PLN 9.4 billion ($ 4.85 bn) on the fight against ASF, subsidies for farmers, and interest on additional public debt. A relatively small loss of PLN 300 million ($ 75 million) was incurred by the meat industry. The loss of attractive export markets, to which Poland could not export pork with an estimated value of $ 5.5 billion, was also costly for the Polish economy. The spread of ASF across Poland causes increasing losses. In 2024 alone, they were conservatively estimated at PLN 1.6-2.0 billion ($ 0.4-0.5 bn) for agriculture and around PLN 1.0 billion for the state budget. This was twice as much as in 2019, when direct costs were estimated at PLN 500 million ($ 125 mln) and indirect costs were thought to be over PLN 1.0 billion ($ 0.25 bn) (8). These costs are bound to increase in the future, so the effective eradication of ASF from forest areas should be a priority for the Polish state.

Tab. 3. Estimates of lost agricultural income in Poland from 2014 to 2024

Year	Number of outbreaks in pigs	Pigs from contact holdings		Lost income (in thousands of PLN)	
		150% of outbreaks	200% of outbreaks	outbreaks + 150% of outbreaks	outbreaks + 200% of outbreaks
2014	9	14	18	1	1
2015	7	11	14	1	1
2016	1,333	2,000	2,666	211	254
2017	5,311	7,967	10,622	831	998
2018	25,395	38,093	50,790	3,467	4,160
2019	35,360	53,040	70,720	6,139	7,367
2020	61,464	92,196	122,928	9,552	11,462
2021	42,248	63,372	84,496	6,359	7,631
2022	3,064	4,596	6,128	676	811
2023	8,505	12,758	17,010	2,447	2,936
2024	26,664	39,996	53,328	6,950	8,340
Total	209,360	314,040	418,720	36,634	43,961

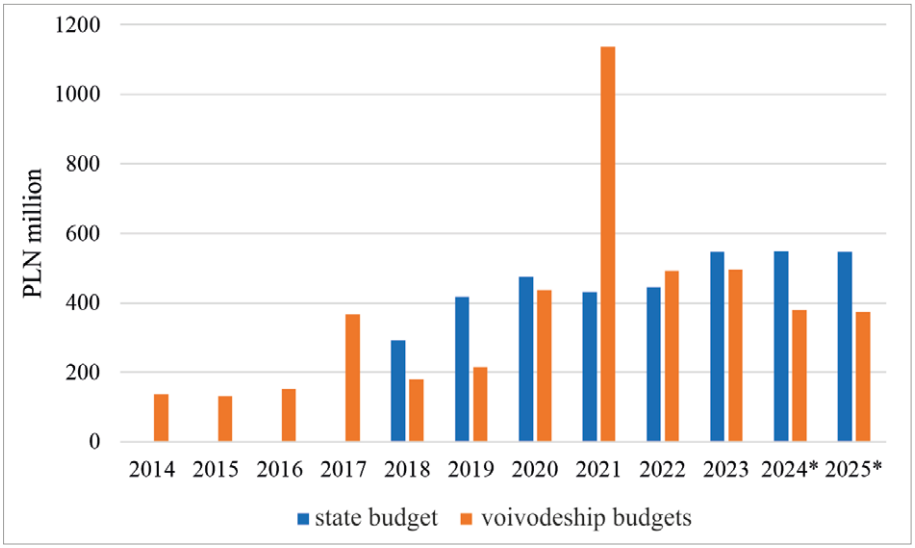

Fig. 3. Central and provincial budget expenditures related to the fight against ASF
Explanation: * Draft budgets

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Corresponding author: dr Janusz Wojtczak, Department of Animal Breeding and Product Quality Assessment, Poznań University of Life Sciences, Złotniki, Słoneczna 1, 62-002 Suchy Las, Poland; e-mail: janusz.wojtczak@interagri.pl