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## LOGISTICS MEASURES TO COMBAT AFRICAN SWINE FEVER

### ABSTRACT

**Background:** The paper was written as a result of research conducted in the field of hunting economy in Poland. The research in this aspect was inspired by the low effectiveness of the originally assumed logistical measures aimed at reducing or even eliminating the outbreaks of this extremely dangerous disease, which attacks both pigs and the wild boar population. A disease that contributes to the necessity to bear, on one hand, increasingly higher costs of preventive actions and, on the other hand, losses caused by the ban on the export of pigs from Poland. The conducted research is an empirical research, the aim of which is to indicate the necessity of coordination of all logistical measures carried out in this field with applicable legal regulations and social awareness. Presentation of best practice in this field applied in other countries struggling with ASF and proposal of an optimal model of disease eradication.

**Methods:** The basic research material was historical data including, on the one hand, data on the development of the disease in Poland (both in terms of the number of outbreaks and the area covered by the disease and potentially endangered by the disease, as well as their geographical location) and the legal regulations in force at the time and public awareness. In the aspect of the latter issue (i.e. public awareness), a questionnaire survey was conducted on deliberately selected research samples.

**Results:** As a result of the analysis, a certain model was created. It contains the necessary elements (logistical measures, legal regulations, social awareness), which in a properly designed model increase the chances of controlling the disease and its effective eradication.

**Conclusions:** Proper design of logistic processes (taking into account time and spatial coordination of all elements) and their subsequent implementation, fully coordinated with the current situation, increases the chances of fighting ASF. Lack of coordination in any scope (inconsistent legal regulations, lack of public awareness) contributes to failure and generates unnecessary costs.

**Keywords:** African Swine Fever, logistical measures, legal regulations, public awareness

## INTRODUCTION

African Swine Fever (ASF) is an extremely serious viral disease. It is caused by African Swine Fever Virus (ASFV). There are some strains of this virus that are different in terms of virulence worldwide and attack only the Suidae family of malleable pigs. This disease was first described in Kenya in 1921 and since then it has spread across many regions of the world (e.g. Chad, Tanzania, Central African Republic, Nigeria, Georgia, Armenia, Russian Federation, Spain, Portugal, [Markowska-Daniel and others 2011], Poland, Slovakia, Czech Republic, France, Malta, Brazil, Dominican Republic, Cuba [Becker 1987]). It is characterized by a very high animal mortality rate. In extreme cases it can reach/ exceed the level of 99%. [Netherton, Wileman 2013]. According to OIE studies, the incubation period of the disease should be assumed to be usually 15 days under breeding conditions (pigs). In the case of the natural environment (wild boar and swine) this period varies from 4 to 19 days. In extreme cases (the so-called acute course of the disease/infection) is shortened and lasts from 3 to maximum 4 days [Galindo-Cardiel and others 2013]. The virus is extremely resistant to various types of factors (e.g. low temperatures). It is able to maintain its infectious properties in blood, faeces, tissues (especially raw, undercooked pork or wild boar products) for even 3-6 months. [Costard et al. 2013]. According to the studies of the European Food Safety Authority (EFSA) and AHAW (EFSA Panel on Animal Health and Welfare), ASFV remains active for up to 6 years (in a darkroom at 5°C) while in a blood serum at 37°C (standard pig temperature is 38.5°C) for up to 18 months. In addition, ASFV is relatively resistant to pH changes and is active (retains its properties to infect) if the pH is between 4 and 10. As a consequence, ASFV retains its pathogenic properties in various types of processes to which cured meats are subjected (e.g. the maturing process of cured meats). ASFV survives up to 280 days in buried meat. [EFSA 2014]

ASFV is very resistant and keeps its infectious properties very long at low temperatures. In raw meat at 4°C this period can be as long as 150 days, and in the case of finished products (e.g. Parma ham) even 399 days [MCKercher et al. 1987].

The effects of different types of disinfectants on ASFV need to be discussed separately. According to studies conducted in this area, lipid solvent-based chemicals, such as 1% formaldehyde and sodium hypochlorite at concentrations ranging from 0.03 to 0.0075%, have been shown to be effective on ASFV. However, the most deadly is the 2% soda solution.

Detergents, glutaraldehyde, alkaline agents and Virkon (in a 1:100 solution) also show some disinfecting effects. Additionally, they inactivate ASFV phenol and commercial disinfectants, agents containing iodine, propiolactan, glycerine aldehyde and ethylene imine according to EFSA studies.

## **LOGISTICS ACTIVITIES TO LIMIT THE RAPID SPREAD OF THE AFRICAN SWINE FEVER VIRUS**

AFRICAN SWINE FEVER appeared in Europe relatively long time ago. The first outbreaks of that disease were reported in Spain and Portugal in 1957. Later (since 1964) the disease also appeared in France, Belgium and the Netherlands. However, ASFV has never been transmitted from the pig population of breeding pigs to the wild boar. The situation is completely different in the case of the ASFV cases in Central and Eastern Europe. There is a different route (in relation to Western Europe) of virus migration. The wild boar is the main vector of this disease. ASFV is transmitted from wild boars to other wild boars or farmed pigs via faeces, urine, blood or meat raw materials and meat processing products from wild boars and pigs. [Pejsak et al. 2018]

The scope of logistics activities aimed at limiting the speed of expansion of the geographical scope of ASFV will be limited to the territory of Poland. The first EU country attacked by a different ASFV strain (attacking Central and Eastern Europe) was Lithuania. The first case was diagnosed on 24 January 2014. After examining the genetic material, it turned out that it is identical to that found in Belarus. However, the first case in Poland was detected on 14 February 2014. After the examination of genetic material, the results obtained also (analogously to Lithuania) indicate a strain present in Belarus [Jazdzewski et al. 2016].

## **METHODS**

A method of comparative analysis was adopted as a method to determine a model solution aimed at slowing down the geographical expansion of ASF prevalence in Poland. Analyzing the current rate of ASFV prevalence expansion, it should be noted that the adopted algorithm of logistics activities did not meet the expectations. The analysis of the literature on the subject clearly indicates that in the initial period of the disease occurrence there was no proper coordination between the elements directly or indirectly influencing the logistics activities. For the period from 14 February 2014 to 13 February 2017 - 202 cases of ASF in wild boars and

23 outbreaks of that disease in pigs were confirmed. The first ASF case in Poland (located near the village of Grzybowski in the municipality of Szudziałowo, 800 metres from the border with Belarus) originated from a wild boar. Such a model of spreading the disease was not typical for ASF found in Western Europe. Consequently, there were no workable practices that could be applied in practice. Analyzing literature data, during the first 6 months of the disease in Poland the source of most infections were dead or infected wild boars. This is evidenced by the relatively small extent of virus spread. Until mid-September 2014, the area included a 10 kilometre wide and 5 kilometre long strip bordering with Belarus. In total, 15 virus cases were detected in wild boars and 2 outbreaks in pigs (small farms with extensive pig maintenance). At this stage of disease development, the logistics activities undertaken were preventive in nature (legal basis - Regulation of the Council of Ministers of 17 January 2014 [Regulation of the Council of Ministers 2014] and extended by new catalogue of activities related to bioasafety of farms conducting breeding of swine (legal basis - Regulation of the Minister of Agriculture and Rural Development of 31 March 2014). It introduced a new catalogue of orders (within bio-safety) in the scope of preventing contact between wild boars (at this stage of the main vector of disease) and pigs. In addition, bans/orders have also been introduced on the transport of pigs, feed, exhibitions, competition shows and fairs in restricted areas. Additionally, regulations concerning hunting economy were introduced. They concerned (in the restricted areas) issues related to the shooting of wild boars - there was a total ban on hunting individual boars without the consent of the district veterinarian. It also referred to (prohibition of) collective hunting. What is more, the Minister of Agriculture and Rural Development used the term: "hunting and trapping of game animals, without the consent of the district veterinarian, with the exception of individual hunting of game animals other than wild boars;". Consequently, this provision was interpreted as a total ban on organising and conducting collective hunting in restricted areas. In addition, a total ban on feeding wild boars was introduced. [Regulation of the Minister of Agriculture 2014]

The author's own research (conducted in this period) in the Supraśl Forest Inspectorate and in neighbouring communes in the group of individuals responsible for organization and physical execution of hunting management (foresters in OHZs, hunters in neighbouring hunting clubs) clearly indicates a partial lack of knowledge of the above mentioned regulation. Moreover, individual hunting was carried out until the relevant orders of the Provincial Veterinary Officer were issued to the management of hunting clubs and OHZs located in the

restricted areas. Moreover, the originally bad interpretation of the restrictions introduced by the Minister resulted in the introduction (for a certain period of time) of a total ban on hunting and trapping of all species of game animals. Later on, the ban was limited to wild boars hunting only. The lack of proper flow of information resulted in a situation in which hunters had a permit to conduct individual hunting (shooting), but did not have any information about the ban on hunting. However, it is not known whether there have been any cases of wild boar carcass acquisition without the appropriate permission of the district veterinarian.

Very interesting is the problem of hunting, with the consent of the district veterinarian. Such consent should be given after a thorough analysis of the risk related to the possible impact of such hunting on the increase in the risk of African swine fever spread (see the Regulation of the Minister of Agriculture and Rural Development of 31 March 2014). The lack of data on the elements influencing the spread of ASF (or rapidly changing information on the disease as well as the regulations of the sanitary authorities in force) caused that the administrative decisions made were highly questionable for recognized scientific authorities. The isolation management model until confirmed by laboratory tests adopted in this case did not fully work. Flis, 2019] On one hand, the adopted procedure failed. The originally published training material (26.03.2014, PIWet - PIB Puławy) was addressed more to pig breeders, not to hunters/people responsible for the implementation of hunting management (e.g. one of the factors determining the correct diagnosis by the competent veterinary services was to be a clinical trial in which a thermometer is a very important element of early diagnosis; or the statement that "laboratory testing begins in a pigsty!!!"). What is more, this instruction recommended the taking of material from animals subjected to euthanasia (such as spleen, tonsils, kidneys, lymph nodes, or in some cases lungs, or bone marrow) without blood. This condition almost completely excludes the acquisition of wild boars, the main vector of the disease at that time. Furthermore, the lack of a very thorough anatomy caused the formation of additional errors - such as e.g. sending tissues and bones or laryngeal/salivary/lymph nodes instead of tonsils. In addition, there was a high risk of transmission of donated tissues in unsuitable packaging (originally no packaging was provided for the collected tissues) such as jars (for samples with blood) or multiple samples in one packaging. Moreover, even veterinary services have sent material for testing in inappropriate packaging (e.g. needle-tubes). In addition, for organisational reasons, the "sending of samples on Friday afternoon, especially from wild boars," was reported as a gross transport error. Furthermore, the freezing of blood samples was prohibited (leading to

hemolysis, which affects the quality of the test). [Markowska-Daniel, 2014] Apart from the above mentioned aspects, there was also the possibility of ASFV spreading during the movement of the samples taken for testing as well as for the so-called gutters (inedible parts after evisceration) left in the fishery. Only since 2018 (10 August 2018), in accordance with the guidelines of the Main Board of the Polish Hunting Association, in the restricted area, shot wild boars could not be eviscerated in the fishery. It is allowed to eviscerate only in the premises of the location where the carcasses of shot wild boars are kept (specialist cold stores meeting the requirements imposed by law). In this respect, a place for evisceration must be designated at this location (i.e. a board bearing the words 'Place to eviscerate'). Moreover, the carcass holding facility itself should be equipped with disinfectant mats and mobile devices to enable the washing and disinfection of the wheels of the means of transport and (if necessary) their loading area. Carcasses of wild boars obtained should be kept refrigerated. Entrails should be collected separately and, where possible, kept at chilled store temperature. In addition, entrails and carcasses shall be marked in such a way as to be fully traceable (i.e. in such a way as to ensure their unambiguous assignment to a given carcass). It must be possible (this is specified as an obligation) for the official veterinarian to inspect the carcasses. It should be stressed that in order to maintain bio-safety rules before leaving the holding point for carcasses of shot wild boars, all disposable materials used to protect the carcass or wild boar from evisceration should be left attached to the entrails and all reusable materials should be effectively cleaned and disinfected. In addition, it is recommended that, before leaving the carcass holding facility, the means of transport by which wild boar carcasses are imported for evisceration and, if necessary, their loading area, be washed and disinfected.

Meanwhile, in areas located outside this area (i.e. the protection area under restriction), evisceration of wild boars may take place in a fishery. The gutting process itself should be carried out on foil (or other leakproof material). In addition, the evisceration site should be thoroughly disinfected with disinfectant in a proper concentration. The disinfection procedure also applies to other sites contaminated with wild boar blood (e.g. shooting, logistical processes undertaken to move the carcass to the means of transport). In order to minimize the likelihood of soil contamination with blood, it is advisable (provided that it is possible to reach the place of shooting directly) to take the carcass directly by means of transport. If access is not possible, plastic containers of a suitable size should be used to drag carcasses or uneviscerated wild boars. The decision also stresses the need to place the entrails and the film on which the gutting is

carried out in a sealed plastic container or bag. Hands and footwear must be disinfected after the above steps have been completed.

It should be noted that appropriate biosafety rules were also imposed for the transportation of carcasses of wild boars (from the place of hunting to the place where shot boars are kept). In this regard, the means of transport should be properly sealed to prevent blood leakage. In addition, these means of transport should be lined with disposable or reusable material suitable for effective cleaning and disinfection. In case of hunters engaged in or employed in the farming of pigs, hybrids of wild boars and domestic pigs or wild boars, the means of transport shall not be used for any activity related to their maintenance or farming.

In addition, the Annex to Decision [EC 2014/709/EU] also contains information on the maintenance of bio-safety rules for the collection of samples for laboratory testing. Such samples should be collected in disposable plastic tubes without anticoagulant, then placed in a string bag and labelled. The minimum volume of blood sample sufficient for laboratory testing shall be 2 ml. In addition, contamination of blood samples with substances from the carcass environment shall be avoided. Additionally, any material or equipment used for blood sampling shall be washed, disinfected or, if not available, disposed of at the end of the process. [Annex to the letter GIWz - 403-455, 2018].

On the other hand, the carcasses of wild boars (in case of restricted areas) reported for inspection had to be stored in a cold store until the result of the inspection was available. The tests themselves were long lasting (according to Markowska-Daniel, there was no ideal method that would guarantee 100% traceability - it was necessary to use at least two laboratory methods; the tests usually lasted several days). [Markowska-Daniel, 2014] At that time, there were large shortages of such installations (i.e. cold stores), especially in the restricted areas. In addition, in 2014, these facilities did not have to comply with all the current guidelines. As a consequence, there were cases of "collective storage of wild boar carcasses from several districts in accessible cold stores" (both restricted and unrestricted). In case of a positive result, only the infected carcass was disposed of. However, there were no guidelines for other carcasses in the cold store. As a consequence (despite the compliance with the sanitary procedures in force), ASFV could continue to spread uncontrollably. According to the data of the Chief Veterinary Inspectorate, 9 cold stores (out of a total of 9) were inspected in 2015 in the areas where ASF outbreaks occurred (i.e. the Białystok, Hajnowski and Sokółski districts) [Report on the activity and sanitary condition of facilities where animal products are produced, 2015]. During that period,

80 cases of ASF and 3 outbreaks of the disease were reported. [State of contagious animal diseases 2014/ State of contagious animal diseases 2015,/ State of contagious animal diseases 2016].

The situation is currently different in this regard. According to the data of the Chief Veterinary Officer, there are 1613 game purchase points (PSD) in Poland. [List of venison purchase points] They are under constant supervision of the Veterinary Inspection, which periodically (in accordance with the adopted standard not less frequently than once every two years and not more frequently than twice a year) conducts a comprehensive inspection including verification of compliance of the existing condition with the applicable veterinary regulations in full scope. At any time it is possible to carry out additional (unannounced) ad hoc inspections carried out by district veterinarians. According to the data provided by the Veterinary Inspection in response to the author's request for access to data, 389 PSDs are supervised in the areas of ASF occurrence in Poland. In 2018 (no statistical data for 2019 as of today), almost all PSDs were controlled in this inspection area (one PSD was not controlled).

It should also be emphasized that the situation in terms of public awareness of ASF has changed dramatically. In 2014, there was no practical information about this dangerous disease. The first illustrative presentations were published on the website of the CIP in Puławy at the end of 2014. They were addressed to veterinarians rather than hunters, the public or pig breeders. Due to the quantitative as well as geographical (territorial) scope of the disease, the public awareness of this serious disease was negligible. It was limited only to selected inhabitants of the affected municipalities. No information was available for visitors to these communes (e.g. pig farmers, entrepreneurs, tourists, road users, hunters). The direct consequence of such a state of affairs was the situation observed after 24 June 2016. Then the fourth ASF outbreak was observed in Hajnówka district. The outbreak which changed the further development of the disease. It was diagnosed in a pigsty (40 sows, 270 pigs). In this case, the human being was at fault. The causal factor was his ignorance, greed and willingness to make a quick profit. The vector of disease is no longer just wild boars. Sick piglets, pig tissues, contaminated straw, etc., have all become the vectors of the disease. ASF started to cover a growing area of Poland. To date (16.10.2019), according to data received by e-mail from the Office of Health and Animal Protection (Chief Veterinary Inspectorate), 5145 ASF cases in wild boars and 216 ASF outbreaks in pigs have been reported.

## RESULTS

Literature studies and author's own research clearly indicate that the lack of coordination between:

- social awareness,
- existing legal regulations and
- logistical measures

affected, affects and will affect the speed of ASF's progressing. The lack of an effective vaccine, lack of acquired immunity (despite the possession of appropriate antibodies) or the constantly expanding catalogue of disease vectors (originally wild boar, later swine, now also a man not maintaining biosafety rules or some insects - flies) causes the increase of the area where ASF effectively occurs or which are directly threatened by its appearance (protection areas, restricted areas or risk areas). An example of the lack of correlation between current legal regulations and social awareness is the analysis of the shooting of wild boars. Originally (at the very beginning of the disease, as well as in some transition periods - later) there was a total ban on shooting wild boars. Of course (due to the small area of ASF risk) it had a minor impact on the wild boar population in Poland (which at that time was steadily growing: in 2013 the wild boar population was estimated at 257 038, 2014 at 258 170). [Major hunting animals in the hunting year 2013/2014 of 31-03-2014], however, on the micro-scale - endangered areas, significantly contributed to the development of the disease. Equally ineffective were attempts to increase the acquisition of wild boars by expanding the catalogue of individuals allowed to hunt (e.g. professional soldiers, etc.). Only a broad social campaign and a change in legal regulations (e.g. Hunting Regulations, Statutes of the Polish Hunting Association, Hunting Law), as well as progress in the field of scientific research in this area, contributed to an increase in the number of wild boars acquired in the country and a decrease in their population (the shooting increased from 219 911 in the 2013/14 marketing year to 310 329 in the 2015/2016 marketing year). The population of wild boars was estimated at 241 073 in 2015 and 228 769 in 2016) [Shooting of major game in 2015/2016 on 31-03-2016], [Major game in 2015/2016 on 31-03-2016]. This situation has led to a decrease in the density of the population of wild boars in terms of number of individuals per km<sup>2</sup>. Further actions are planned to reduce the population of wild boars population and to continuously increase the effective hunting rate. An example of such logistics activities is the planned introduction of the so-called coordinated collective hunting (the so-called "large-area") for wild boars. In accordance with the proposals of the Ministry of the

Environment and the guidelines of the National Veterinary Officer, this type of hunting differs from classical group hunting for animals only because it is carried out simultaneously in hunting regions of neighbouring districts. In addition, synchronised hunting in the context of the sanitary shooting of wild boars is to be carried out in a strip of several kilometres outside the silent hunting zone in order to prevent the spread of ASF. The area of the planned coordinated shooting runs through a part of the following voivodships: Pomorskie, Warmińsko-Mazurskie, Podlaskie, Mazowieckie, Lubelskie, Łódzkie, Świętokrzyskie, Podkarpackie. It covers a total of about 320 hunting districts (map), which constitutes about 6.8% of the hunting districts leased by the Polish Hunting Association (PZŁ). [Announcement of the Chief Veterinary Officer]

The second example of correlation between the indicated elements (social awareness, existing legal regulations and logistics activities) is the human vector in the case of ASF transmission. At the beginning of the disease there was no information about this type of vector. Originally (as already indicated above), the ASF transmission vector were infected wild boars. In accordance with the legal regulations then in force (e.g. the Regulation of the Council of Ministers of 17 January 2014), the need to raise the level of public awareness of the ASF was noticed (as indicated in point 3.4 "Conducting an information campaign for entities conducting activities supervised by the Veterinary Inspectorate, related to the production of food of animal origin and feed for farmers, hunters, local authorities and the public"). Regulation of the Council of Ministers of 17 January 2014]. However, the material made available at that time (due to the initial period of research on ASF) left much to be desired in terms of substance. They took into account only one vector of disease transmission - wild boars. It was only after the first ASF case was recorded in pigs (i.e. 24 June 2016) that the situation changed dramatically. The sources of the disease were extended by a second vector - swine. In addition, a broader programme of national research on ASF and its transmission modes has been implemented. As a result of this research (e.g. in PIWet in Puławy, University of Life Sciences in Lublin and other leading research centres in Poland), social campaign (using all currently available mass media) and introduction of very strict legal regulations (e.g. Regulation of the Minister of Agriculture and Rural Development of 31 March 2014, Announcement of the Minister of Agriculture and Rural Development of 16 January 2018). on the publication of the uniform text of the Regulation of the Minister of Agriculture and Rural Development, Regulation of the Minister of Agriculture and Rural Development of 6 May 2015 on combating African swine

fever), social awareness and knowledge of the third ASF vector (human) have clearly increased. However, it is very difficult to develop a logical model in this respect. On one hand, there are premises and social acceptance for limiting the human ability to transmit ASF. This is clearly specified by the existing biosafety rules (both for pig breeding and for procedures related to hunting management processes). On the other hand, however, it is very difficult for society to accept a ban on feeding wild animals or importing animal products from abroad. However, a total lack of acceptance is observed with regard to the potential risk of ASFV transmission on footwear/clothing during people's visits to forests, meadows or fields, especially during seasonal, intensive expansion (holiday season or "mushroom picking" and the occurrence of berry, raspberry, etc. harvests).

## CONCLUSIONS

Combating a disease for which there is no cure and an effective vaccine is not easy. This is proven by numerous historical examples. The situation is no different in the case of ASF. This disease has been present on the European continent for a very long time. However, the current virus strain is new. In this case it is not possible to apply best practice used in countries struggling with this disease for a long time but in completely different conditions (e.g. Spain, France or Portugal - no vector in the form of wild boars, completely different form of human vector). The comparative analysis presented earlier clearly indicates that there is a constant need for coordination between the provisions of law, social awareness and the logistics activities undertaken. Moreover, all available means should be used to change certain stereotypes of thinking or human attitudes. This is particularly evident when trying to reduce the impact of human vectors and wildlife - wild boars. On one hand, best practices observed in countries struggling with ASF in this area (e.g. Czech Republic) or countries "preparing" and creating so-called "good initial conditions" (Germany, France) clearly indicate the need to reduce the number of wild boars population. However, in these countries there is widespread social consent for this type of action. Referring to the Polish reality in this respect, the situation of blocking hunting (both individual and collective) as well as harassment of hunters in all mass media is common. In the case of Germany or France, there are very strict legal regulations in this respect, which effectively deter potential opponents from blocking attempts (high fines or even imprisonment). In Poland, a discussion on this issue is still under way. On the other hand,

in these countries (Germany, France or the Czech Republic) the tradition of harvesting undergrowth or mushrooms is not as strong as in Poland.

It is advisable to present here a certain model, which, according to the author, will increase the chances of combating the spread of ASF in the territory of Poland. As far as the current legal regulations are concerned, it is advisable to continuously improve and update them. In March 2019, the Regulation of the Minister of Agriculture and Rural Development of 20 March 2019 on the introduction in 2019 in the territory of the Republic of Poland of the "Programme aimed at early detection of infections with the virus causing African swine fever and broadening the knowledge on the disease and its control" was announced. The programme provides for such actions as: reduction of the population of wild boars by hunting and sanitary shooting, increasing the shooting of wild boar females as an effective tool in reducing the population of this species or further banning the feeding of boars. In addition, the State Treasury will bear part of the costs related to the acquisition of wild boars and the maintenance of appropriate biosafety procedures. However, the financing of additional cold stores for the storage of carcasses of wild boars has not been addressed. A model was assumed in which the current number and territorial layout of the functioning cold stores is sufficient. It would have to be examined whether this assumption is correct (the model is based on PSD). Moreover, in order to increase the effectiveness of individual hunting, the relevant provisions were modified to allow for the possibility of using in case of wild boars hunting the heat and night vision. In this respect, it seems justified that the state should provide financial support for the purchase of such equipment by hunters/ people using this type of equipment. This is particularly important, as wild boars are an exceptionally nocturnal species. Another important issue is the disposal of waste left over from hunting. In this respect, it would seem appropriate to develop a model that would enable better protection of this type of hazardous waste (e.g. each hunting circle/HEZ to be equipped with a container, which will be collected by waste treatment plants controlled by the health authorities, if necessary).

As far as public awareness is concerned, it seems necessary to continue the awareness campaign in order to make the public aware of the important role that it plays in the spread of ASF on one hand and, on the other hand, the enormous costs to the economy as a result of restrictions on trade in pigs and possible embargoes on foreign markets. In addition, a social programme should be developed and implemented in consultation with the State Forests and the Polish Hunting Association in the area of principles of forest use and popularisation of

hunting. Only such a programme (a large-scale, long-term action) can lead to a more efficient fight against ASF (e.g. through more conscious use of the forest - not leaving animal waste or more frequent disinfection of shoes and clothing, as well as greater social acceptance for hunting - reducing the population of wild boars in Poland). It also seems appropriate to continuously train individuals directly or indirectly involved in the fight against ASF (such as entrepreneurs, breeders or hunters). In the latter case in particular, it seems appropriate to introduce an obligation for annual training in biosafety in hunting by health authorities. It should also be emphasized that scientific research should be conducted to counteract ASF (the state should secure appropriate funds for this purpose). They cannot (as it was the case so far) be limited only to veterinary specialities. They should also be extended to leading centres in the field of law, administration or necessary logistics activities. As the author's research indicates, the lack of coordination between these elements directly influences the acceleration of the ASF spread on the territory of the country. In addition, an ASF information flow management system should be implemented. Cases of dead animals must be immediately reported to the competent authority, which must take action to safeguard the site and to dispose of the carcasses. In addition, the system must be capable of coordinating all services and groups involved in the ASFV control process. The procedures for reporting new cases/accidents and, in the longer term, any compensation or additional costs incurred (e.g. biosafety for individuals/business entities suffering any loss due to ASF) should also be simplified as much as possible.

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