European Food Safety Authority

EFSA Journal 2014;12(4):3628

SCIENTIFIC OPINION

Scientific Opinion on African swine fever[1]

EFSA Panel on Animal Health and Welfare (AHAW)[2, 3]

European Food Safety Authority (EFSA), Parma, Italy

This scientific opinion, published on 4 July 2014, replaces the earlier version published on 7 April 2014*.

ABSTRACT

The risk for endemicity of ASF in the eastern neighbouring countries of the EU and spread of ASFV to unaffected areas was updated until 31/01/2014. The assessment was based on a literature review and expert knowledge elicitation. The risk that ASF is endemic in Georgia, Armenia and the Russian Federation has increased from moderate to high, particularly due to challenges in outbreak control in the backyard production sector. The risk that ASFV will spread further into unaffected areas from these countries, mainly through movement of contaminated pork, infected pigs or contaminated vehicles, has remained high. In Ukraine and Belarus, the risk for ASF endemicity was considered moderate. Although only few outbreaks have been reported, which have been stamped out, only limited activities are ongoing to facilitate early detection of secondary spread. Further, there is a continuous risk of ASFV re-introduction from the Russian Federation, due to transboundary movements of people, pork or infected wild boar. The number of backyard farms is greatest in the west of Ukraine and westwards spread of ASFV could result in an infected area near the EU border, difficult to control. In Georgia, Armenia and the Russian Federation, the risk for endemicity of ASF in the wild boar population is considered moderate, mainly due to spill-over from the domestic pig population, whereas in Ukraine and Belarus this was considered to be low. In those areas in the Russian Federation where wild boar density is high, this risk may be higher. Intensive hunting pressure in affected wild boar populations may increase the risk for spread, possibly with severe implications across international borders. The risk for different matrices to be infected/contaminated and maintain infectious ASFV at the moment of transportation into the EU was assessed and ranged from very high for frozen meat, to very low for crops.

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KEY WORDS

African swine fever, risk assessment, endemicity, domestic pigs, wild boar, Eastern Europe

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[3] Acknowledgement: The Panel wishes to thank the members of the Working Group on African Swine Fever: Anette Bøtner, Sergei Khomenko, Frank Koenen, Liisa Sihvonen, Hans-Herman Thulke and José Manuel Vizcaino for the preparatory work on this scientific opinion, the hearing experts: Maria Luisa Arias, Daniel Beltran-Alcrudo, Sandra Blome, Klaus Depner, Vittorio Guberti, Claire Guinat, Anton Karaulov, Jonna Kyyrö, Tigran Markosyan, Iwona Markowska-Daniel, Dmitry Morozov, Külli Must, Carsten Potzsch, Dietrich Rassow and Mikheil Sokhadze, and EFSA staff: Sofie Dhollander, Justyna Jaskiewicz and Andrey Gogin for the support provided to this scientific opinion.

* Minor changes of editorial nature were made. The changes do not affect the contents of this scientific opinion. To avoid confusion, the original version of the scientific opinion has been removed from the website, but is available on request, as is a version showing all the changes made.

Suggested citation: EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), 2014. Scientific Opinion on African swine fever. EFSA Journal 2014;12(4):3628, 77 pp. doi:10.2903/j.efsa.2014.3628

Available online: www.efsa.europa.eu/efsajournal

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SUMMARY

Following a request from the European Commission, EFSA's Panel on Animal Health and Welfare (AHAW Panel) was asked to deliver a scientific opinion on African swine fever and to update the significance of the occurrence and risk of endemicity of ASF in the countries neighbouring the EU (Term of Reference 1, ToR1). Secondly, the AHAW Panel was asked to rank the possible pathways of introduction of ASFV into the EU on the basis of their level of risk, with a view to enhance preparedness and prevention (ToR2).

To address the first ToR, an update was provided on the ASF situation in the eastern neighbouring countries of the EU since the last Scientific Opinion on African swine fever of the EFSA Panel on Animal health and Welfare (EFSA AHAW Panel, 2010a). To do so, an extensive literature review was carried out, describing the geographic distribution of ASFV, the epidemiological features of the outbreaks and challenges for ASFV prevention and control in the eastern neighbouring countries of the EU. The literature review also screened if new information has become available about the appearance of clinical signs and the detection of antibodies. The same qualitative risk assessment model was used as in the risk assessment carried out in 2010 (EFSA AHAW Panel, 2010a), but the parameters for which sufficient evidence was found, possibly resulting in a change of the risk estimates, were elicited through expert knowledge elicitation, using a nominal group technique approach.

The experts judged that the risk that ASF is endemic in Georgia, Armenia and the Russian Federation has increased from moderate to high, particularly due to challenges in outbreak control in the backyard production sector. The risk that ASFV will spread further into unaffected areas from these countries, mainly through movement of contaminated pork, infected pigs or contaminated vehicles, has remained high. In Ukraine and Belarus, the risk for ASF endemicity was considered moderate. Although only few outbreaks have been reported, which have been stamped out, only limited activities are ongoing to facilitate early detection of secondary spread. Further, the experts judged that there is a continuous risk of ASFV re-introduction from the Russian Federation, due to transboundary movements of people, pork or infected wild boar. The number of backyard farms is greatest in the west of Ukraine and westwards spread of ASFV could result in an infected area near the EU border, difficult to control. In Georgia, Armenia and the Russian Federation, the risk for endemicity of ASF in the wild boar population is considered moderate, mainly due to spill-over from the domestic pig population, whereas in Ukraine and Belarus this was considered to be low. In those areas in the Russian Federation where wild boar density is high, this risk may be higher. Furthermore, the experts judged that intensive hunting pressure in affected wild boar populations may increase the risk for spread, possibly with severe implications across international borders.

To address ToR2, an extensive literature review looked into the detection time of the virus in different matrices. Then, the matrices were ranked according to their risk to be infected/contaminated and maintain infectious ASFV at the moment of transportation into the EU, based on expert knowledge elicitation. This ranking did not take into account possible volumes of these matrices transported into the EU. The risk for different matrices ranged from very high for frozen meat, to very low for crops.

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BACKGROUND AS PROVIDED BY THE EUROPEAN COMMISSION[4]

African swine fever (ASF) is a highly contagious and fatal disease of domestic pigs and wild boar that is transmitted through direct contact, ingestion of contaminated feedstuffs and certain tick species. ASF is considered one of the most dangerous animal diseases of pigs; it affects trade and has a serious socio-economic impact on people's livelihood.

ASF is transmitted by direct contacts between infected and uninfected animals; it is also transmitted through feeding of virus contaminated products (swill and garbage waste) and through vectors.

ASF was confirmed in Georgia in 2007 and then it spread to the Russian Federation where numerous outbreaks have been notified in domestic pigs and wild boar. In 2012 an outbreak of ASF was reported in Ukraine and in 2013 Belarus confirmed the disease in a backyard holding in the region of Grodno, some forty kilometres from the Lithuanian border. In July, a second outbreak was confirmed in a commercial holding in Belarus, close the Russian border. Although there are not recent official reports of new cases in Belarus, there is indication that the ASF epidemic is still on-going there, possibly in domestic pigs and wild boar

The main measures to control ASF are laid down in Council Directive 2002/60/EC and Commission Decision 2003/422/EC. No vaccine is available to prevent ASF infection and the control provisions applied in case of an outbreak are based on classical disease control measures.

The ASF epidemiological situation has changed significantly in Eastern Europe in the last year and the presence of the disease close to the EU border represents a serious risk to the livestock population of the Union and a challenge for animal health risk managers. It is therefore necessary to better determine the extent of the problem in order to better target preventive and control measures in the light of the current evolution of the ASF epidemic at the EU border updating and completing the scientific opinion issued by EFSA in 2010.

TERMS OF REFERENCE AS PROVIDED BY THE EUROPEAN COMMISSION

In view of the above, and in accordance with Article 29 of Regulation (EC) No 178/2002, the Commission asks EFSA for a scientific opinion on:

- Update the significance of the occurrence and risk of endemicity of ASF in the countries neighbouring the EU at higher risk;
- The evaluation of all the possible pathways of introduction of ASF into the EU, ranking them on the basis of their level of risk with a view to enhance preparedness and prevention.

[4] Background as provided by the European Commission on 22/10/2013.

ASSESSMENT

1. Introduction

The ASF situation in the infected areas is very dynamic. The mandate was received on 22/10/2013 and the background information, provided in Section 2, was updated until 31 January 2014.

African swine fever virus (ASFV) was introduced into Georgia in 2007 and since then it has further spread throughout the Caucasus and the Russian Federation. In July 2012, ASFV entered Ukraine and recently, in June 2013, it was notified by Belarus (OIE, 2013). In January 2014, ASF was again detected and confirmed in Ukraine both in wild boar and domestic pigs and in the Lithuanian population of wild boar (OIE, 2014). In 2009 the European Commission requested a Scientific Opinion on African Swine Fever from EFSA on the risk of endemicity of ASF in the in Trans Caucasian Countries and the Russian Federation, and the risk for the introduction of the virus into the EU from these eastern neighbouring countries (EFSA AHAW Panel, 2010a). In that same period, a Scientific Opinion on the Role of Tick Vectors in the Epidemiology of Crimean-Congo Hemorrhagic Fever and African Swine Fever in Eurasia was adopted, which provided the status on the current state of knowledge the role of the tick vectors in the epidemiology of African swine fever (EFSA AHAW Panel, 2010b). Besides, a detailed Scientific Review on African Swine Fever describing the global occurrence, aetiology, pathobiology, epidemiology, diagnosis, prevention, control and eradication of ASF was carried out by a consortium between the UCM, FMV-UTL and CIRAD (Sánchez-Vizcaíno et al., 2009).

This opinion deals with an update on the situation in the eastern neighbouring countries of the EU (The Russian Federation, Georgia and Armenia), but now also including Ukraine and Belarus, and aims to update the risk for endemicity (including further spread to unaffected areas) since the last Scientific Opinion on African Swine Fever in these countries (EFSA AHAW Panel, 2010a). To do so, a literature review was carried out, describing the geographic distribution of ASFV in the neighbouring countries (Section 2.1), the epidemiological features of the outbreaks (Section 2.2) and challenges for ASFV prevention and control in the eastern neighbouring countries of the EU (Section 2.3). The literature review looked also if new information has become available about the appearance of clinical signs (Section 2.4) and the detection of antibodies (Section 2.5). These aspects were considered relevant for the assessment of the risk for endemicity. The same qualitative risk assessment model was used as in 2010, but the parameters for which sufficient evidence was found, possibly resulting in a change of the risk estimates, were elicited through a nominal group technique (NGT) expert knowledge elicitation approach (see Section 3.1 for methodology and 4.1 for the results) for this scientific opinion.

The second ToR requested to evaluate all the possible pathways of introduction of ASFV into the EU, and to rank them on the basis of their level of risk with a view to enhance preparedness and prevention. After further clarification with the requestor of the mandate, it was decided to address only transport of infectious/contaminated matrices for this ToR2. Other potential pathways of introduction of ASF, were already addressed in the previous Scientific Opinion on ASF (EFSA AHAW Panel, 2010). Further, movement of infected wild boar and pigs into unaffected areas (e.g. transboundary movement of wild boars or movement of free ranging pigs) were reconsidered in ToR1 and thus these pathways were not considered as a 'contaminated matrix' that could be transported into the EU.

To address ToR2, an extensive literature review looked into the detection time of the virus in different matrices (Section 2.6). Then, the matrices were ranked according to their risk, based on expert knowledge elicitation. This ranking did not take into account possible volumes of these matrices transported into the EU (see Sections 3.2 for methodology and 4.2 for the results).

This scientific opinion did not aim to update the actual risk of introduction of ASFV as such, but only compared the plausibility of possible virus sources to contain infectious virus at the moment of

introduction. Recently, several research projects have focussed on the introduction of ASFV into the EU, e.g. through legal movement of live pigs (Mur et al., 2012a); through other transport associated routes, such as returning trucks and waste from international ships and planes (Mur et al., 2012b); through illegal transport of animal products (Costard et al., 2013) or by wild boar (De la Torre et al., 2013), using semi-quantitative approaches, except for the legal import pathway that was estimated quantitatively. Furthermore, several detailed risk profiles were developed on a national level, such as the risk profile developed by the Finnish Food Safety Authority (EVIRA, 2011), the Estonian Institute of Veterinary Medicine and Animal Sciences (Viltrop and Jeremejeva, 2011), the Federal Research Institute for Animal Health of Germany (FLI, 2011) and DEFRA (2011, 2012, 2013). Most recently, the ARRIAH (All-Russian Institute for Animal Health) has published a new forecast on the African swine fever situation in 2014 in the Russian Federation (Dudnikov et al., 2014), which predicts that the risks of ASF spread within the country, as well as to its neighbours in 2014 will remain very high.

The information provided in Section 2 (Update of the ASF situation) is based on information extracted from peer-reviewed scientific papers or media reports. When reference is made to media reports, this is explicitly mentioned in the text and the web-link was inserted. The information provided in the Section 4 (Results) is a summary of the expert opinion elicitation provided in Appendix A and B.

2. Update of ASF situation in the countries neighbouring the EU

2.1. Geographic distribution of notified ASF outbreaks in the eastern countries neighbouring the EU

2.1.1. South Caucasus Countries

On 5/06/2007 ASFV (Georgia 2007/1 isolate) was introduced into Georgia by ship waste, which was disposed around the port of Poti and subsequently the virus quickly spread through the whole country with fifty eight outbreaks notified to the OIE. Since 16/01/2008, there were no more notifications and the situation appeared as resolved on the OIE WAHID website. Georgia and Armenia were not declared free of ASF by OIE.



Figure 1: Outbreaks in the southern Caucasus (FAO EMPRES-i and media reports until 31/01/14)

Since the first notification of African swine fever in Armenia, on 29/08/2007, 13 further outbreaks have been notified. Since 30/12/2007 up to 2010, the situation appeared as resolved on the OIE WAHID website; however, 4 more outbreaks of ASF in 2010 and other 11 in 2011, were declared to the OIE, which probably represented just a part of the actual epidemic. These outbreaks affected wild boar population and domestic pigs very close to the Georgian border (less than 30 km), revealing the persistence of the virus in the area (Sánchez-Vizcaíno et al., 2013). This fact is supported by the media that still reports cases of ASF, such as the following: in May in the Republic of South Ossetia in the Zanurskiy region bordering with Georgia (http://www.fsvps.ru/fsvps/asf/news/6602.html); and in July and August 2013 in two regions of the Republic of Armenia (Tavush and Lory) bordering with the Georgia and the Azerbaijan (http://news.am/eng/news/165266.html; http://www.armtoday.info/default.asp?Lang=_Ru&NewsID=94082).

Azerbaijan has a very low density of domestic pigs, and pig husbandry is highly clustered in the few Christian communities. The only reported outbreak occurred in January 2008 in Nidzh, a village where about half of the national pig population was kept. In June 2011 Azerbaijan submitted a self-declaration regarding ASF free status to the OIE, however, several ASF outbreaks were reported in the media from the disputed area called Nagornyi Karabakh in February 2013 (see Figure 1, https://www.kavkaz-uzel.ru/articles/219762/https://www.kavkaz-uzel.ru/articles/219762/).

2.1.2. The Russian Federation

Oganeysyan et al. (2013) have analysed the spatio-temporal patterns of ASF occurrence in the Russian Federation, in the wild boar and domestic pig populations. According to these authors three phases could be distinguished, since the first introduction at the end of 2007 by a wild boar in the Shatoy'skoe Ushel'e of the Chechen Republic (November 2007).

First, they describe the development of the endemic area in the South and North-Caucasian Federal districts in the period 2008-2010. The ASF epidemic that began in Chechnya in 2007 continued to spread in the population of wild boar toward the west. Of great importance in the Russian Federation ASF epidemic was the epidemiological chain of events occurring in 2008 in the Republic of North Ossetia-Alania, involving direct contact and ASFV transmission between infected wild boar and domestic pigs. This was facilitated by the practice of free range pig farming, traditional in the southern regions of Russia (Gogin et al., 2013). The first outbreaks in domestic swine were reported in June 2008, in the Republic of North Ossetia. In the second half of 2008, OIE posted reports of 44 outbreaks of ASF in the Republic of North Ossetia, the Chechen Republic, the Republic of Kabardino-Balkaria, the Krasnodarskii and Stavropol'skiy Kray. In the three consecutive years, a total of 177 outbreaks were reported in this area (Oganeysyan et al., 2013).

In a second phase, between 2011 and 2013, besides the continuation of the outbreaks in the Caucasus districts, the disease started to spread further from the endemic zone toward the European part of Russia, covering new territories such as the Saratovskaya Oblast, the Nizhny-Novgorodskaya Oblast, the Voronezhskaya Oblast, the Kurskaya Oblast, the Tverskaya Oblast, the Leningradskaya Oblast, the Murmanskaya Oblast and the Arkhangelskaya Oblast (Oganeysyan et al., 2013).

Since 2012, a second endemically affected region has formed in the Tverskaya Oblast. In the first six months of the year, the majority of outbreaks also were registered in the Krasnodarskiy Kray, the Volgogradskaya Oblast (Oganeysyan et al., 2013).

In 2013 many outbreaks were registered not only in central European part of Russia (the Voronezhskaya Oblast', the Moskovskaya Oblast'), the northern endemically affected region extended to the eastern (the Yaroslavskaya Oblast') and to the western part of the Russian Federation, first of all to the Smolensk Oblast' and then to the Pskov Obalst', bordering with Belarus. Simultaneously outbreaks in domestic pigs and wild boar continued to be registered in southern endemic zone: the Volgogradskaya Oblast' and the Rostovskaya Oblast' bordering with Ukraine (see Figure 2).

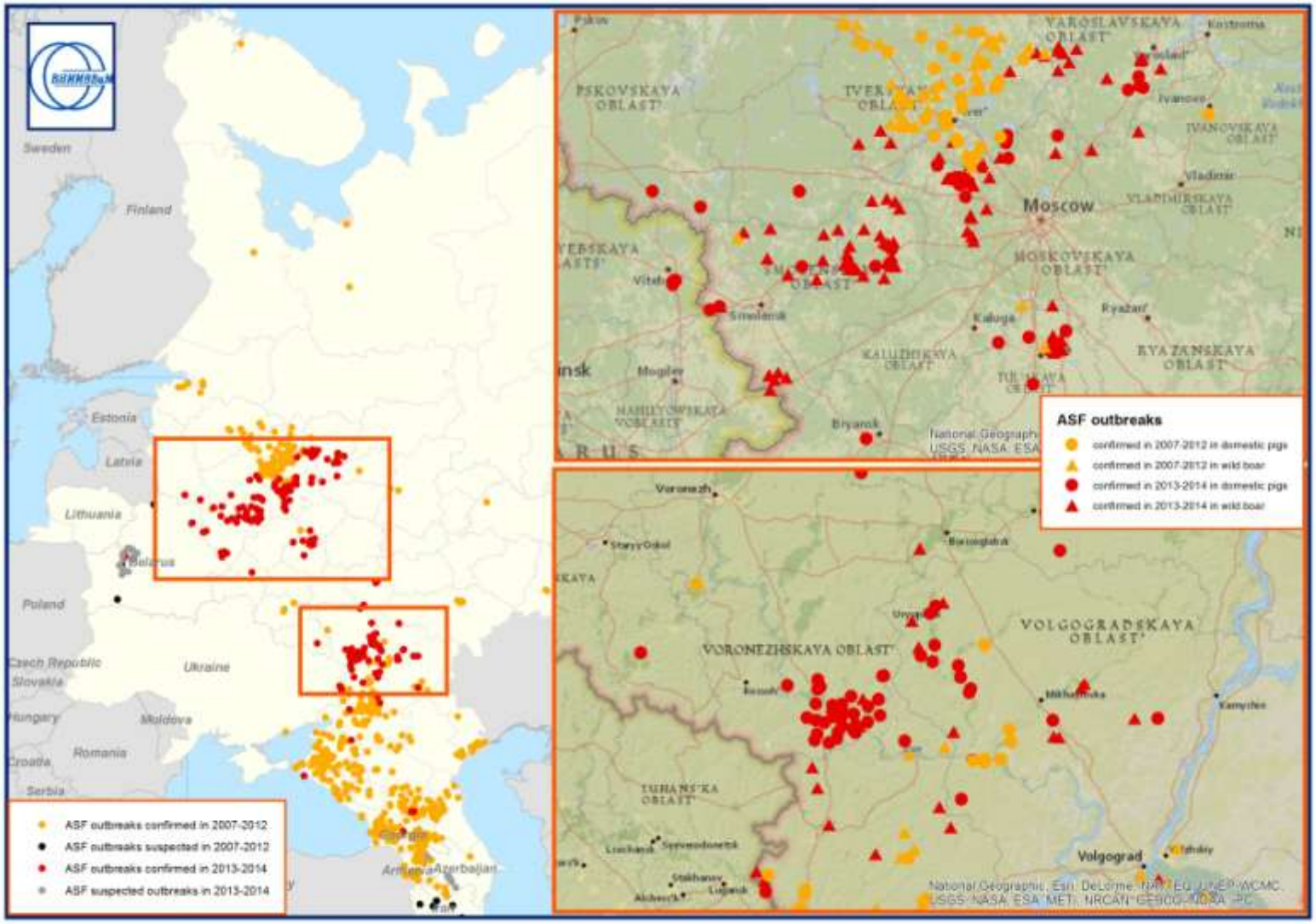


Figure 2: ASF outbreaks in the Russian Federation reported until 31/01/2014 (source: NIIVViM, Pokrov, http://fsvps.ru/fsvps-docs/ru/iac/asf/2013/2013-12-27/10.pdf)

2.1.3. Ukraine and Belarus

In Ukraine, an ASF outbreak was notified on 30/07/2012 to OIE in the Zaporozhye region at the Black Sea Coast, East of the Crimean peninsula (OIE, 2012; see Figure 3). This was the first time ASF has been reported in the Ukraine since an introduction decades ago into the USSR (http://www.agronews.ru/news/detail/118305/).

The second case of ASF in Ukraine was reported on 06/01/14 in wild boar, which was found on the riverside at the border with the Russian Federation (Rostovskaya oblast), - affected by ASF since 2009. The last outbreak in wild boar has been confirmed in the bordering territory on 30/12/2013 (Official website of Rostov Regional Veterinarian Service: http://uprvetro.donland.rB/Ulog/ViewPost.aspx?pageid=55665&ItemID=106918&mid=50494).

Subsequently, ASFV has been detected also in wild boar hunted in this border area (http://irtafax.com.ua/news/2014/01/2014-01-13-66.html; http://lugansk.comments.ua/news/2014/01/13/160104.html). Both animals seem to have escaped intensive hunting pressure just across the border where even helicopter driven hunts were conducted in order to exterminate wild boar. This outbreaks triggered disease control measures in the radius of 10 km. Three villages were quarantined and all backyard pigs (slightly more than 100) were slaughtered and processed as a precautionary measure. On 30 January 2014, ASF was found on a small farm in Lugansk Oblast in some 20 km from the place where positive carcass of wild boar was previously found.

Belarus has reported ASF for the first time in backyard pigs in the region of Grodno in the west of the country on 21/06/2013. On 4/07/2013, the second outbreak was reported in Vitebsk region, the area that is close to the Russian border (OIE-WAHID, online). There are multiple media reports on ASF control measures implemented in Belarus before and following these two officially reported cases, which describe either suspicious mortalities in wild boar or domestic pigs in 2012-2013, involving quarantine and depopulation of domestic pigs, and depopulation of wild boar.

On the 9th and 27th of January 2014, the Russian Federation lifted the temporary restrictions imposed earlier on the pig farms and meat-processing plants, located in the Brest Oblast and in the Mogilev Oblast of the Republic of Belarus respectively (http://fsvps.ru/fsvps/news/8583.html?_language=en). Taking into account the fact that Belarus is a member of the Customs Union, which implies the absence of customs and veterinary controls when passing the Russian border, where a difficult situation with ASF has been seen for the past 5 years, and taking into consideration the large number of ASF outbreaks in the central federal area of Russia in 2011 (http://www.tmb.ie/destinations/news.asp?id=185803), the risks remain that ASF can be re-introduced into Belarus. Furthermore, there is concern that ASFV may have been spilled over in the wild boar population in the areas bordering Smolensk oblast and possibly in other parts of Belarus.

Based on the official information, there have been only a few outbreaks in Ukraine and Belarus. However, considering unofficial information, these may not have been the first cases. The reported outbreaks have all been controlled rapidly.

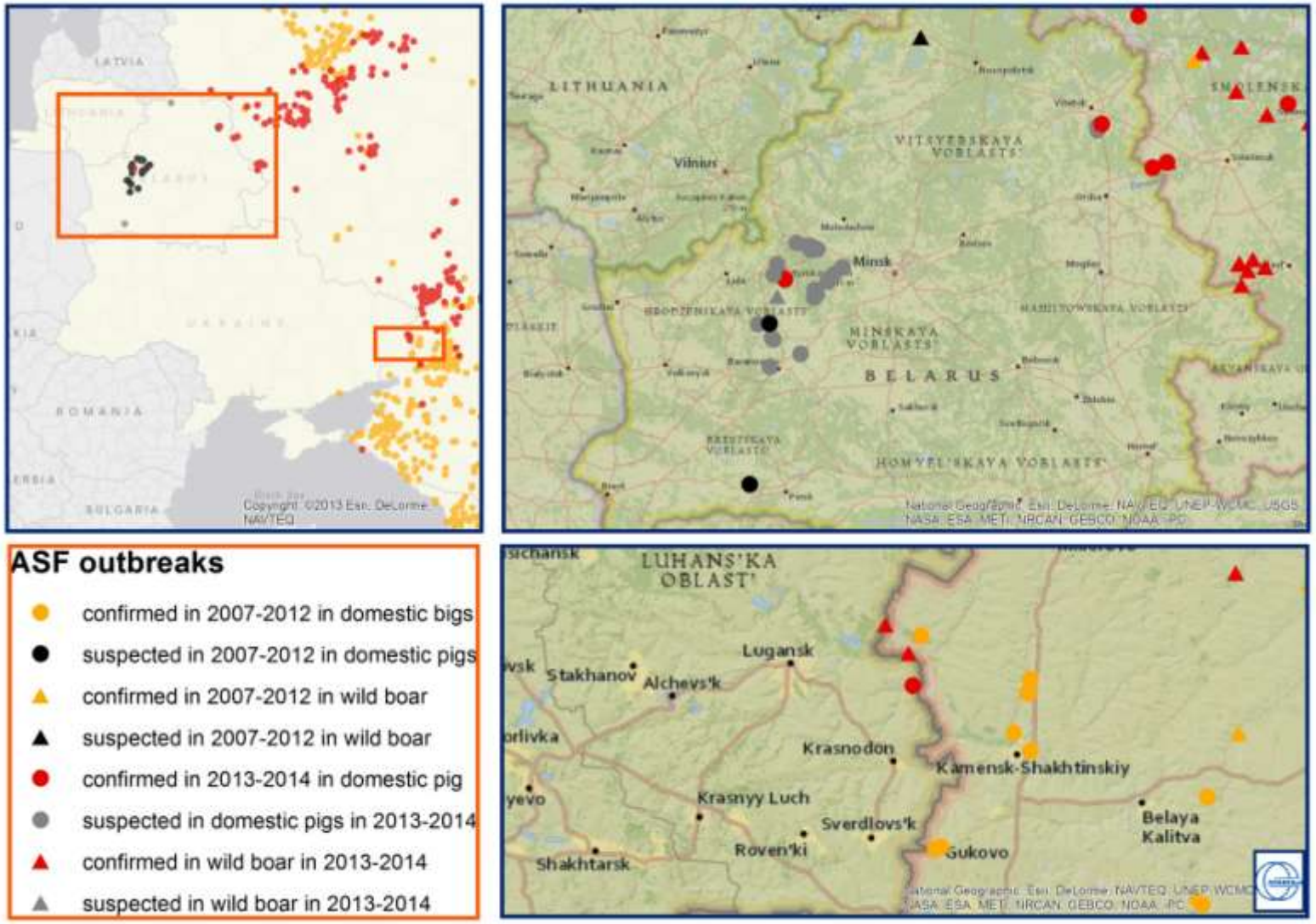


Figure 3: ASF outbreaks in Ukraine and Belarus, reported until 31 Jan. 2014 (FAO EMPRES-I and media reports)

2.2. Epidemiological features of ASF outbreaks in the third countries neighbouring the EU

2.2.1. South Caucasus Countries

2.2.1.1. Outbreaks in pig holding of different biosecurity

In Georgia and Armenia, most pigs are located in backyard farms (85-97 %, FAO, 2013) and it is this sector that has suffered primarily from the ASF epidemic.

2.2.1.2. Seasonality of the outbreaks

Data available for historical outbreaks in Armenia (Figure 1) suggest that the ASF seasonality pattern seems to be different from what is observed in the Russian Federation (Figure 4). In 2010-2011 an increased ASF incidence in backyard pigs was observed in the beginning of production season in February-March (the first seasonal peak accounted for 25 % of outbreaks) and closer to its end in August through November (52 % of outbreaks). This apparently reflects differences between production systems in these countries. In Armenia, ASF outbreaks were nearly exclusively registered in the areas with free-range pig production.

2.2.1.3. Possible risk factors for spread of the disease

The situation regarding possible risk factors for spread of the disease in the South Caucasus countries was considered as unchanged, since no new information was available since 2010.

2.2.1.4. Main mechanism for virus maintenance and re-introduction of ASFV

The situation regarding maintenance and re-introduction of ASFV in the South Caucasus countries was considered as unchanged, since no new information was available since 2010.

2.2.2. The Russian Federation

2.2.2.1. Outbreaks in pig holding of different biosecurity

The production systems of the Russian Federation can be divided into three main categories: 1) specialized, industrial production units with generally a high level of biosecurity (HB) 2) small commercial farms and 3) backyard subsistence production, with 61 %, 5 % and 34 % of the total population respectively). The last two categories have typically a low to non-existent level of biosecurity. These low biosecurity (LB) sectors are generally more susceptible to incursions of ASF (FAO, 2013).

An analysis of all ASF outbreaks since 2007 revealed that most outbreaks were reported in the backyard pig production sector (63.2 % of total number of outbreaks), followed by cases in small- and middle-scale commercial pig farms (18.2 %) and outbreaks in specialized pig production units (16 %). Most number of affected large pig farms (36 of 51 holdings) are located in the Krasnodarskiy kray.

In 2013, most outbreaks in the backyards sector were registered in the central part of European Russia – in the Voronezhskaya, Smolenskaya, Moskovskaya and Yroslavskaya oblast'(Figure 2) (Belyanin, 2013). ASF virus was detected at 14 slaughterhouses, meat processing plants and food stores, which were epidemiologically linked with the affected holdings, and the virus was also detected in 25 cases of illegally disposed carcasses of domestic pigs.

Since 2007, about 40 % (39.8) of all the registered ASF outbreaks/cases were in wildlife (Figure 4). Since 2012, a characteristic feature was the identification of a large number of so called 'infected objects' in the environment (the locations where carcasses of wild boar were discovered or infected animals were identified). Ninety three of 106 ASF outbreaks in wild boar in 2013 were registered as 'infected objects'. Since they were not considered by the official veterinary authorities as outbreaks, these infected objects have not been notified to the OIE (National Institute of Veterinary Virology and Microbiology, Pokrov).

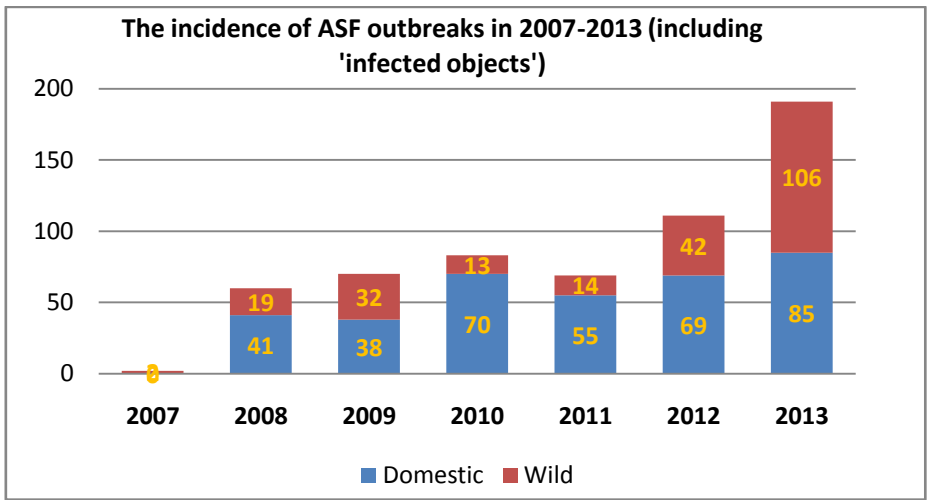


Figure 4: The incidence of ASF outbreaks in the Russian Federation

2.2.2.2. Seasonality of the outbreaks

The seasonality of ASFV detections in wild boar in 2008-2012 has been shown to be bi-modal (spring-early summer and winter months), which has been linked to the ecology of the species and timing of spill-overs from domestic pigs (FAO, 2013; Dudnikov, 2014). However, once data for 2013 was included, the seasonal incidence charts for domestic and wild pigs appeared to look very similar, suggesting that in 2012-2013, outbreaks in wild boar more and more often occurred as epidemics that were seasonally synchronised with those in domestic pigs (Dudnikov et al., 2014), and are mainly observed in summer and fall (see Figure 4). The authors have pointed out that the current surveillance for ASF in wild boar (based on a mix of passive surveillance for mortalities and opportunistic hunting, focused on the ASF affected areas and aiming at population control) is not likely to adequately describe real seasonal prevalence and incidence of the disease in the Russian Federation. This issue needs to be urgently addressed in order to better understand evolving epidemiological patterns of ASF in wild boar population (Dudnikov et al., 2014).

The lowest ASF incidence is observed from December through May, when most adult pigs in the LB sector have been slaughtered for the Christmas celebrations and the remaining population consists mainly of sucking piglets. Once the disease is introduced in the LB sectors, its prevalence starts to increase towards the middle of the production season (June to August), when pig population density and activities both increase (FAO, 2013). In conclusion, the most intense period for spread of ASFV can be expected to be during the summer months.

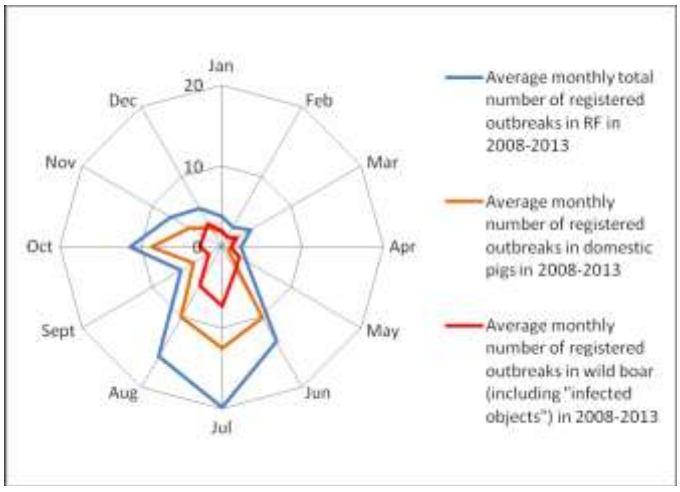


Figure 5: Seasonality of ASFV detections in the Russian Federation in 2007-2013 (total, wild boar and domestic pigs)

2.2.2.3. Possible risk factors for spread of the disease

Spread through introduction of infected pigs in the herd

Introduction of infected pigs in the herd can occur during the incubation period, before the onset of clinical signs, e.g. to repopulate farms. Quarantine measures are often not adequately applied in outbreaks in low biosecurity farms. Often, the separation of the epidemiological unit will be defined by the separation of backyards, or parts of villages, when in reality, the population of the entire settlement may be affected and should be under quarantine (Oganesyan et al., 2013).

Spread through swill feeding with contaminated pork

The FAO Empress report (2013) states that the source of ASFV in the Russian ASF outbreaks is mostly through contaminated swill. Low biosecurity holdings commonly use swill as supplementary feed, often including untreated possibly ASF-contaminated pork or pig products. Often, infected meat may have been stored chilled, frozen or after treatment and kept over long periods of time, thus acting as source of ASFV, since low temperatures and some non-heat treatments do not inactivate the virus. Also, the involvement of catering services, using frozen meat, has lead to distant spread of ASFV (Dudnikov, 2011). The spread of ASF through contaminated meat has also been reported more than once in the media, e.g.: http://www.rg.ru/2012/08/20/reg-cfo/chuma.htmlthat.

Additionally, Gulenkin et al. (2011) concluded from their spatio-temporal analyis of the outbreaks in the Russian Federation that the distribution of cases among domestic pigs coincided with the main transportation routes and the distribution of population density. Thus, they hypothesized that a likely cause of disease spread northwards into Russia could have been the trade of animals and animal products (Gulenkin et al., 2011).

Spread through spill over into the wild boar population

Of all registered outbreaks/cases of ASF in the Russian Federation, 40 % were in wild boar. Almost all positive wild boar were found in regions with previous detections of ASF`V infections in domestic pigs (OIE, 2014). Usually, the wild boar get infected through scavenging on illegally disposed ASF-infected pig carcasses from the domestic sector. Once ASFV enters the wild boar population, it spreads as a result of active social interactions, leading to localized epidemics, where most of the wild boar population dies. Wild boar are capable of sustaining limited transmission for several months when there is a high population density and favourable timing for virus introduction. Nonetheless, until now there is not enough evidence to suspect that an independent year-round ASF transmission cycle in wild boar got established in the Russian Federation (FAO, 2013).

Many studies carried out in other ASF infected areas in the EU (i.e. in Sardinia), suggest that ASFV tends to disappear in wild boar populations when the interaction with infected domestic or free range pigs is limited (Laddomada et al., 1994; Manelli et al., 1997, 1998; Rolesu et al., 2007; Mur et al., 2012). The probability of transmission of infectious diseases through direct or indirect contact between susceptible wild boar populations depends on many factors, including the population density (Diekman et al., 1995). The correlation between the wild boar density and the possible presence and duration of other infectious diseases, such as Aujesky disease, classical swine fever, foot and mouth disease, porcine circovirus type 2 and tuberculosis, has already been described (Vicente et al., 2004, 2013; Rossi et al., 2005; Gortázar et al., 2006; Acevedo et al., 2007; Boadella et al., 2012; EFSA, 2014b. However, it is currently impossible to know the population density threshold for ASFV spread in wild boar populations, due to lack of knowledge on the exact population size and population dynamics and the epidemiology of ASF in wild boar. Further, the extent of potential spread and maintenance in the population are not well understood (EFSA AHAW Panel, 2014).

In the Tver Oblast in the Russian Federation, in 2011 and 2012, for example, spill-over of ASFV by domestic pigs has led to numerous infections of wild boar, which might have been, again, the source of outbreaks in domestic pigs, through direct or indirect transmission, especially to pigs farmed in the backyard farms.

It may be difficult to judge whether the infected wild boar are merely the cause of spill over from domestic pigs or, alternatively, if maintenance of ASFV in the wild boar population in this particular

area occurs. This needs to be evaluated through an appropriately designed field surveillance scheme (Dudnikov et al., 2011, 2014). According to the Empress (FAO, 2013), it seems much more likely that the backyard sector serves as the major source of virus from which ASFV spills both to wild animals and industrial units. The lack of biosecurity in this sector could be the reason for this.

Currently available evidence does not allow concluding whether wild boar can serve as a maintenance host or only serve as spill over host.

In the context of possible wild boar role in the spread of ASF, the intensive hunting of animals in the affected areas of the Russian Federation needs to be seriously taken into account. It is well known that intensive hunting pressure on wild boar population leads to dispersion of groups and individuals (Sodeikat and Pohlmeyer, 2003; Thurfjell et al., 2013). Heavy hunting of the affected wild boar populations may significantly increase transmission and facilitate progressive geographical spread of ASF, as may have been the case in January 2014 in Ukraine. The two positive wild boar found in Lugansk Oblast have escaped from intensive hunting on the Russian side of the border to Ukraine. Similar incidents are possible along the border of affected countries (e.g. Belarus) with the EU Member States, after the recent preventive depopulation campaign that was carried out in Belarus in wild boar.

Spread through contaminated feed, vehicles or people

According to FAO (2013), secondary spread through fomites, such as contaminated vehicles, represents 1 % of all the sources of the outbreaks in the Russian Federation. Also people from holdings nearby, or professionals visiting the farms during outbreak investigations, have been shown to be the source of secondary spread. Furthermore, it has been reported that farmers sell potential contaminated feed when suspecting an outbreak, to avoid economic losses in case a confirmation of ASF. To identify the possible routes of ASFV transmission in the Russian Federation, based on the results of the epidemiological investigations, it has been shown that the main routes of virus transmission were through animal movement (38 %) and through swill feeding (35 %). At the same time, in 23 % of outbreaks (including single cases), the routes of transmission were not established (Belyanin, 2013; see Table 1).

Table 1: Main sources and routes of transmission established during the outbreaks of ASF in domestic pigs in years 2008-2012

Source and transmission of virus	Number	%
Selling infected pigs	1	0,3
Neighbourhood (infected pigs in backyards)	5	1,7
Direct contact with humans (having a meal right at the farm)	1	0,3
Contact during transportation, shipping, movement	108	38
ASFV infected wild boar	4	1,4
Swill feeding	100	35
Not established	65	23
Total:	284	100

Source: Belyanin, 2013

Spread through infected ticks

The involvement of tick vector in epidemiology of ASF in Russian Federation is not well understood. *Ornithodoros* ticks move over short distances only by being carried passively on the host during acquisition of a short blood meal, but otherwise they only occupy burrows or buildings (EFSA AHAW Panel, 2010b). Studies on other ASFV isolates showed that titres sufficient for virus transmission to the host during feeding can be sustained in the tick up to 50 weeks post infection (Greig 1972; Wilkinson 1984; Mellor and Wilkinson 1985; Kleiboeker, Burrage et al. 1998; Basto, Portugal et al. 2006). The virus can remain present in ticks after 3-8 years after infection (Sanchez Botija 1982; Boinas 1995). European ticks of *O. erraticus* and *O. marocanus* species are able to transmit the virus

trans-stadially after 5 moults (Endris, Hess et al. 1992), which may contribute to virus persistence in its tissues for 5 years and transmission to pigs has been shown for ca. 2 years (Boinas, 1994).

Presence of ticks of the *O. erraticus* group has been reported in the Caucasus; however, knowledge of their distribution, host preferences and their role in the epidemiology of ASF is limited (see Table 3 of EFSA AHAW Panel, 2010b). Under laboratory conditions, it has been demonstrated that the ASFV Georgia 2007/1 strain can replicate in the *O. erraticus* and that high titers of the virus up can be maintained, to at least 12 weeks (Diaz, Netherton et al. 2012).

The ecological niche of these ticks in the region has not been adequately determined. Once a focus is established, soft ticks may have a role as local reservoirs of ASFV, as already observed in the Iberian Peninsula where repeated outbreaks occurred in premises infested with ticks (Perez-Sanchez et al., 1994; Arias and Sanchez-Vizcaino, 2002). The Spanish ASF eradication programme showed that in areas of outdoor pig production, where infected ticks occurred, the time to achieve eradication was significantly longer that in areas without ticks (Arias and Sanchez-Vizcaino, 2002).

On-going research, carried out under the EU ASForce research project, is evaluating the presence or absence of *Ornithodoros* by serology and field confirmation of ticks detection in several European countries , amongst which the Russian Federation. Preliminary serological results suggest the presence of ticks of genus *Ornithodoros* in some areas, however, further studies for field detection are needed to confirm these findings (Sanchez-Vizcaino, personal communication).

2.2.2.4. Main mechanism for virus maintenance and re-introduction of ASFV

The backyard sector commonly uses swill as supplementary feed, which may include untreated ASF-contaminated pork or pig products. Often, the contaminated meat may have been stored chilled, frozen or after treatment and kept over long periods of time, thus acting as the main mechanism for ASFV maintenance and re-introduction. Virus re-introduction and amplification mainly takes place in the backyard pigs and then ASFV seasonally spills over first to small farms and then to the specialized pig farms (see Table 1).

Wild boar are unlikely to be a maintenance host and seem to act as sentinels for unreported ASFV circulation in the LB pig production sector (FAO, 2013). The possible role of *Ornithodoros* ticks as a potential reservoir still has to be clarified. Currently there is no field data available suggesting a long term infection of *Ornithodorus* ticks in the outbreak areas.

2.2.3. Ukraine and Belarus

2.2.3.1. Outbreaks in pig holding of different biosecurity

In Ukraine and Belarus, respectively 43 % and 80 % of the pig population are bred in industrial farms with good biosecurity measures in place. The outbreak in Ukraine in 2012 (Zaporizhzya Oblast) and 2014 (Lugansk Oblast) both occurred on a small private subsistence farm. The two positive detections in wild boar in Lugansk Oblast were linked to movements of infected wild boar from the neighbouring Rostov Oblast, where ASF has been present both in domestic and wild animals since 2009. One of the 2 officially reported cases in Belarus was in a backyard holding and other in a large commercial holding.

2.2.3.2. Seasonality of the outbreaks

The introductions to domestic pigs both in Ukraine and Belarus occurred in summer, which perfectly fits the seasonality pattern of ASF as observed in the Russian Federation. However, most recent introductions to Ukraine with wild boar occurred during the winter period, when ASF presence in wild boar population has been shown to increase (FAO, 2013)

2.2.3.3. Possible risk factors for spread of the disease

ASF has been introduced into Ukraine in 2012, through swill feeding of contaminated pork into a smallholder's farm. The epidemiological link between detections in wild boar and domestic pigs, as well as risks of further spread, in Lugansk Oblast in 2014 are yet to be revealed by epidemiological investigation and ongoing surveillance in both wild boar and domestic pigs. In Belarus, the official explanation was that the disease was introduced through contaminated feed, which was illegally imported from the endemic area of the Russian Federation (Minister of Agriculture, http://reporter.by/Belarus/afrikanskuyu-chumu-svinej-zavezli-s-kombikormom/). Furthermore, it is known that civil unrest is correlated with uncontrolled spreading of animal diseases. Taking into account the current political situation in Ukraine, this may be an additional risk factor for spread.

2.2.3.4. Main mechanism for virus maintenance and re-introduction of ASFV

The similar population density and practices of pig keeping as well as pork trade make it highly likely that the mechanisms sustaining the ASFV transmission cycle in Ukraine, Belarus and The Russian Federation will be the same (e.g. involving primarily the backyard sector, swill-feeding and illegal trade of pork products). Involvement of wild boar as an occasional (transient) host or a maintenance host also remains a possibility to bear in mind as disease progressively spreads westwards into the high population density areas.

2.3. Challenges for ASFV detection and control in the countries neighbouring the EU

2.3.1. South Caucasus Countries

The situation regarding detection and control was considered as unchanged, since no new information was available since 2010.

2.3.2. The Russian Federation

Reporting

It can be expected that outbreaks in the backyard sector are strongly under-reported (FAO, 2013). Reporting in the backyard sector strongly depends on the awareness of the pig owners, and most critically on timely compensation. Moreover, under-reporting in the backyard sector seems to be increasing as the epidemic evolves (FAO, 2013).

Early detection of infected holdings, tracing and rapid control of outbreaks

Detection of new ASF introductions in whichever sector is most often delayed. From 2009 to 2011, an average of 4.6 days and up to 11 days (Dudnikov et al., 2011) passed from the first sign of disease (usually indicated by death) before the ASF diagnosis was confirmed in the laboratory. These delays allowed for unnoticed ASFV spread, slaughter of infected animals and transportation of contaminated products outside the outbreak area, sometimes to long distances (FAO, 2013). An additional constraint in the ASF detection is that there is no approved or recommended test kit for the ASF diagnostic in the Russian Federation. Regional laboratories use different commercial test-kits and methods and sometimes false-positive or false-negative results are obtained (A. Gogin, personal communication, 2014).

Tracing of possible dangerous contacts should be both retrospective and prospective. This is impossible in low biosecurity farms, where no records are kept of animal movement into and out of the farms. In this regard, all the pigs in the entire village may be considered as possibly having been in contact with the infected pigs. A large number of backyard and small-commercial pigs holdings are present with low biosecurity levels. Further, there is no animal identification system in the infected eastern neighbouring countries of the EU, hampering efficient tracing of animal movements.

The lack of tracing system in the LB sector, together with the illegal and uncontrolled movement of animals and products is probably one of the most difficult challenges to be solved (Sánchez-Vizcaíno et al., 2013). The illegal trade of products was the origin of many outbreaks in Russian Federation in 2011 and 2012, as well as for the introduction of ASF in Ukraine (http://www.fsvps.ru/fsvps/news/5043.html?_language=en). Additionally, home slaughtering in the backyard sector can lead to lack of traceability.

Veterinary services

The Russian Federation has 83 independent veterinary authorities, 58 of them are in European part of Russia. Capacity and efficiency of each particular regional veterinary authority depends on the regional budget. Therefore, collaboration between the different involved stakeholders and agencies for prevention and early response to ASF outbreaks is complicated and may hinder efficient operation. Furthermore, since the disease is not dangerous for humans this has led to underestimation of the economic importance.

Although at the moment all movements of all agricultural products out of the ASF-affected area is banned in the Russian Federation, local authorities and stockholders are very reluctant to invoke this measure without sufficient evidence, and decisions can sometimes take weeks or even months (FAO, 2013).

Further, there is a lack of sanitary slaughterhouses, and when all susceptible animals in the radius from 5 to 20 km around the affected farm should be destroyed, several thousands of pigs may need to be destroyed.

2.3.3. Ukraine and Belarus

Only few outbreaks were reported in Ukraine and Belarus, which have been dealt with appropriately.

2.4. Clinical signs

Since the emergence of ASFV in Georgia in 2007, no changes in the sequence of the Caucasian ASFV genome has been observed but only two regions have been sequenced (B464L and 5183L), (Malogolovkin et al., 2012). Field observations and experimental studies have shown that a broad range of clinical signs (mild to severe) can be present after infection of wild boar or domestic pigs with this strain. Based on the experimental inoculation studies, the incubation period ranges from 3 to 6 days post experimental infection (dpi) and is shorter following intramuscular versus oral inoculation. A hundred percent mortality rate was reported after 5-11 dpi in wild boar and 7-10 dpi in domestic pigs. Wild boar and domestic pigs become viraemic as early as at 2 dpi and 4 dpi, respectively, while presence of virus in faeces and oronasal excretions occurs at 4 dpi and continues throughout the course of the disease until death (Gabriel et al., 2011; Blome et al. 2012, 2013).

However, rather atypical clinical signs without a clear fever reaction were observed after low dose with oral inoculation in some wild boar (Sandra Blome, personal communication, 2014) and unspecific clinical signs such as fever, lethargy and inappetence were mostly observed after both low and high dose infection in domestic pigs with the Caucasian ASFV strain (Claire Guinat, personal communication, 2014). Additionally, recent experimental infection with a Russian isolate showed animals surviving the infection with both high and low doses (1of 6 and 2 of 6 respectively). In all the surviving animals, antibodies were detected from day 12 to 21 post inoculation (Gruzdev et al., 2013).

In the field, ASF can be missed in individual animals due to unspecific clinical signs, both in the backyard farms as in large farms (Belyanin, 2013). Karaulov et al. (2011) indicated that for a long time (12-37 days) the morbidity or mortality observed in farms may not be much higher than usual and ASFV could spread further through the movement of animals in these first weeks before suspicion by the farmers were raised about an ASFV infection.

Transmission is most efficient when a high virus load, as in blood, is involved (Sanchez-Vizcaino, 2006).

2.5. Detection of antibodies

Detection of antibodies against ASFV was reported by Georgia and Armenia in the follow-up reports sent to the OIE during the outbreaks in 2007-2008, and more recently in 2010 (OIE, 2014). In the Russian Federation, positive serological results were reported at the beginning of the outbreaks in the reports sent to OIE in 2008 (Follow-up reports 3, 4 and 7).

Currently serological data are scarce since no sero-surveillance is performed in the infected countries neighbouring the EU.

Kurinnov et al. (2012) reported on field studies on domestic pigs and wild boar with the acute form of the disease, carried out during the outbreak investigations in the affected regions of the Russian Federation, revealing up to 49 % of all sampled tissues positive for specific antibodies against ASFV, detected by indirect immuno-fluorescence. The same paper mentions 5 056 serum samples collected from domestic pigs in the affected regions (North-Caucasian and Southern Federal districts) for which specific antibodies against ASFV have not been detected, however, no information on the applied sampling and diagnostic procedure was provided.

On the other hand, Mur et al. (personal communication, 2014) performed a serological study with 405 samples (329 sera of domestic pigs and 76 samples of serum and organ exudates of wild boar) from five different regions in infected areas of the Russian Federation. Antibodies were detected in 42 of these samples (10.4 %) from Volgograd and Tver region, 23 positives in domestic pigs and 19 positives in wild boar samples, revealing the existence of antibodies against ASFV in the infected areas.

Long-term infection with the Caucasian isolate of wild boar and pigs could not been observed in the experimental set-up, due to the high fatality rate (Blome et al., 2013), in contrast with the observations made on the Mediterranean isolates (Wilkinson 1984; Carrillo, Borca et al. 1994).

The role of long-term carrier pigs in the maintenance and spread of the Caucasian ASFV strain is still under discussion. With other strains, some transmission has been observed from recovered pigs or their tissues. For examples, experimental infections showed that virus can be isolated from lymph tissues from pigs up to 6 months after infection (Wilkinson, 1984). In another study, ASFV DNA was detected in peripheral blood mononuclear leukocytes at more than 500 days post-infection by a PCR assay (Carrillo et al., 1994). The occurrence of carriers, however, is only one factor that could contribute to the possible maintenance of ASF.

2.6. Detection of ASFV in different matrices

The only study testing the persistence of the Caucasian ASFV strain in meat products (Gazaev et al., 2012) was carried out on salted meat from infected pigs. Virus could be isolated for at least 84 days in chilled meat and 118 days in frozen meat.

Table 2: Detection of virus in different matrices

Matrix of ASFV		Time of ASFV detection (dpi)	Reference	Notes
Live animals and vectors				
Domestic pigs	Portuguese isolate	30 dpi	Wilkinson et al. (1989)	Observational study. Shedding measured by observation of transmission by direct contact
		56 dpi	Wilkinson et al. (1989)	Observational study. Shedding measured by transmission if blood products were involved in transmission
	Isolates: Brazil`78, Malta`78, The Netherlands`86	4-70 dpi	de Carvalho Fereira et al. (2012,2013)	Experimental study. Airborne shedding.
		30-35 dpi (faeces) 2-70 dpi (blood and oropharyngeal fluid)	de Carvalho Fereira et al. (2012, 2013)	Experimental study. Observation lasted 70 days post inoculation.
	Unknown isolate	35-42 dpi	Geering, Forman et al. (1995)	Observational study. Shedding
	Spanish, Portuguese and Sardinian isolates	180 dpi	Wilkinson (1984)	Experimental study. Virus isolated from lymphnodes.
	Spanish isolates: E75-L7 and E75-CV1	500 dpi	Carrillo, Borca et al. (1994)	Experimental study. Detected in peripheral blood by PCR
	Isolates from Brazil and Dominican Republic	180 dpi	(Mebus and Dardiri 1980); Hamdy and Dardiri (1984)	In tissues
	Malta `78 isolate	180 dpi	Wilkinson, Wardley et al. (1981) Wilkinson (1984)	In tissues
	Unknown isolates	456 dpi- isolate unknown	(Detray 1957)	In blood
			McDaniel (1980)	Carriers for life
	Armenian strain 2008	14 days (6-20 days after wild boar infection)	Blome, Gabriel et al. (2013)	Pigs infected by close contact with wild boar, previously experimentally infected. Blood tested. Followed by death.
	ASFV Caucasus	3 days (6-9 dpi)	Blome, Gabriel et al. (2013)	Presence tested in blood, faecal swab and oropharyngeal fluid. Followed by death.
		3-6 days (4-10 dpi)	Blome (2013 personal communication)	Armenian strain. Presence tested in blood and oral swabs. Followed by death.

Table continued overleaf.

Table 2: Detection of virus in different matrices (continued)

Matrix of ASFV		Time of ASFV detection (dpi)	Reference	Notes
Wild boar	Armenian strain 2008 ASFV Caucasus	5 days (2-7 dpi)	Blome et al. (2013)	Presence tested in blood, faecal swab and oro-pharyngeal fluid; death after 7th day
		3 days (6-9 dpi)	Blome, Gabriel et al. (2013)	In blood, faecal swab and oro-pharyngeal fluid Followed by death
		1-9 days (4-13 dpi)	Blome (2013 personal communication)	Armenian strain. Presence tested in blood and oral swabs. Followed by death.
Ticks (*Ornithodoros* species)		166 days (21-187 dpi)	Kleiboeker, Burrage et al. (1998)	Successful transmission after 21 days post-feeding (ticks post-inoculation)
		260 days (21-280 dpi)		Persistence in the tick
		21-35 days	Kleiboeker, Scoles et al. (1999)	Failed attempt to infect ticks orally. Virus was not detected after few weeks p.i.
		50 weeks	Greig (1972)	
		Up to 300 days	(Wilkinson 1984)	Maintenance and transmission of infection
		8 years	Sanchez Botija (1982)	
		2 years 9 months	Boinas (1995)	
		7 years	Basto, Portugal et al. (2006)	High titres persist for 20 weeks
		Up to12 weeks	Diaz, Netherton et al. (2012)	Study on Georgia 2007/1 strain high titres persistence (observational period)
		106 days	Mellor and Wilkinson (1985)	Infected ticks naturally transmitted virus to pigs after 106 days post inoculation
		3 years	Ravaomanana, Michaud et al. (2010)	
		5 years 3 months	Boinas, Wilson et al. (2011)	Presence in ticks
		380 days		Successful transmission to pigs.
		5 years	Boinas (1994)	
		1 year	Hess, Endris et al. (1989)	

Table continued overleaf.

Table 2: Detection of virus in different matrices (continued)

Matrix of ASFV	Time of ASFV detection (dpi)	Reference	Notes
Meat and tissues			
Meat and pork fat stored at 22-27 °C (salted)	16 days	Kolbasov et al. (2011)	Russian strain (Stavropol). No detection at day 20. Virus isolation.
Chilled meat	105 days	Adkin et al. (2004)	
	150 days in 4 °C	Kowalenko et al. (1965, as cited in AHA, 2003)	
	150 days in 4 °C (muscle tissue)	CFSPH (2010)	
	155 days, 6-8 °C	Kovalenko et al. (1972)	Experimental infection Observation lasted 30 days post inoculation
	104 days	Kovalenko et al. (1967)	
	84 days in 4-6 °C	Kolbasov et al. (2011)	
Frozen meat and organs	1 000 days	Adkin et al. (2004)	
	104 days in -4 °C	Kowalenko (1967, as cited in Animal Health Australia, 2003) IRA Australia (2001)	
	Several years	CFSPH (2010)	
	104 days	Kovalenko et al. (1967)	
	118 days	Kolbasov et al. (2011)	Observation period. Russian strain (Stavropol). Virus isolation
	103 days,-6-8 °C (in parchment)	Kovalenko et al. (1972)	Experimental infection Observation lasted 30 days post inoculation

Table continued overleaf.

Table 2: Detection of virus in different matrices

Matrix of ASFV	Time of ASFV detection (dpi)	Reference	Notes
Spleen	204 days, stored at 6-8 °C 280 days, placed in Petri dish and buried at a depth of 8 cm (June)	Kovalenko et al. (1972)	Experimental infection. Observation lasted 30 days post inoculation
Skin/ fat	300 days	Adkin et al., 2004	
Bone marrow (meat with bone)	180 days	Kowalenko (1965, as cited in Animal Health Australia, 2003)	
	188 days	Agriculture, Fisheries and Forestry – Australia (2001)	
	188 days (femoral), 6-8 °C	Kovalenko et al. (1972)	Experimental infection. Observation lasted 30 days post inoculation
Offal	105 days	Adkin et al. (2004)	
Skins and hides	0 days	Biosecurity New Zealand (2007)	Processing sufficient enough to destroy virus unless production is in vicinity to infected pig farm and contaminated water is used.
Meat products			
Meat cooked for 70 °C for 30 min	0 days	Adkin et al. (2004)	
Salted meat	84 days in 4-6 °C	Kolbasov et al. (2011)	Testing only during observation period (presence in tissues can be longer). Russian strain (Stavropol) Virus isolation
Naturally smoked meat	30 days	Adkin et al. (2004)	
	300 days	Adkin et al. (2004)	
Dried fat	140 days- Iberian and Serrano ham	Mebus et al. (1993, 1997)	*In vivo* and *in vitro* virus assay (hemadsorption, immunofluorescence, virus isolation, serum of experimentally infected pigs tested for antibodies)

Table continued overleaf.

Table 2: Detection of virus in different matrices

Matrix of ASFV	Time of ASFV detection (dpi)	Reference	Notes
Salted(cured) and dried meat (Iberian, Serrano, Parma ham) Curing time in days: Iberian ham (365-730) Iberian shoulder (240-420) Iberian loin (90-130) Serrano ham (180-365) Parma ham (360-540)	140 days- Iberian shoulders	Mebus et al. (1993, 1997)	*In vivo* and *in vitro* virus assay (hemadsorption, immunofluorescence, virus isolation, serum of experimentally infected pigs tested for antibodies)
	180 days- Serrano	Gregg (pers comm) in Animal Health Australia (2003)	
	399- Parma ham	McKercher, Yedloutschnig et al. (1987)	US experiment Virus isolation
	300- Parma ham	McKercher, Yedloutschnig et al. (1987)	Italian experiment Virus isolation
	112- Iberian loins	Mebus, House et al. (1993); (Mebus, Arias et al. 1997)	*In vivo* and *in vitro* virus assay (hemadsorption, immunofluorescence, virus isolation, serum of experimentally infected pigs tested for antibodies)
	140 days	CFSPH (2010)	
Salted (cured), Fermented and dried (salami)	30 days	McKercher, Hess et al. (1978)	
	120 days	MacDiarmid (1991) AHA (2003)	
Salted (cured), fermented dried and spiced (pepperoni)	30 days	McKercher, Hess et al. (1978)	
	120 days	MacDiarmid (1991)	
Ham in brine	180 days	Blackwell (1983) MacDiarmid (1991)	

Table continued overleaf.

Table 2: Detection of virus in different matrices

Matrix of ASFV	Time of ASFV	Reference	Notes

	detection (dpi)		
Secreta			
Serum	7 days (ph 13.4) Several hours (ph < 4)	OIE (2013) Pirtle et al. (1991)	
	2 230 days, (without preservative, in glass flask with rubber cap), 4-6 °C	Kovalenko et al. (1972)	Experimental infection lasted 30 days post inoculation
Blood	540 days in 4 °C	CFSPH (2010)	540 days at 4 °C
	70 days- on wooden surfaces	USDA (2007)	70 days- on wooden surfaces
	105 days (putrefied blood)	USDA (2007)	105 days (putrefied blood)
	2 900 days, lyophilized blood in ampoules, 4-6 °C 2 230 days, (defibrinated blood, without preservative), 4-6 °C	Kovalenko et al. (1972)	Experimental infection. Observation lasted 30 days post inoculation
	81 days (summer-autumn), on boards contaminated by ASFV-infected blood, stored in the ground at the depth of 12 cm 192 days on boards, contaminated by ASF-infected blood, stored on the soil surface	Kovalenko et al. (1972)	Experimental infection. Observation lasted 30 ì days post inoculation

Table continued overleaf.

Table 2: Detection of virus in different matrices

Matrix of ASFV	Time of ASFV detection (dpi)	Reference	Notes

		112 days on bricks, contaminated by blood, stored under the ground at the a depth of 12 cm 81 days in garden soil in buried boxes 81 days, contaminated forest soil buried in boxes 50 days in summer 176 days in winter Lake water containing the blood from infected pig (dilution 1:100), in glass flask, buried at a depth of 12 cm		
Faeces		60-100 days	Haas, Ahl et al. (1995)	
		60-160 days	Strauch (1991)	
		11 days, held in room temperature	Penrith (2009) CFSPH (2010) Mur, Martinez-Lopez et al. (2012)	
		159 days, 4-6 °C 155 days, (wet faeces in a glass flask buried in the ground to a depth of 12 cm)	Kovalenko et al. (1972)	Experimental infection. Observation lasted 30 days post inoculation

Table continued overleaf.

Table 2: Detection of virus in different matrices

Matrix of ASFV	Time of ASFV	Reference	Notes

		detection (dpi)		
Urine		45 days (in glass flask buried in the ground to a depth of 12 cm)	Kovalenko et al. (1972)	Experimental infection. Observation lasted 30 days post inoculation
Nasal aerosol		5 min half-life (humidity > 30 %)	Donaldson and Ferris (1976)	
		14-19 min	de Carvalho Ferreira et al. (2012)	
Liquid manure (slurry)= manure and urine, no bedding		84 days at 17 °C 112 days at 4 °C	Haas et al. (1995)	
		30s-3min at 60 °C	Turner et al. (1999)	
Other				
Bloodsucking insects (*Stomoxys calcitrans*- stable fly)		2 days	Baldacchino, Muenworn et al. (2013)	

ASFV: African Swine Fever Virus; dpi:days post inoculation

3. Risk assessment methodology

3.1. ToR1: Update the significance of the occurrence and risk of endemicity of ASF in the countries neighbouring the EU at higher risk

3.1.1. The risk assessment model

In 2010, a qualitative risk assessment model was developed, dealing with risk factors affecting spread of ASFV and assessing the impact of prevention and control measures on the risk for endemicity of the disease in the neighbouring countries of the EU (EFSA AHAW Panel, 2010a). The pathways were outlined as such that the risk of events leading to potential spread and mitigation could be elicited by the experts of the working group.

ToR1of the current mandate requests for an update of these pathways assessing the risk of endemicity in both the wild boar and domestic pig population in the neighbouring countries of the EU. For the Scientific Opinion (SO) developed in 2010 (EFSA AHAW Panel, 2010a), one pathway was developed for the Russian Federation and one for Georgia and Armenia separately, due to diverse farming systems' structures, different animal density and functioning of the Veterinary Services. These risk pathways were updated for the current SO, using the same qualitative model as developed in 2010. For the already developed risk pathways for the Russian Federation, on one hand, and Georgia and Armenia on the other hand, only those risk estimates were re-elicited where new evidence did become available since the last assessment, indicating that the risk estimate needed to be re-elicited.

For Ukraine and Belarus, a new risk pathway was developed, due to the more recent introduction of ASFV in these two countries. Ukraine and Belarus were assessed together, because they have both a higher proportion of industrial farms (Ukraine has 8 mil. pigs with 43 % industrial farms and Belarus has 4 mil. pigs with 80 % of the farms industrial farms), compared to Georgia and Armenia with a much higher proportion of back yard farms (both 95 %, and small pig population size of less then half a mill pigs) (FAO, 2013). The proportion of backyard farms will have the biggest impact on the risk factors for spread.

What concerns the assessment of the impact of the mitigation measures, however, it was decided to deal with those parameters individually, when they are specific for either Belarus or Ukraine (e.g. the rapid stamping out of outbreaks).

3.1.2. Expert knowledge elicitation (EKE)

3.1.2.1. Choice of hearing experts:

A group of 21 hearing experts was recruited, who were involved either in the ASF outbreak investigations or surveillance activities in the infected areas neighbouring the EU, or in risk assessments for introduction of ASFV into the EU. Care was taken to have a balance of the geographical origin.

3.1.2.2. The approach:

The approach that was followed for the EKE is a nominal group technique (NGT), which is a combined elicitation approach, making use, on one side of anonymous judgements of experts (so pre-empting difficulties and biases that may arise from experts having to negotiate a group consensus) and on the other hand, allowing some degree of interaction between experts. The latter allowed the experts to gain exposure to new arguments or facts about which they may not have been aware, and indeed, curing misconceptions (EFSA AHAW Panel, 2014)

The process of the elicitation was as following:

1) First elicitation round: the experts were asked to provide their judgements on the risk estimates individually through an anonymous web-based survey. The participants were asked to provide the rationales for their choices for all the questions they had answered.

2) Second elicitation round: feed back on the outcome of the first round was provided to the experts, including a summary of the rationales and basic calculations of the results. The experts were then asked to revise their answers through the anonymous web-based survey, if wanted, and possible update their rationales.

3) Third elicitation round: feed back on the second round was provided to the experts, before they met physically, including the uncertainty of the estimates. The measure 'Entropy' first described by Shannon (1948) was used to express the uncertainty of the answers as such, which is in difference to the approach used to describe uncertainty in 2010.

The following cut-off values were agreed by the working group: low entropy (< 25 %), moderate entropy (> 25, < 35 %) and high entropy (> 35 %). The experts agreed on the group estimates which had low entropy. For those parameters with high entropy, the experts were asked to provide their judgements individually and anonymously after the discussion. The median of the chosen answers was taken as the group response, and was used to feed the risk assessment model.

4) Feed back on the update outcomes of the model was provided to the group of experts, and conclusions were formulated and agreed upon.

3.2. ToR2: The evaluation of the possible pathways of introduction of ASF into the EU, ranking them on the basis of their level of risk with a view to enhance preparedness and prevention.

The second ToR requested to evaluate all the possible pathways of introduction of ASFV into the EU, and to rank them on the basis of their level of risk with a view to enhance preparedness and prevention. After further clarification with the requestor of the mandate, it was decided to address only transport of infectious/contaminated matrices for this ToR2. Other potential pathways of introduction of ASF were already addressed in the previous Scientific Opinion on ASF (EFSA AHAW Panel, 2010). Further, movement of infected wild boar and pigs into unaffected areas (e.g. transboundary movement of wild boars or movement of free ranging pigs) were already addressed in ToR1 and thus these pathways were not considered as a 'contaminated matrix' that could be transported into the EU.

Twenty-one experts were asked to judge on the ability of different matrices to contain and maintain infectious ASFV. A list of potential matrices of importance for potential introduction of ASFV into the EU was developed based on the information published in literature provided in Table 2. The experts were asked to rank the different matrices according to their increasing risk to be contaminated/ infected and maintain infectious virus at the moment of transportation into the EU, without taking into account the possible volumes or amounts transported into the EU. The risk estimates were defined as in Table 3.

Table 3: Definitions of the risk of different matrices to become contaminated/infected and maintain infectious virus at the moment of transportation into the EU

Score	Risk	Definition
5	Very High	In **nearly all** cases, the matrix could be contaminated/infected and maintain infectious virus at the moment of transportation into the EU
4	High	In **most** cases, the matrix could be contaminated/infected and maintain infectious virus at the moment of transportation into the EU
3	Moderate	In **some** cases the matrix could be contaminated/infected and maintain infectious virus at the moment of transportation into the EU
2	Low	In only **rare** cases the matrix could be contaminated/infected and maintain infectious virus at the moment of transportation into the EU
1	Very low	In **very rare and exceptional** cases the matrix could be contaminated/infected and maintain infectious virus at the moment of transportation into the EU
0	Negligible	Sufficiently low to be **ignored**

In a second, on-line elicitation round, the experts were asked to rank the risk of the matrices, and provided rationales for their choices. The median of the chosen answers was taken as the group response.

4. Results

4.1. ToR1: Update the significance of the occurrence and risk of endemicity of ASF in the countries neighbouring the EU at higher risk

4.1.1. Risk of endemicity in domestic pigs and spreading to unaffected areas

4.1.1.1. Georgia and Armenia

Since the previous risk assessment (EFSA AHAW Panel, 2010a), only limited new information has become available on the ASF situation in Georgia and Armenia (see Sections 2.1.1, 2.2.1, and 2.3.1). The **presence of the disease** in the domestic pig population was estimated after considering all the information available about possible ASF outbreaks in Georgia and Armenia, and the estimated risk of undetected spread of ASF in these countries. The experts judged that there is a high possibility that disease is currently present in the domestic pig population in Georgia and Armenia. The uncertainty of this judgement was considered moderate (see Appendix A, Question 1 for the detailed rationales). No outbreaks have been recently reported to OIE in these countries but there are some media reports about disease in swine, with clinical signs that are consistent with ASF infection. Since 2008, subsequent to the ASF incursion, Georgia and Armenia have not been declared free of ASF by the OIE.

A **non-effective long-term response** was estimated as a combination of not dealing rapidly with new outbreaks and non-effective preventive measures. The experts judged that the risk for a non-effective long-term response in G/A remains high, similar to an earlier estimate for 2010. The only parameter that was reassessed in this pathway branch was the possibility that **clinical signs** would be present. All the other parameters were assumed to have remained the same. The experts judged that the possibility of clinical signs in association with ASF infection is moderate, with a moderate uncertainty. The underlying rationale for this assessment includes the very broad range of presentation of clinical signs, ranging from mild to severe signs or per-acute dead in individual animals. This presentation is not entirely consistent with the typical clinical signs described in the literature, including experiments. Nonetheless, the presence of ASF infection in an epidemiological unit cannot be missed. The presence of clinical signs in the field will greatly depend on the route of infection, the infectious dose, and the prior immune status of the animals. Even in experiments, there is a wide range of clinical signs in pigs, depending on both the infection route and the infectious dose (see Appendix A, Question 2 for the detailed rationales).

The **risk of ASF being endemic** in the domestic pig population in some areas of Georgia and Armenia was estimated by combining the disease presence and the risk of a non-effective long-term response. The experts judged that there is a high risk that ASF is endemic in domestic pigs in some areas of Georgia and Armenia. The risk of local and long-distance spread were each assessed to be high. Therefore, the **risk that ASF will spread further into unaffected areas** from the endemic areas in Georgia and Armenia was considered to be high (see Appendix B, Figure 6).

4.1.1.2. The Russian Federation

The new available information on the ASF situation in the Russian Federation since the risk assessment in 2010 was summarised in Sections 2.1.2, 2.2.2 and 2.3.2.

The **presence of the disease** in the domestic pig population was estimated after considering all the information available about possible ASF outbreaks and the estimated risk of undetected spread of ASFV in the Russian Federation. The experts judged that the high frequency of official disease reporting (OIE-WAHID, online), together with the ample published information and media reports,

suggest that there is a high possibility that the disease is currently present in domestic pigs in the Russian Federation. The uncertainty of this judgement was considered low (Appendix A, Question 5).

A **non-effective long-term response** was estimated as a combination of not dealing rapidly with new outbreaks and non-effective preventive measures. The experts judged that the risk for a non-effective long-term response in the Russian Federation remains high, similar to an earlier estimate for 2010. The parameters that were reassessed in this pathway branch were the possibility that clinical signs would be present, the possibility that suspected cases would be reported to the veterinary services, the possibility that the outbreak control measures would be effective and the possibility of tracing dangerous contacts in ASF outbreaks (Appendix A, Question 6-9).

The experts judged that the possibility of **clinical signs** in association with ASFV infection is moderate, with a high uncertainty. The reasons were similar to those mentioned above for the possibility of clinical signs in domestic pigs infected with ASFV in Georgia and Armenia (Appendix A, Question 6).

The experts judged that there is a moderate possibility that farmers **report** suspected cases to the Veterinary Services (moderate uncertainty). As mentioned in Appendix A, the underlying rationale for this judgement included that a financial compensation programme is only implemented in some regions of the Russian Federation (with compensation at market price), and farmers may be reluctant to report the disease, especially in those areas where no compensation programme is in place, or where it occurs with important delays, or, where the disease has been circulating already for a while (Appendix A, Question 7).

The experts judged that the possibility that the Veterinary Services of the Russian Federation can **control outbreaks effectively** and rapidly is low (low uncertainty). The underlying rationale for this judgement included the difficulties faced in the backyard sector, leading to delayed diagnosis and lack of early response. Stamping out is not always performed as in the EU: not all animals are killed and destroyed (Appendix A, Question 8).

In most of the backyard farms, effective **tracing** is extremely complicated, especially tracing of informal animal movements and potentially infected pork meat. Therefore, the experts considered that in the Russian Federation, the possibility that the Veterinary Services can effectively trace dangerous contacts is low (moderate uncertainty), although some effective tracing may be present in commercial farms in some regions (Appendix A, Question 9).

The **risk of ASF being endemic** in the domestic pig population in some areas of the Russian Federation was estimated by combining the disease presence and the risk of a non-effective long-term response. The experts judged that there is a high risk that ASF is endemic in domestic pigs in some areas of the Russian Federation. The risk of local and long-distance spread were each assessed to be high. Therefore, the **risk that ASF will spread further into unaffected areas** from the endemic areas in the Russian Federation was considered to be high (see Appendix B, Figure 7).

4.1.1.3. Ukraine and Belarus

Since the infection has only been detected in Ukraine in 2012 and in Belarus in 2013, the previous risk assessment (EFSA AHAW Panel 2010) did yet not include these countries in the assessment for endemicity. For this current update, it was therefore decided that all parameters of the risk pathway had to be elicited, however, from some parameters ('possible spread of ASFV through pets and pests', 'possible spread of ASFV through ticks (given their presence)' or 'possible spread of ASFV through indirect contact in the environment'), it was decided that these parameters are not expected to be different from the Russian Federation or from Georgia or Armenia and the values can be copied.

Again, the **presence of the disease** in the domestic pig population was estimated after considering all the information available about possible ASF outbreaks in Ukraine and Belarus, and the estimated risk of undetected spread of ASF in these countries. The experts judged that there is a moderate possibility

that the disease is present in domestic pigs in Ukraine and Belarus (moderate uncertainty). The underlying rationale for this assessment included the permeability of the border between Belarus and the Russian Federation (i.e. the so called Customs Union, which also includes Kazakhstan), the frequent movement of people between the Russian Federation and Ukraine and Belarus, which are difficult to monitor or control. Also the possibility of transboundary spread of infected wild boar was taken into account for this judgement, as shown through recent events in Ukraine (Appendix A, Question 12 and 13).

The experts judged that the most important risk factors possibly leading to **undetected spread** of ASFV in Ukraine or Belarus would be swill feeding and the possible movement of infected pigs between backyard holdings. The experts judged that the possibility of undetected spread of ASFV through movement of infected pigs or movement of contaminated pork would be moderate (both judgements had a low uncertainty). Further, the experts judged that the possibility that ASFV could spread by people, involved with pig-keeping; through contaminated vehicles; and through contaminated feed would be moderate as well (moderate, moderate and high uncertainty respectively). The experts judged that the possibility for undetected spread in the pig population in Ukraine and Belarus, through direct contact of pigs with wild boar, and consecutively further spread to domestic pigs would be low in Belarus and moderate in Ukraine. This judgement took into account the different proportions of backyard farms, their geographic distribution and the possible crossing points with the wild boar habitat in both countries. Spill-over into the wild boar population and vice versa will depend on the extent of the interface between the two populations. The experts agreed that wild boar play a minor role in spread of ASFV compared to illegal movement of pork (followed by swill feeding) and they do not play a role in spread to and from farms with a high level of biosecurity (Appendix A, Question 14-20).

A **non-effective long-term response** was estimated as a combination of not dealing rapidly with new outbreaks and non-effective preventive measures. Stamping out is not always performed as in the EU: not all animals are killed and destroyed. The experts judged that the risk for a non-effective long-term response in Ukraine and Belarus is moderate.

The parameters that were elicited for this pathway branch were the possibility that clinical signs would be present, the possibility that suspected cases would be reported to the veterinary services, the possibility that the outbreak control measures would be effective, the possibility of tracing dangerous contacts in ASF outbreaks, and the possibility of effective preventive measures.

As for Armenia, Georgia and the Russian Federation, the experts judged that the possibility of **clinical signs** in association with ASFV infection is moderate, with a high uncertainty (Appendix A, Question 21).

The experts judged that there would be a moderate possibility that farmers would **report** suspicious cases to the Veterinary Services (low uncertainty). Further, they thought that currently, since there were only a few outbreaks, the Veterinary Services have been effective to **contain the outbreaks and identify dangerous contacts**. They fear, however, that when there would be more introductions, or undetected spread, the situation will become difficult to handle (Appendix A, Question 22-24).

Concerning the possibility of effective preventive measures, the experts agreed that effective preventive measures should include passive surveillance to detect outbreaks early and prevent further spread of ASFV. Passive surveillance needs to be accompanied by fair compensation programmes and awareness building of farmers, other players in the pig/pork market chain, and agricultural and veterinary staff. The experts judged that the possibility that all these preventive measures are carried out effectively is low in Ukraine and Belarus (low uncertainty). The underlying rational for this judgement was that although there are several preventive measures taken in both countries, they are not likely to be effective to prevent new outbreaks. Reasons mentioned during the EKE were the lack of experience and the occasional and unstructured character of the actions. In summary, that there is no plan. On-going preventive measures are sero-surveillance and collection of tissue samples for PCR

in industrial farms in Belarus, and occasional sample collection in Ukraine. Further, passive surveillance and awareness building is carried out in both countries (e.g. to avoid spread via swill, infected pigs, etc. and to alert for the economic implications of an outbreak) (Appendix A, Question 25).

The **risk of ASF being endemic** in the domestic pig population in some areas of Ukraine and Belarus was estimated by combining the disease presence and the risk of a non-effective, long-term response. The experts judged that there is a moderate risk that ASF is endemic in the domestic pig population in some areas of Ukraine and Belarus. The risk of local and long-distance spread were each assessed to be moderate. Therefore, the **risk that ASF will spread further into unaffected areas** from the endemic areas in Ukraine and Belarus was considered to be moderate (see Appendix B, Figure 8).

4.1.2. Risk of endemicity in wild boar and spreading to unaffected areas

4.1.2.1. Georgia and Armenia

The **presence of the disease** in the wild boar population was estimated after considering all the information available about possible ASF cases in wild boar in Georgia and Armenia, and the estimated risk of undetected spread of ASF in the wild boar population in these countries.

The experts judged that based on some unofficial sources of information/media reports that the possibility that ASFV is present **in the wild boar** population is moderate (high uncertainty). It was agreed that this was mainly caused by spill-over from outbreaks in the domestic pig sector. The experts judged the population density sufficiently low so that it is unlikely that ASFV will spread efficiently in the wild boar population, and so the actual risk of disease presence in the wild boar population in the Georgia and Armenia is estimated to be moderate (Appendix A, Question 3).

A **non-effective long-term response** was estimated as a combination of not dealing rapidly with new cases in wild boar and non-effective preventive measures. The experts judged that the risk for a non-effective long-term response in Georgia and Armenia is high.

The only parameter that was reassessed in this pathway branch was the possibility that **clinical signs** would be present. All the other parameters were assumed to have remained the same. The experts judged that the possibility of clinical signs in association with ASF infection is moderate, with a moderate uncertainty. The experts judged that when wild boar are infected with ASFV, **clinical signs** would be most often present, although some subclinical cases may be present as well. In fact, the experts assumed that wild boar and pigs, have the same susceptibility to the virus, and therefore, there is no reason to differentiate for the presence of clinical signs between the two (Appendix A, Question 4).

The **risk of ASF being endemic** in the wild boar population in some areas of Georgia and Armenia was estimated by combining the disease presence and the risk of a non-effective, long-term response. The experts judged that there is a moderate risk that ASF is endemic in the wild boar population in some areas of Georgia and Armenia. The **risk that ASF will spread further into unaffected areas** from the endemic areas in Georgia and Armenia was considered to be low (see Appendix B, Figure 9).

4.1.2.2. The Russian Federation

The **presence of the disease** in the wild boar population was estimated after considering all the information available about possible ASF cases in wild boar in the Russian Federation, and the estimated risk of undetected spread of ASF in the wild boar population in this country.

Based on the information available in Section 1.1.2 and the EKE the experts judged that the possibility that ASFV is present in the wild boar population in the Russian Federation is high (Appendix A, Question 10). The underlying rational for that judgement were the repeated infected cases of ASFV infected wild boar notified during the last years, and other published information available. A different

prevalence can be expected in the different regions, though, based on the different interaction with the domestic pig sector, and the subsequent possibility of spill-over of ASFV into the wild boar population.

Again, a **non-effective long-term response** was estimated as a combination of not dealing rapidly with new cases in wild boar and non-effective preventive measures. The experts judged that the risk for a non-effective long-term response in the Russian Federation is high. The only parameter that was reassessed in this pathway branch was the possibility that **clinical signs** would be present. All the other parameters were assumed to have remained the same. For the same rational as mentioned above, the experts judged that the possibility of clinical signs in association with ASF infection is moderate, with a high uncertainty (Appendix A, Question 11).

The **risk of ASF being endemic** in the wild boar population in some areas of Russian Federation was estimated by combining the disease presence and the risk of a non-effective, long-term response. The experts judged that there is a moderate risk that ASF is endemic in the wild boar population in some areas of The Russian Federation. The **risk that ASF will spread further into unaffected areas** from the endemic areas in The Russian Federation was considered to be moderate (see Appendix B, Figure 10).

4.1.2.3. Ukraine and Belarus

The **presence of the disease** in the wild boar population was estimated after considering all the information available about possible ASF cases in wild boar in Ukraine and Belarus, and the estimated risk of undetected spread of ASF in the wild boar population in this country. Based on the information available in Section 2.1.3, the experts judged that the possibility that ASFV is present in the wild boar population in the Ukraine and Belarus is moderate, with a moderate uncertainty. The reasoning behind this judgement was that there is no real border with the Russian Federation (i.e. Customs Union), and habitat of wild boar spread uninterrupted across the border. Further, due to the vastness of the forest, it is difficult to find infected (i.e. sick and dead) wild boar through passive surveillance. On the other hand, it is compulsory to send samples from all killed wild boar for PCR analysis in Belarus and, so far, all results have been negative. However, they might not receive a lot of samples compared to the number of killed wild boar.

The risk factors that may lead to **spread of ASFV in the wild boar population,** which were elicited were 'the possibility that the currently applied hunting regime could lead to spread of ASFV' and 'the possibility that direct contact between wild boar will lead to spread of ASFV, taking into account the specific wild boar population density'.

The experts judged that the possibility that direct contact between wild boar will lead to spread in the wild boar population in Ukraine and Belarus is low. The underlying rational for this judgement was that the wild boar population density is rather patchy in Ukraine and Belarus, however there is only scarce quantitative information available about the population demography. Wherever the density is low, the chance for spread is expected to be low and vice versa (Appendix A, Question 26, 27, 28 and 30).

The experts thought that the possibility that the hunting regime in Ukraine can contribute to spread of ASFV into the wild boar population is low, with a low uncertainty. Currently, the hunting regime applied in Ukraine is aiming at keeping the population level stable (so no depopulations) and to keep also the population at their normal territory (so it should not increase long distance dispersal). However, there are plans to implement a wild boar depopulation campaign in Lugansk Oblast (in the Eastern Border of Ukraine).

The experts thought that the possibility that the hunting regime in Belarus can contribute to spread of ASFV into the wild boar population is moderate, with a high uncertainty. Although there is currently no official confirmation of ASFV infection in wild boar in Belarus, it is not allowed to do normal hunting. Furthermore, depopulation may stimulate 1) illegal poaching of wild boar, which is difficult

to control, and 2) undetected spread. Additionally, the depopulation of wild boar in Belarus may attract wild boar from the Russian Federation and it will be difficult to sustain the depopulation on a long term basis (due to the high reproduction rate of wild boar) (Appendix A, Question 34).

Again, a **non-effective long-term response** was estimated as a combination of not dealing rapidly with new cases in wild boar and non-effective preventive measures. The experts judged that the risk for a non-effective long-term response in Ukraine and Belarus is high. Parameters that were elicited in the pathway branch were the possibility to present clinical signs in association with ASFV infection, the possibility to detect a sick wild boar and the possibility that suspicious cases would be reported.

The outcomes for the elicitation of the possibility for clinical signs and to find sick or dead wild boar were the same as mentioned above for Georgia and Armenia. The experts thought that the possibility that suspect cases in wild boar are **reported** to the veterinary service in Ukraine and Belarus is low (low uncertainty). For example, in Belarus it is compulsory to send samples from shot boar or boar found dead (e.g. on the road), however, not many samples are received. For example, in Ukraine, 685 sera and 648 tissue samples were received from wild boar during the hunting season in 2013, and all of them were tested negative (Appendix A, Question 31).

The **risk of ASF being endemic** in the wild boar population in some areas of Ukraine and Belarus was estimated by combining the disease presence and the risk of a non-effective, long-term response. The experts judged that there is a moderate risk that ASF is endemic in the wild boar population in some areas of Ukraine and Belarus. The **risk that ASF will spread further into unaffected areas** from the endemic areas in Ukraine and Belarus Federation was considered to be moderate (see Appendix B, Figure 11).

4.2. ToR2: The evaluation of all the possible pathways of introduction of ASF into the EU, ranking them on the basis of their level of risk with a view to enhance preparedness and prevention.

Table 4: Ranking of matrices according to their ability to contain and maintain infectious ASFV (based on expert elicitation)

Rank	Matrix
Very high	Frozen meat
High	Chilled meat Wild boar (transported) Domestic pigs (transported) Skin fat Vehicles for animal transport-contaminated inside
Moderate	Naturally smoked meat Salted, fermented, dried (+/- spiced) meat (e.g. pepperoni, salami,…) Salted, dried meat (e.g., salted and dried hams, shoulders, loins…) Any vehicles-contaminated outside People involved with pig-keeping Slurry Animal feed Litter Fomites
Low	People not involved with pig-keeping Ticks
Very low	Vegetables Crops Pests (rodents) Pets Hay and straw Bloodsucking insects
Negligible	Meat cooked for 70 °C for 30 min

The experts judged that frozen meat coming from infected animals has a very high risk to be contaminated and remain contaminated with infectious ASFV at the moment it would be transported over the EU border. The underlying reason for this judgement was that ASFV has been detected for several years in frozen meat, depending on the temperature (Adkin et al., 2004; Kolbasov et al., 2011; Smirnov et al., 2011) (Table 2).

The experts judged that chilled meat, wild boar, domestic pigs, skin fat and vehicles for animal transport have a high risk to become and remain infected/contaminated with infectious ASFV at the moment they are being transported into the EU.

The underlying rational for this judgement was based on several publications, provided in Table 2. For example, ASFV has been detected in chilled meat from infected pigs for several months (Plowright et al., 1994; Adkin et al, 2004; Kovalenko et al., 1972 cited by Smirnov and Butko, 2011). Further, domestic pigs can shed infectious ASFV from 4 to 70 days post inoculation (Fereirra et al., 2013). Infectious virus has been detected in tissues of domestic pigs for up to 500 days (Carrillo, Borca et al. 1994). In skin fat, ASFV has been detected for 300 days (Adkin et al., 2004). Vehicles for animal transport that are not properly disinfected can contain contaminated blood or faeces or other excreta, which may contain infectious ASFV for several days, depending on the temperature (Kovalenko et al., 1972).

Naturally smoked meat, salted and dried meat, salted fermented and dried meat, any type of vehicle, people involved with pig-keeping, slurry, animal feed, litter and fomites were judged to have a moderate risk to become and remain contaminated with infectious ASFV at the moment they are being transported into the EU. The underlying rational for this judgement was based on several publications, provided in Table 2. For example, ASFV has been detected in naturally smoked meat for up to 30 dpi (Adkin et al., 2004). In salted, dried meat, ASFV can persist for up to 120 days (MacDiarmid, 1991). In ham in brine, ASFV can be detected for up to 180 days (Blackwell, 1983). ASFV has been detected for more than 100 days in slurry, depending on the temperature (Haas et al., 1995).

The experts judged that people not involved with pig-keeping have a low risk to become and remain contaminated with infectious ASFV at the moment they are being transported into the EU.

Infectious ASFV has been detected for several years in ticks (Sanchez Botija 1982), however, currently there is no field data available suggesting a long term infection of *Ornithodorus* ticks in the outbreak areas. In addition, the risk of ticks accompanying a transport are considered also low.

Vegetables, crops, pests, pets, hay and straw and bloodsucking insects were judged to have the lowest risk to become and remain contaminated with infectious ASFV at the moment they are being transported into the EU.

The experts judged that meat cooked for 70 °C for 30 min. has a negligible risk to become and remain contaminated with infectious ASFV at the moment they are being transported into the EU. This judgement was based on published information. Adkin et al. (2004) demonstrated that meat cooked for 70 °C for 30 min does not contain infectious ASFV.

CONCLUSIONS

Table 5: Risk estimates for TOR1

Risk question	Region	Risk estimate	Rationale	Overall judgement*	Risk estimate
Domestic pigs		**2014**	**2014**	**2014**	**2010**
Risk of ASF endemicity in some areas of:	Georgia and Armenia	H	High risk for disease presence and limited control measures	H	M
	Russian Federation	H	High frequency of official reporting and challenges in outbreak control	H	M
	Belarus and Ukraine	M	Only few outbreaks reported but continuous risk for re-introduction	H/M	Not done
Risk of ASF spreading to unaffected areas	Georgia and Armenia	H	Free-ranging pigs and limited control measures	H	H
	Russian Federation	H	High risk of spread mainly through contaminated pork and infected pigs	H	H
	Belarus and Ukraine	M	High number of backyard farms and depopulation without destroying meat	H/H	Not done
Wild boar					
Risk of ASF endemicity in some areas of:	Georgia and Armenia	M	Risk for frequent spill-over from domestic pigs and non-effective long term response	-	L
	Russian Federation	M		-	M
	Belarus and Ukraine	L		-	Not done
Risk of ASF spreading to unaffected area	Georgia and Armenia	M	Limited spread, which can increase when depopulation activities are carried out	-	L
	Russian Federation	M		-	M
	Belarus and Ukraine	M		-	Not done

* Overall judgement: before the elicited parameters were inserted in the risk pathways, as shown in Appendix B, the experts were asked to write down their overall judgement for the risk for endemicity and spread for the two populations together. The median of their answers was taken as the group's response.

General conclusions

- The literature review and fact-finding for this opinion was updated until 31/01/14.
- No changes in the sequenced regions of the genome of the Caucasus ASFV strain have been detected since the first introduction in Georgia in 2007.
- Both field observations and experimental findings in wild boar and domestic pigs show that despite high virulence of the ASFV strains involved, clinical signs in wild boar and domestic pigs are not always clear and will depend on the infectious route, dose and the immune status of the animals. However, in the majority of cases, clinical signs, including mortality, are present.
- There is currently no sero-surveillance in Georgia, Armenia and the Russian Federation, and thus the actual sero-prevalence is unknown.
- The presence of long-term, non-clinical carriers in the infected neighbouring countries of the EU cannot be excluded.

- The potential role of long-term, non-clinical carriers in the epidemiology of the disease is not known.

- There is no animal identification system in the infected eastern neighbouring countries of the EU, hampering efficient tracing of animal and animal product movements.

- Current measures to control ASF in the affected countries on all organisational levels are not expected to slow the spread of the disease within and outside of the countries.

- The backyard sector is an important part of pig production in the infected eastern neighbouring countries of the EU and represents an agro-ecological niche that facilitates spread of ASFV, mainly due to inadequate biosecurity, e.g. swill feeding, possible movement of infected pigs, or contaminated swill or vehicles, and home-slaughter.

- Intensive hunting pressure applied to the affected populations may increase the risk for spread of ASFV in wild boar populations, with particularly severe implications at the international borders.

Domestic pigs

- Since 2008, Georgia and Armenia have not been declared free of ASF by the OIE.

- In Georgia and Armenia, although there is no recent official notification of ASF in domestic pigs, the experts rated the risk as high for ASF presence in the domestic pig population.

- Due to the very limited control measures implemented in Georgia and Armenia, including the lack of compensation, the risk that ASF is endemic in Georgia and Armenia has increased to high, and the risk that it may spread to unaffected areas remains high.

- There is a high risk that ASF is endemic in some areas of the Russian Federation, and the risk that it will spread into unaffected areas, mainly through movement of contaminated pork, infected pigs or contaminated vehicles, is high as well.

- ASFV was introduced in Ukraine and Belarus in 2012 and 2013, respectively, and there is a continuous risk of ASFV re-introduction from the Russian Federation due to the frequent movement of people and pig products, as well as the possibility of transboundary spread movement of infected wild boar.

- Considering the pattern of backyard farms in Ukraine and Belarus, the risk for spread of ASFV is considered to be moderate.

- There are more backyard farms in the west of Ukraine, and progressive movement of the infection towards the west of Ukraine will result in an infected area near the EU border, which will be difficult to control.

- Based on the official information, there have been only a few outbreaks in Ukraine and Belarus, however, considering unofficial information; these may not have been the first cases. The reported outbreaks have all been rapidly controlled rapidly.

- In Belarus, there has been a policy of preventive depopulation and compensation. However, it is not compulsory to destroy the meat from culled animals and this may pose an additional risk for future spread of ASFV in and from this areas.

- There are only a limited number of ongoing activities that will facilitate early detection of secondary spread in Ukraine and Belarus.

- Taking into account the above, the risk that ASF would become endemic in Ukraine and Belarus is considered to be moderate and the risk to further spread into unaffected areas is considered moderate as well.

Wild boar

- There is a high risk for endemicity in the domestic pig population, leading to a constant spill-over of ASFV into the wild boar populations in Georgia and Armenia and the Russian Federation.

- The low wild boar population density in Georgia and Armenia, even further decreased due to mortality, associated with the occasional spill- over of ASFV, results in a moderate risk for endemicity in the wild boar population and a moderate risk for spread to unaffected areas.

- In the Russian Federation, the overall risk for endemicity and further spread to unaffected areas in the wild boar population remains moderate; however, in those areas with high wild boar density, this risk may be higher.

- The continuous distribution of wild boar across the Russian Federation, Ukraine and Belarus would favour the potential for transboundary spread of ASFV in the region.

- The currently applied wild boar depopulation regime in Belarus, may increase the risk of spread of ASFV.

- In Ukraine and Belarus, the overall risk for endemicity and spread to unaffected areas in the wild boar population is evaluated to be moderate.

ToR2:

- The experts judged that frozen meat coming from infected animals has a very high risk of contamination, and of remaining contaminated with infectious ASFV at the moment it would be transported across the EU border.

- The experts judged that chilled meat and skin fat coming from infected animals, wild boar, domestic pigs, and vehicles for animal transport have a high risk of to remaining contaminated with infectious ASFV at the moment they are being transported into the EU.

- Naturally smoked meat, salted and dried meat, salted fermented and dried meat coming from infected animals, any type of vehicle that has been in contact with infected pigs, people involved with pig-keeping, slurry, animal feed, litter and fomites were judged to have a moderate risk of to becoming and remaining contaminated with infectious ASFV at the moment they are being transported into the EU.

- The experts judged that people in infected areas who are not involved with pig-keeping have a low risk of becoming and remaining contaminated with infectious ASFV at the point at which they moment they are being transported into cross into the EU.

- Infectious ASFV has been detected for several years in ticks (Sanchez Botija 1982), however, currently there is no data available suggesting a long-term infection of *Ornithodorus* ticks in the outbreak areas. In addition, the risk of ticks accompanying a transport is also considered low.

- Vegetables, crops, pests, pets, hay and straw and bloodsucking insects were judged to have the lowest risk to become becoming and remaining contaminated with infectious ASFV at the moment they are being transported into the EU.

- The experts judged that meat cooked for 70 °C for 30 min has a negligible risk of remaining contaminated with infectious ASFV at the moment they are being transported into the EU.

REFERENCES

Acevedo P, Vicente J, Ruiz-Fons JF, Cassinello J and Gortázar C, 2007. Estimation of European wild boar relative abundance and aggregation: a novel method in epidemiological risk assessment. Epidemiology and Infection, 135, 519-527.

Adkin A, Coburn H, England T, Hall S, Hartnett E, Marooney C, Wooldridge M, Watson E, Cooper J, Cox T and Seaman M, 2004. Risk assessment for the illegal import of contaminated meat and meat products into Great Britain and the subsequent exposure of GB livestock (IIRA): foot and mouth disease (FMD), classical swine fever (CSF), African swine fever (ASF), swine vesicular disease (SVD). Veterinary Laboratories Agency, New Haw.

Agriculture, Fisheries and Forestry – Australia, 2001. Generic Import Risk Analysis (IRA) for Uncooked Pig Meat. Pig Meat Issues Paper, 43-46.

AHA (Animal Health Australia), 2003. Persistence of Disease Agents in Carcases and Animal Products. Report for Animal Health Australia by Scott Williams Consulting Pty Ltd. Available at: http://www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/WilliamsReport.pdf [Accessed on 01.11.2013].

Arias M and Sánchez-Vizcaíno JM, 2002. African swine fever eradication: the Spanish model. In: Trends in emerging viral infections of swine. Eds Morilla A Yoon KJ and Zimmerman JJ, Iowa State Press, Ames, IA, 133-139.

Baldacchino F, Muenworn V, Desquesnes M, Desoli F, Charoenviriyaphap T and Duvallet G, 2013. Transmission of pathogens by *Stomoxys* flies (Diptera, Muscidae): a review. Parasite, 20, 26.

Basto AP, Nix RJ, Boinas F, Mencles S, Silva MJ, Cartaxeiro C, Portugal RS, Leitao A, Dixon LK and Martins C, 2006. Kinetics of African swine fever virus infection in *Ornithodoros erraticus* ticks. Journal of General Virology, 87, 1863-1871.

Belyanin S, 2013. Dynamic of spreading and monitoring of epizootological process of african swine fever in Russian Federation. PhD Thesis. (Authors Abstract). Pokrov, 2013 (in Russian). Available at: http://vniivvim.ru/dissertation/advert/

Biosecurity New Zealand, 2007. Import Risk Analysis: Hides and skins from specified animals. Ministry of Agriculture and Forestry, Wellington, New Zealand, 42-43.

Blackwell JH, 1983. Foreign animal-disease agent survival in animal products – Recent developments. Journal of the American Veterinary Medical Association, 183, 353-353.

Blome S, Gabriel C, Dietze K, Breithaupt A and Beer M, 2012. High virulence of African swine fever virus Caucasus isolate in European wild boar of all ages. Emerging Infectious Diseases, 18, 708.

Blome S, Gabriel C and Beer M, 2013. Pathogenesis of African swine fever in domestic pigs and European wild boar. Virus Research, 173, 122–130.

Boadella M, Gortázar C, Vicente J and Ruiz-Fons F, 2012. Wild boar: An increasing concern for Aujeszky's disease control in pigs? BMC Veterinary Research, 8, 7.

Boinas, FS, 1994. The role of *Ornithodoros erraticus* in the epidemiology of African swine fever in Portugal. PhD thesis, University of Reading.

Boinas, FS, 1995. Epidemiological characterization of the role of *Ornithodoros erraticus* as a reservoir of African swine fever in Portugal. Veterinaria Tecnica, 5, 30-36.

Boinas FS, Wilson AJ, Hutchings GH, Martins C and Dixon L, 2011. The Persistence of African Swine Fever Virus in Field-Infected *Ornithodoros erraticus* during the ASF Endemic Period in Portugal. PLoS ONE, 6, e20383.

Carrillo C, Borca MV, Afonso CL, Onisk DV and Rock DL, 1994. Long-Term Persistent Infection of Swine Monocytes/Macrophages with African Swine Fever Virus. Journal of Virology, 68, 580-583.

Costard S, Jones BA, Martı´nez-Lo´pez B, Mur L, De la Torre A, Martínez M, Sánchez-Vizcaíno Fernando, Sánchez-Vizcaíno J-M, Pfeiffer DU and Wieland B, 2013. Introduction of African Swine Fever into the European Union through Illegal Importation of Pork and Pork Products. PLoS ONE, 8, e61104.

de Carvalho Ferreira HC, Weesendorp E, Elbers AR, Bouma A, Quak S, Stegeman JA and Loeffen WL, 2012. African swine fever virus excretion patterns in persistently infected animals: A quantitative approach. Veterinary Microbiology, 160, 327-340.

de Carvalho Ferreira HC, Weesendorp E, Quaka S, Stegeman JÁ and Loeffen WLA, 2013. Quantification of airborne African swine fever virus after experimental infection. Veterinary Microbiology, 165, 243–251.

De la Torre A, Bosch J, Iglesias I, Muñoz MJ, Mur L, Martínez-López B, Martínez M and Sánchez-Vizcaíno JM, 2013. Assessing the Risk of African Swine Fever Introduction into the European Union by Wild Boar. Transboundary and Emerging Diseases, doi:10.1111/tbed.12129 Available online at: http://onlinelibrary.wiley.com/doi/10.1111/tbed.12129/pdf.

DEFRA (Department of Environment, Food and Rural Affairs), 2011. African Swine Fever in Russia, 11th April 2011. Available at: http://archive.defra.gov.uk/foodfarm/farmanimal/diseases/monitoring/documents/asf-russia-110411.pdf

DEFRA (Department of Environment, Food and Rural Affairs), 2012. African Swine Fever in Ukraine .Available at: http://www.defra.gov.uk/animal-diseases/files/poa-asf-ukraine-20120802.pdf

DEFRA (Department of Environment, Food and Rural Affairs), 2013. African Swine Fever in Belarus and Russia. Available online at: http://www.defra.gov.uk/animal-diseases/files/poa-asf-russia-20130624.pdf

DeTray, DE, 1957. African swine fever in wart hogs (*Phacochoerus aethiopicus*). Journal of the American Veterinary Medical Association, 130, 537–540.

Diaz AV, Netherton CL, Dixon LK and Wilson AJ. 2012. African swine fever virus strain Georgia 2007/1 in *Ornithodoros erraticus* ticks. Emerging Infectious Diseases, 18, 1026-1028.

Diekmann O, Metz JAJ and Heesterbeek JAP, 1995. The legacy of Kermack and McKendrick. In: Epidemic Models: Their Structure and Relation to Data. Ed Mollison D. Cambridge University Press, Cambridge, UK, 95–115.

Donaldson AI and Ferris NP, 1976. The survival of some air-borne animal viruses in relation to relative humidity. Veterinary Microbiology, 1, 413–420.

Dudnikov SA, Petrova ON, Oganesyan AG, Gulenkin VM, Bardina NS, Erastova EE, Dudorova MV and Karaulov AK, 2011. A forecast for African Swine Fever in the Russian Federation in 2012. 36 pp. Available at: http://www.fsvps.ru/fsvps-docs/ru/iac/publications/iac_public24.pdf

Dudnikov S, Petrova O, Karaulov A, Korennoy F, Bardina N, Tatsenko E and Gulyonkin V, 2014. The prediction on african swine fever in Russian Federation in 2014. Federal Service for Veterinary and Phytosanitary Surveillance. ARRIAH. IAC of Department of veterinary surveilance. –Vladimir. 2014. 42 pp. Available at: http://www.fsvps.ru/fsvps-docs/ru/iac/publications/iac_public.pdf

EFSA (European Food Safety Authority), 2014. Guidance on Expert Knowledge Elicitation in Food and Feed Safety Risk Assessment. EFSA Journal 2014;12(6):3734, 278 pp. doi:10.2903/j.efsa.2014.3734

EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), 2010a. Scientific Opinion on African Swine Fever. EFSA Journal 2010;8(3):1556, 149 pp. doi:10.2903/j.efsa.2010.1556

EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), 2010b. Scientific Opinion on the Role of Tick Vectors in the Epidemiology of Crimean Congo Hemorrhagic Fever and African Swine Fever in Eurasia. EFSA Journal 2010;8(8):1703, 156 pp. doi:10.2903/j.efsa.2010.1703

EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), 2014. Evaluation of possible mitigation measures to prevent introduction and spread of African swine fever virus through wild boar. EFSA Journal 2014;12(3):3616, 23 pp. doi:10.2903/j.efsa.2014.3616

Endris RG and Hess WR, 1992. Experimental transmission of African swine fever virus by the soft tick *Ornithodoros (Pavlovskyella) marocanus* (Acari: Ixodoidea: Argasidae). Journal of Medical Entomology, 29, 652–656.

EVIRA (Finnish Food Safety Aurhority), 2011. Research Reports. 2011. Possible routes of entry into the country for African swine fever – Risk profile. 64 pp.

FAO (Food and Agriculture Organization of the United Nations), 2013. African swine fever in the Russian Federation: risk factors for Europe and beyond. Empress Watch, Vol. 28, May 2013. Rome

FLI (Federal Research Institute for Animal Health), 2014. African Swine Fever. Available at: http://www.fli.bund.de/fileadmin/dam_uploads/Publikationen/FLI-Informationen/FLI-Information_ASP20140218-en.pdf

Gabriel C, Blome S, Malogolovkin A, Parilov S, Kolbasov D, Teifke JP and Beer M. 2011. Characterization of African Swine Fever Virus Caucasus Isolate in European Wild Boar. Emerging Infectious Diseases, 17, 2342-2345.

Gazaev I, Malogolovkin A, Tsybanov S and Kolbasov D, 2012. Conservability of ASFV in pork products. 6th Annual meeting EPIZONE “Viruses on the move”. 12th-14th January, Brighton, United Kingdom.

Geering, WA, Forman AJ and Nunn MJ, 1995. Exotic diseases of animals: a field guide for Australian veterinarians. Canberra, A.C.T. : Australian Government Publishing Service 445 pp.

Gogin A, Gerasimov V, Malogolovkin A and Kolbasov D, 2013. African swine fever in the North Caucasus region and the Russian Federation in years 2007–2012. Virus Research, 173, 204–211.

Gortázar C, Acevedo P, Ruiz-Fons F and Vicente J, 2006. Disease Risks and Overabundance of Game Species. European Journal of Wildlife Research, 52, 81-87.

Greig A, 1972. The localization of African swine fever virus in the tick *Ornithodoros moubata* porcinus. Archiv für die Gesamte Virusforschung, 39, 240–247.

Gulenkin VM, Korennoy FI, Karaulov AK and Dudnikov SA, 2011. Cartographical analysis of African swine fever outbreaks in the territory of the Russian Federation and computer modeling of the basic reproduction ratio. Preventive Veterinary Medicine, 102, 167–174.

Gruzdev KN, 2013. Report about work Reference Laboratory for African Swine Fever FGBI "ARRIAH" in 2013. Available at: http://www.arriah.ru/en/main/news/report-about-work-reference-laboratory-african-swine-fever-fgbi-arriah-2013.

Haas B, Ahl R, Bohm MR and Srauch D, 1995. Inactivation of viruses in liquid manure. Revue Scientifique et. Technique,14, 435-445.

Hamdy FM and Dardiri AH, 1984. Clinical and immunological responses of pigs to African swine fever virus isolated from the western hemisphere. American Journal of Veterinary Research, 45, 711-714.

Hess WR, Endris RG, Lousa A and Caiado JM, 1989. Clearance of African Swine Fever virus from infected tick (Acari) colonies. Journal of Medical Entomology, 26, 314-317.

Karaulov AK, Shevtsov AA and Bardina NS, 2011. Peculiarities of epizootic process at African swine fever in modern conditions. Veterinary of Kuban, 3, 8-10. Available at: http://www.kubanvet.ru/journal_n3_11-04.html?template=print.

Kleiboeker SB, Scoles GA, Burrage G and Sur J-H, 1999. African Swine Fever Virus Replication in the Midgut Epithelium Is Required for Infection of Ornithodoros Ticks. Journal of Virology, 73, 8587–8598.

Kleiboeker SB, Burrage TG, Scoles GA, Fish D and Rock DL, 1998. African swine fever virus infection in the argasid host, *Ornithodoros porcinus porcinus*. Journal of Virology, 72, 1711-1724.

Kolbasov D, Tsybanov S, Malogolovkin A, Gazaev I and Mikolaychuk S, 2011. Identification of ASF virus in pork products. Veterinaria, 10, 54-56.

Kowalenko J, Sidorow M and Burba L, 1965. African swine feve and control measures. Int Zeitschr Landwirtisch Deutsche, 1, 47-52.

Kovalenko J, Sidorow M and Burba L, 1967. I. Experimental study of African swine fever. II. Pasture ticks and Haematopinus as possible reservoirs and vectors of African swine fever, Trudy Vsesoyuznogo Instituta Eksperimental`noi Vetreinarii, 33, 76-90 and 91-94.

Kovalenko Y, Sidorov M and Burba L, 1964. Survival of African swine fever in the environment.Vestnik Selsk. Nauki pp. 62.

Kurinnov V, Belyanin S and Vasilyev A, 2012. Experimental and field research of specific antibodies in tissues of the house pigs infected with virus ASF and wild boar with an acute clinical course. Veterinary of Kuban'. N4, 9-11. Available at: http://vetkuban.com/en/archive.html

Laddomada A, Patta C, Oggiano A, Caccia A, Ruiu A, Cossu P and Firinu A, 1994. Epidemiology of classical swine fever in Sardinia: a serological survey of wild boar and comparison with African swine fever. Veterinary Record, 134, 183–187.

MacDiarmid S, 1991. The importation into New Zealand of meat and meat products. A review of the risks to animal health. NASS Publication – Ministry of Agriculture and Fisheries, 91, 180.

Malogolovkin A, Yelsukova A, Gallardo C, Tsybanov S and Kolbasova D, 2012. Molecular characterization of African swine fever virus isolates originating from outbreaks in the Russian Federation between 2007 and 2011. Veterinary Microbiology, 158, 415–419.

Manelli A, Sotgia S, Patta C, Oggiano A, Carboni A, Cossu P and Laddomada A, 1998. Temporal and spatial patterns of African swine fever in Sardinia. Preventive Veterinary Medicine, 35, 297–306.

Manelli A, Sotgia S, Patta C, Sarria A, Madrau P, Sanna L, Firinu A and Laddomada A, 1997. Effects of husbandry methods on seropositivity to African swine fever virus in Sardinian swine herds. Preventive Veterinary Medicine, 32, 235–241.

McDaniel HA, 1980. African swine fever. In: Diseases of Swine, 5th edition. Eds Leman AD, Straw B, Glock RD, Mengeling WL, Penny RHC and Scholl E. Iowa State University Press, Ames, 300–308.

McKercher PD, Hess WR and Hamdy F, 1978, 'Residual viruses in pork products', Appl Environ Microbiol, vol. 35, pp. 142-145,

McKercher PD, Yedloutshnig RJ, Callis JJ, Murphy R, Panina GF, Civardi A, Bugnetti M, Foni E, Laddomada A, Scarano C. and Scatozza F, 1987. Survival of viruses in 'Prosciutto di Parma' (Parma ham). Journal of the Canadian Institute of Food Science Technology, 20, 267-272.

Mebus CA and Dardiri AH, 1980. Western hemisphereisolates of African swine fever virus – asymptomatic carriers and resistance carriers to challenge inoculation. American Journal of Veterinary Research, 41, 1867-1869.

Mebus CA, House C, Ruiz Gonzalvo F, Pined JM, Tapiador J, Pire JJ, Bergada J, Yedloutschnig RJ, Sahu S, Becerra V and Sánchez-Vizcaíno JM, 1993. Survival of Foot-and-mouth disease, African

swine fever, and Hog cholera viruses in Spanish Serrano cured hams and Iberian cured hams, shoulders and loins. Food Microbiology, 10, 133-143.

Mebus C, Arias M, Pineda J, Tapiador J, House J and Sánchez-Vizcaíno JM, 1997. Survival of several porcine viruses in Spanish dry-cured meat products. Food Chemistry, 59, 555-559.

Mellor PS, Kitching RP and Wilkinson PJ. 1987. Mechanical transmission of capripox virus and African swine fever virus by *Stomoxys calcitrans*. Research in Veterinary Science, 43, 109–112

Mellor PS and Wilkinson PJ, 1985. Experimental transmission of African Swine fever virus by *Ornithodorros savinyi* (Audouin). Research in Veterinary Science, 39, 353-356.

Mur L, Boadella M, Martínez-López B, Gallardo C, Gortazar C and Sánchez-Vizcaíno JM, 2012a. Monitoring of African Swine Fever in the Wild Boar Population of the Most Recent Endemic Area of Spain. Transboundary and Emerging Diseases, 59, 526-531.

Mur L, Martínez-López B, Martínez M, Costard S, Wieland B, Pfeiffer DU and Sánchez-Vizcaíno JM, 2012b. Quantitative Risk Assessment for the Introduction of African swine fever virus into the European Union by Legal Import of Live Pigs. Transboundary and Emerging Diseases, 59, 134-144.

Mur L, Martínez-López B and Sánchez-Vizcaíno, 2012c. Risk of African swine fever introduction into the European Union through transport-associated routes: returning trucks and waste from international ships and planes. BMC Veterinary Research, 8, 149.

Oganesyan AS, Petrova ON, Korennoy FI, Bardina NS, Gogin AE and Dudnikova SA, 2013. African swine fever in the Russian Federation: Spatio-temporal analysis and epidemiological overview. Virus Research, 173, 204–211.

OIE (World Organisation for Animal Health), 2013. African swine fever. Aetiology, epidemiology, diagnosis, prevention and control. Available at: http://www.oie.int/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_cards/AFRICAN_SWINE_FEVER.pdf [Accessed on 01.11.2013]

OIE (World Organisation for Animal Health), 2014. Report Archive. Available at: http://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/reportarchive

OIE-WAHID (World Organisation for Animal Health-World Animal Health Information Database), online. Available at: http://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home

Perez-Sanchez R, Astigarraga A, Oleaga-Pérez A and Encinas-Grandes A, 1994. Relationship between the persistence of African swine fever and the distribution of *Ornithodoros erraticus* in the province of Salamanca, Spain. Veterinary Record, 135, 207-209.

Ravaomanana J, Michaud V, Jori F, Andriatsimahavandy A, Roger F, Albina E and Vial L, 2010. First detection of African Swine Fever Virus in Ornithodoros 812 porcinus in Madagascar and new insights into tick distribution and taxonomy. Parasite Vectors, 3, 115.

Rolesu S, Aloi D, Ghironi A, Oggiano N, Oggiano A, Puggioni G, Patta C, Farina S, and Montinaro S, 2007. Geographic information systems: a useful tool to approach African swine fever surveillance management of wild pig populations. Veterinaria Italiana, 43, 463–467.

Rossi S, Fromont E, Pontier D, Crucière C, Hars J, Barrat J, Pacholek X, Artois M. 2005. Incidence and persistence of classical swine fever in free-ranging wild boar (*Sus scrofa*). Epidemiology and Infection, 133, 559-568.

Sanchez Botija C, 1982. African swine fever: new developments. Revue scientifique et technique, 1, 1065-1094.

Sánchez-Vizcaíno JM, 2006. African Swine Fever. In: Diseases of Swine. 9th edition. Blackwell Publishing, Ames, Iowa, 291-298.

Sánchez-Vizcaíno JM, Martínez-López B, Martínez-Avilés M, Martins C, Boinas F, Vial L, Michaud V, Jori F, Etter E, Albina E and Roger F, 2009. Scientific report submitted to EFSA on African Swine Fever. 1-141.

Sánchez-Vizcaíno JM, Mur L and Martínez-López B, 2013. African swine fever (ASF): Five years around Europe. Veterinary Microbiology, 165, 45-50.

Shannon CE, 1948. A Mathematical Theory of Communication. Bell System Technical Journal, 27, 379–423, 623–656.

Smirnov A and Butko M, 2011. Stability of exciter and ASF control measures. Veterinary Doctor, 6, 2-7.

Sodeikat G and Pohlmeyer K, 2003: Escape movements of family groups of wild boar *Sus scrofa* influenced by drive hunts in Lower Saxony, Germany. Wildlife Biology, 9, 43-49.

Strauch D, 1991. Survival of pathogenic micro-organisms and parasites in excreta, manure and sewage sludge. Revue Scientifique et Technique Office International des Epizooties, 10, 813-846.

Thurfjell H, Spong G and Ericsson G, 2013. Effects of hunting on wild boar *Sus scrofa* behaviour. Wildlife Biology, 19, 87-93.

Turner C and Williams SM, 1999. Laboratory-scale inactivation of African swine fever virus and swine vesicular disease virus in pig slurry. Journal of Applied Microbiology, 87, 148-157.

USDA-APHIS-VS. 2007. Mission to Assess the African Swine Fever (ASF) Outbreak Republic of Georgia July 31-August 10, 2007, p. 15.

Vicente J, Segalés J, Höfle U, Balasch M, Plana-Durán J, Domingo M and Gortazar C, 2004. Epidemiological study on porcine circovirus type 2 (PCV2) infection in the European wild boar (*Sus scrofa*). Veterinary Research, 35, 243-253.

Vicente J, Barasona JA, Acevedo P, Ruiz-Fons JF, Boadella M, Diez-Delgado I, Beltran-Beck B and Gortazar C, 2013. Temporal trend of tuberculosis in wild ungulates from mediterranean Spain. Transboundary and Emerging Diseases, 60, 92-103.

Viltrop A and Jeremejeva J, 2011. Risk Profile of African Swine Fever for Estonia. Available at: http://www.agri.ee/public/juurkataloog/TRUKISED/2011/riskiprofiil_sigadeaafrikakatk_2011.pdf

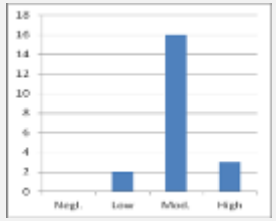
Wilkinson PJ, Wardley RC, Williams SM,1981. African Swine Fever virus (Malta-78) in pigs. Journal of Comparative Pathology, 91, 277-284.

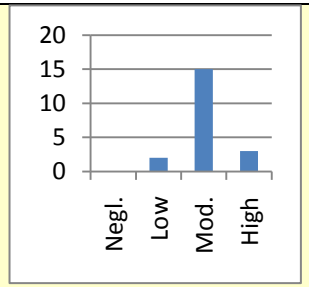
Wilkinson PJ, 1984. The persistence of African swine fever in Africa and the Mediterranean. Preventive Veterinary Medicine, 2, 71–82.

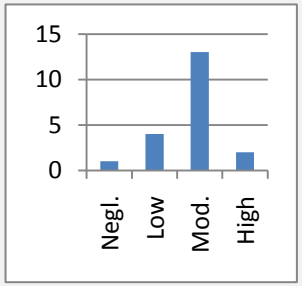
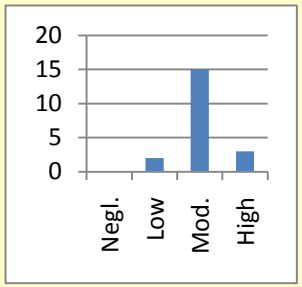
Wilkinson PJ, 1989. African swine fever virus. In: Virus Infections of Porcines. Ed Pensaert MB. Amsterdam: Elsevier. Science Publishers, 17-35.

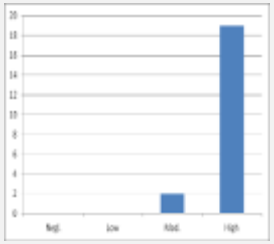
APPENDICES

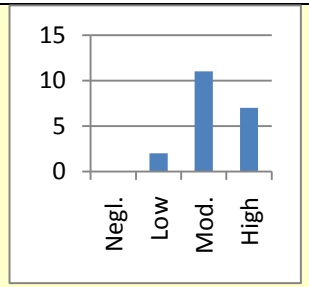
APPENDIX A: SUMMARY OF EXPERT KNOWLEDGE ELICITATION

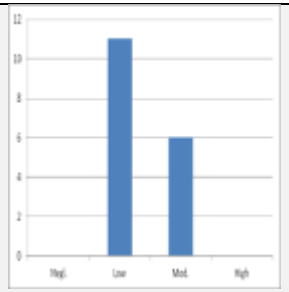
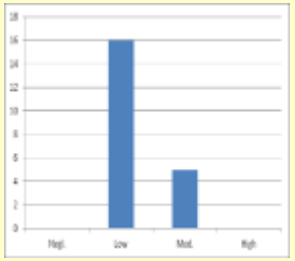
Question No.	Full answer	Answer	Frequency of answers		Rationale summary
1. Disease presence in domestic pigs in Georgia or Armenia: How likely is it that a domestic pig in Georgia or Armenia (Georgia and Armenia) is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Georgia and Armenia since 2010, and there is no other information available that indicates ASF presence in pigs.	Negligible	0/21		
	No outbreaks have been notified in Georgia and Armenia since 2010, but there is some information available that indicates ASF presence in pigs.	Low	2/21	 Entropy = 0.31	• 1 expert refers to news from August 2013 on ASF outbreaks in domestic pigs (possibly wrong box ticked) • 1 expert did not provide any rationale
	Some outbreaks have been notified in Georgia and Armenia since 2010, and there is information available that indicates ASF presence in pigs.	Moderate	16/21		• 6 experts refer to official reports • 3 experts mention unofficial information of outbreaks since 2013 in Armenia • 1 expert notes that official reports do not reflect real epidemiological situation due to improper surveillance and diagnostics • Additionally 1 expert claims that endemicity may be established in Georgia due to difficulties in eradication, high proportion of backyard farming, weak veterinary services • 6 experts did not provide rationales
	Repeated outbreaks have been notified in Georgia and Armenia since 2010, and there is a lot of information available that indicates ASF presence in pigs.	High	3/21		• 2 experts refer to non-official information about ASF presence in Georgia and media report on ASF in Russian Federation originating from Georgia. 1 of them draws conclusion on lack of proper eradication programme. • 1 expert did not provide any rationale
2. Clinical signs in domestic pigs in Georgia or Armenia: How likely is it that an ASFV infection with the Caucasian strain in domestic pigs results in noticeable clinical signs in Georgia or Armenia (Georgia and Armenia), taking into account the immune status of the population at this moment?	Clinical signs are not present in domestic pigs infected with ASFV in Georgia and Armenia.	Negligible	0/20		
	Clinical signs are only sometimes present in domestic pigs infected with ASFV in Georgia and Armenia.	Low	2/20		• 1 experts based the response on assumption due to lack of data • 1 expert did not provide any rationale
	Clinical signs are most often present in domestic pigs infected with ASFV in Georgia and Armenia.	Moderate	15/20		• 1 expert mentions moderate to severe clinical signs observed in experimental set up • 1 expert concludes this response based on mortality rates • 1 expert refers to no changes in the virus but possibility of less clinical signs in the field • 3 experts point out possibility of Ab positive animals without clinical signs (example in Armenia

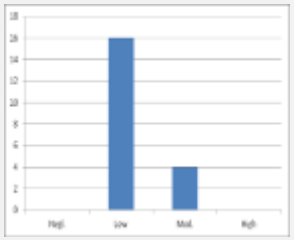
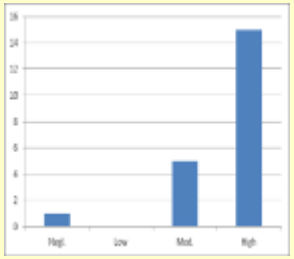
				 Entropy = 0.32	between 2010-2011 given by 1 of them), however virulence of Caucasian strain is unknown due to lack of surveillance • 1 experts refers to negative results of ASF Ab test ran in 2010 and claims that herd immunity should not mask clinical signs • 1 expert refers to internet sources without any specific details • 5 experts did not provide any rationale • Clinical signs not always present. It depends on the route of infection, doses, and prior immunity • Difference history what concerns duration of infection status of country..some countries are infected for 7 years, and others only recently infected • Clinical signs are dependent on the source of infection (if blood involved or not) • No typical signs as in the books • Animals may survive infections • Experimental infections usually use higher ID as in the field. Some experiments with low ID, however show very broad spectrum of clinical signs….. • Animals that have survived and have high titer of AB will not be infected, however, those that have low level of AB may become chronic carriers… • Virus shedding only during the viraemic period • Not many indications that there are a lot of surviving animals • Carriers have not yet been identified in Russian Federation, Georgia and Armenia, Belarus and Ukraine • Animals could still spread virus as pig product (even when not shedding) • The Caucasus and Sardinian strain are not so different what concerns pathogenicity • Georgia: both cases with clinical and without clinical signs observed • Armenia: no serosurveillance, but to give an idea, from 10 samples taken from holding with outbreak one year ago.
	Clinical signs are always present in domestic pigs infected with ASFV in Georgia and Armenia.	High	3/20		• 1 expert refers to no genetic changes in the Caucasian strain (Blome et al., 2013) but possibility of unusual clinical presentation: unspecific symptoms, peracute deaths (2 experts) • 1 expert claims that virus has not adapted since 2007 and at least all infected piglets show clinical signs regardless possible survivors between adult pigs • 3 experts did not provide any rationale

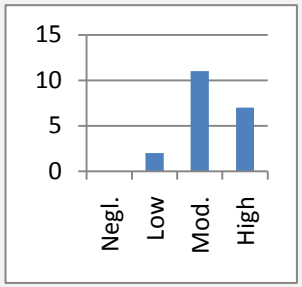
3. Disease presence in wild boar in Georgia or Armenia: How likely is it that a wild boar in Georgia or Armenia (Georgia and Armenia) is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Georgia and Armenia since 2010, and there is no other information available that indicates ASF presence in wild boar.	Negligible	1/20		• None of experts did not provide rationales
	No outbreaks have been notified in Georgia and Armenia since 2010, but there is some information available that indicates ASF presence in wild boar.	Low	4/20		• 4 experts refers to low density of wild boar population in Georgia and Armenia, which enables disease transmission cycle, although spill-over from domestic pigs and wild boar through backyard farming is possible according to 2 of them as ASF was unofficially reported in Armenia in WB years ago (2 experts). 1 of these experts mentions wild boar as sentinel for ASFV circulation in pigs • 1 expert refers to WAHID information without any specific details • 1 expert is certain of spill-over to WB population from potentially infected domestic pigs • 4 experts did not provide rationales
	Some outbreaks have been notified in Georgia and Armenia since 2010, and there is information available that indicates ASF presence in wild boar.	Moderate	13/20	Entropy = 0.43	• 2 expert mentions limited surveillance in wild boar impossible to ascertain anecdotal infection in wild boar • 1 expert concludes rationale based on mortality rates • 1 expert refers to internet sources without specific details • 4 experts did not provide any rationale
	Repeated outbreaks have been notified in Georgia and Armenia during the last years, and there is a lot of information available that indicates ASF presence in wild boar.	High	2/20		• expert did not provide any rationale
4. Clinical signs in wild boar in Georgia or Armenia: How likely is it that an ASF outbreak in wild boar results in noticeable clinical signs in Georgia or Armenia (Georgia and Armenia)?	Clinical signs are not present in wild boar infected with ASFV in Georgia and Armenia.	Negligible	0/20		• According to 1 expert- although European wild boar is susceptible to ASF (Blome et al., 2012, Blome et al., 2011), it is not possible to observe clinical signs in wildlife other than post-mortem.
	Clinical signs are only sometimes present in wild boar infected with ASFV in Georgia and Armenia.	Low	2/20		• None of experts provided a rationale
	Clinical signs are most often present in wild boar infected with ASFV in Georgia and Armenia.	Moderate	15/20	Entropy = 0.32	• 3 experts refer to experimental studies, which revealed presence of acute form of ASF in wild boar (Blome et al, 2011 and 2013). 1 of the experts points out the route of infection performed experimentally differs from natural, therefore results should be treated with caution when extrapolated to wild boar. • 1 expert expects similar virulence of ASFV in wild boar and domestic pigs but accounts for possibility of sub-clinical or chronic course of disease • 1 expert mentions possibility of no clinical signs in seropositive wild boar on example of testing in Armenia (2007-2011)

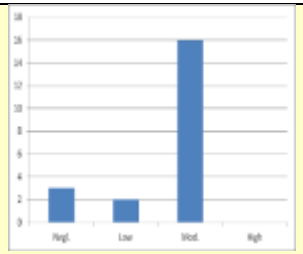
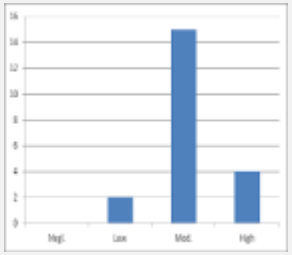
					• 1 expert refers to mortality rate • 1 expert refers to internet source and WAHID without any specific details • 5 experts did not provide rationales • In experimental infection there is no difference in susceptibility between WB and DP • No reason to differentiate WB and DP
	Clinical signs are always present in wild boar infected with ASFV in Georgia and Armenia.	High	3/20		• 2 experts refer to clinical signs observed in experimental infections and field reports, especially that virus did not change genetically since 2007 according to 1 of them. • 1 expert refers to official reports on dead wild boar • 1 expert mentions that death as the only noticeable symptom in wild boar, is challenging to detect due to limited passive surveillance and animals scavenging on carcasses in the wild. • 2 experts did not provide rationales
5. Disease presence in domestic pigs in The Russian Federation: How likely is it that a domestic pig in The Russian Federation (Russian Federation) is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Russian Federation since 2010, and there is no other information available that indicates ASF presence in pigs.	Negligible	0/21	 Entropy = 0.14	
	No outbreaks have been notified in Russian Federation since 2010, but there is some information available that indicates ASF presence in pigs.	Low	0/21		
	Some outbreaks have been notified in Russian Federation since 2010, and there is information available that indicates ASF presence in pigs.	Moderate	2/21		• 2 experts did not provide rationales
	Repeated outbreaks have been notified in Russian Federation since 2010, and there is a lot of information available that indicates ASF presence in pigs.	High	19/21		• 11 experts refer to official information available through OIE, Federal veterinary Services of Russian Federation on situations in Russian Federation since 2008. 1 of them also mentions insufficient control measures and socioeconomic problems in Russian Federation which may contribute to virus maintenance • 1 expert draws conclusion based on mortality rate • 1 expert mentions endemicity to be almost established in some areas of Russian Federation • 7 experts did not provide rationales
6. Clinical signs in domestic pigs in The Russian Federation: How likely is it that an ASF outbreak in domestic pigs results in noticeable clinical signs in The Russian Federation (Russian Federation)?	Clinical signs are not present in domestic pigs infected with ASFV in Russian Federation.	Negligible	0/20		
	Clinical signs are only sometimes present in domestic pigs infected with ASFV in Russian Federation.	Low	2/20		• 2 experts did not provide rationales
	Clinical signs are most often present in domestic pigs infected with ASFV in Russian Federation.	Moderate	11/20		• 2 experts refer to no genetic changes in viral genome but some possibility that evident clinical signs may not be evident based on field reports and lack of serosurveillance

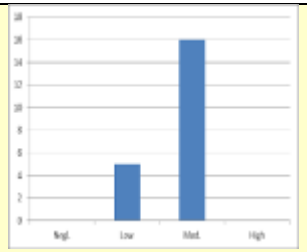
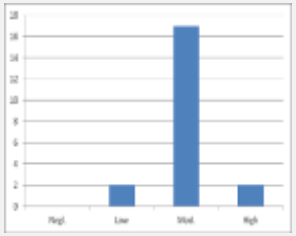
				 Entropy = 0.40	• 1 expert refers to official and unofficial reports • 3 experts did not provide rationales • Clinical signs not always present. It depends on the route of infection, doses, and prior immunity • Difference history what concerns duration of infection status of country..some countries are infected for 7 years, and others only recently infected • Clinical signs are dependent on the source of infection (if blood involved or not) • No typical signs as in the books • Animals may survive infections • Experimental infections usually use higher ID as in the field. Some experiments with low ID, however show very broad spectrum of clinical signs….. • Animals that have survived and have high titer of AB will not be infected, however, those that have low level of AB may become chronic carriers… • Virus shedding only during the viraemic period • Not many indications that there are a lot of surviving animals • Carriers have not yet been identified in Russian Federation, Georgia and Armenia, Belarus and Ukraine • Animals could still spread virus as pig product (even when not shedding) • The Caucasus and Sardinian strain are not so different what concerns pathogenicity • Georgia: both cases with clinical and without clinical signs observed • Armenia: no serosurveillance, but to give an idea, from 10 samples taken from holding with outbreak one year ago. •
	Clinical signs are always present in domestic pigs infected with ASFV in Russian Federation.	High	7/20		• 3 experts refer to no genetic changes in viral genome since 2008 • 4 experts mentions that clinical signs though always present may be unspecific and therefore misleading • 2 experts also refer to experimental study demonstrating severe clinical signs • 1 expert refers to official mortality and morbidity reports • 1 expert is uncertain about the response • 5 experts did not provide rationales
7. Disease reporting in The Russian Federation: How likely is it that suspected cases in domestic pigs are reported to the veterinary service in the Russian Federation?	In no areas of the Russian Federation, suspected cases are reported to the veterinary services.	Negligible	0/17		
	In a few areas of the Russian Federation, suspected cases are reported to the veterinary services.	Low	11/7		• 2 experts mention differences between regions and production systems given access to administration as and perception of ASF as a proxy

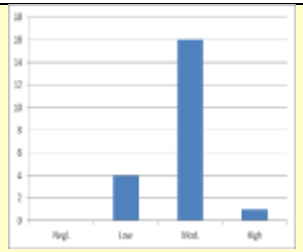
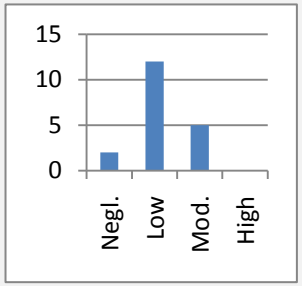
				 Entropy = 0.28	• 1 expert refers to unofficial information without any specific details • 1 expert did not provide any rationale • Less reporting in backyard sector than industrial sector • Compensation is happening at market price in some regions
	In the majority of the areas in the Russian Federation, suspected cases are reported to the veterinary services.	Moderate	6/17		• 4 experts mention limited reporting in backyard production due to lack of compensation system. 2 of them mention fraudulent practices of masking carcasses, especially in backyard production. 1 of them expects less reporting in areas, where ASF has already occurred. • 1 expert refers to absence of funded national eradication program, which limits reporting. • 1 expert concludes that based on visible clinical signs • 1 expert mentions that reports are present form different part of Russian Federation • 9 experts did not provide rationales
	In the entire Russian Federation, all suspected cases are reported to the veterinary services.	High	0/17		• 1 expert refers to reporting to OIE since 2008
8. Effective control measures in The Russian Federation: Taking into account possible differences between areas in the Russian Federation, how likely is it that control measures applied upon the case confirmation are effective to contain the outbreak (e.g. rapid stamping out)?	In none of the areas of the Russian Federation, the Veterinary Services are efficient in rapidly controlling the outbreaks after the case confirmation.	Negligible	0/21	 Entropy = 0.24	
	In a few areas of the Russian Federation, the Veterinary Services are efficient in rapidly controlling the outbreaks after the case confirmation.	Low	16/21		• 1 expert mentions lack of interest of pig producers and government, which hampers disease control efforts (e.g. uncontroll movements) • 1 expert mentions lack of veterinary supervision in backyard sector (Gogin et al., 2013) • 4 experts refer to insufficient control measures (FAO, 2013; official CVO communication, lack of national eradication scheme) • 1 expert refers to personal communication sources • 9 experts did not provide rationales
	In the majority of the areas in the Russian Federation, the Veterinary Services are efficient in rapidly controlling the outbreaks after the case confirmation.	Moderate	5/21		• 3 experts mention differences between regions in terms of veterinary service activities, budget, level of preparedness and education. 1 of them points out a problem of delayed application of control measures due to timely diagnosis (FAO, 2013) • 1 expert claims control measures are efficient and refers to website of FSVSP • 1 expert refers to official and unofficial information without any specific details
	In the entire Russian Federation, the Veterinary Services are always very efficient in rapidly controlling the	High	0/21		

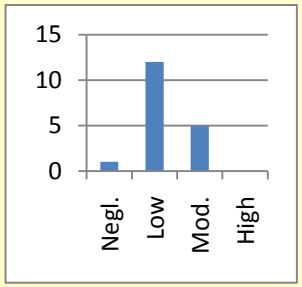
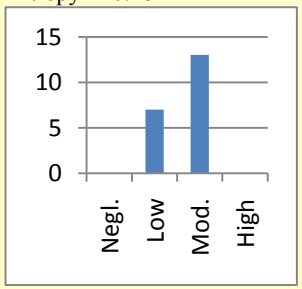
	outbreaks after the case confirmation.				
9. Effective tracing in The Russian Federation: Taking into account possible differences between areas in the Russian Federation, how likely is it that prevention and control measures in place will identify dangerous contacts and therewith hamper containment of the outbreak in the Russian Federation?	In none of the areas of the Russian Federation, the Veterinary Services are efficient in tracing dangerous contacts.	Negligible	1/21		• 1 expert mentions informal tracing procedure reliant on the pig owner.
	In a few areas of the Russian Federation, the Veterinary Services are efficient in tracing dangerous contacts.	Low	16/21		• 2 expert mentions uncontrolled movement of pork products from ASF affected regions (Gogin et al., 2013) • 2 expert mentions insufficient control measures (FAO), 2013) such as lack of traceability system • 1 expert mentions differences between regions • 3 experts mention that spread is associated with illegal movement of products and swill in backyard systems and wild boar movement enabling tracing according to 1 of them (FAO, 2013) • 1 expert mentions unofficial and official information without any specific details • 8 experts did not provide rationales
	In the majority of the areas in the Russian Federation, the Veterinary Services are efficient in tracing dangerous contacts.	Moderate	4/21	Entropy = 0.29	• 1 expert claims control measures are efficient and refers to website of FSVSP • 1 expert mentions traceability systems present in commercial farms but points out protocol differences between regions • 2 experts did not provide rationales
	In the entire Russian Federation, the Veterinary Services are efficient in tracing dangerous contacts.	High	0/21		
10. Disease presence in wild boar in The Russian Federation: How likely is it that a wild boar in The Russian Federation (Russian Federation) is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Russian Federation during the last years, and there is no other information available that indicates ASF presence in wild boar.	Negligible	1/21		• None of experts provided any rationales
	No outbreaks have been notified in Russian Federation during the last years, but there is some information available that indicates ASF presence in wild boar.	Low	0/21		
	Some outbreaks have been notified in Russian Federation during the last years, and there is information available that indicates ASF presence in wild boar.	Moderate	5/21		• 2 experts mentions ASF surveillance in wild boar but diagnosis is incidental according to 1 of them. From 2008-2010 positive cases in wild boar were reported. • 1 expert mentions difference between production systems and areas with different pig densities as proxy for contact between domestic pigs and wild boar
	Repeated outbreaks have been notified in Russian Federation during the last years, and there is a	High	15/21	Entropy = 0.32	• 5 experts refer to official reports (OIE, FSVSP) and 1 of them to unofficial information without any specific details • 1 expert mentions it is well known fact

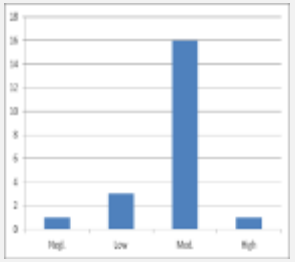
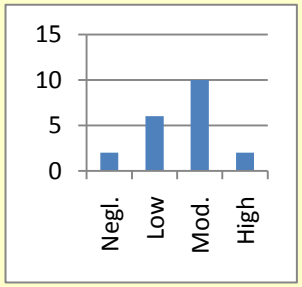
	lot of information available that indicates ASF presence in wild boar.				• 2 experts mention that reporting of cases in wild boar creates illusion of WB implication in ASF epidemiology • 7 experts did not provide rationales
11. Clinical signs in wild boar in The Russian Federation: How likely is it that an ASF outbreak in wild boar results in noticeable clinical signs in The Russian Federation (Russian Federation)?	Clinical signs are not present in wild boar infected with ASFV in Russian Federation.	Negligible	0/20	 Entropy = 0.4	• 1 expert mentions that clinical signs are not evident in wild boar apart post-mortem changes (Blome, 2012, 2011)
	Clinical signs are only sometimes present in wild boar infected with ASFV in Russian Federation.	Low	2/20		• 1 expert mentions that diagnosis in WB is incidental and relies on passive surveillance for corpse or animal shooting. • 2 experts did not provide rationales
	Clinical signs are most often present in wild boar infected with ASFV in Russian Federation.	Moderate	11/20		• 3 experts refer to experimental studies (Blome, 2013), which demonstrated severity of clinical signs in wild boar. One of experts mentions challenge to detect them in wild animals. Another expert points out different conditions of infection in experimental set than in real life. • 1 expert refers to mortality rate • 1 expert mentions unchanged virulence of ASFV but also possibility of existence seropositive wild boar • 1 expert mentions that presence of ASF appears in epidemic waves, therefore herd immunity does not mask clinical signs • 1 expert refers to unofficial source of information without any specific details • 2 experts did not provide rationales • In experimental infection there is no difference in susceptibility between WB and DP • No reason to differentiate WB and DP
	Clinical signs are always present in wild boar infected with ASFV in Russian Federation.	High	7/20		• 2 experts refers to experimentally demonstrated susceptibility and high lethality in wild boar • 2 experts mentions lack of changes in viral genome since 2007. One of them assumes unusual clinical presentations may be present, when the other points out that no sub-clinical or chronic disease has been reported in the field. • 4 experts did not provide rationales
12. Disease presence in domestic pigs in Ukraine: How likely is it that a domestic pig in Ukraine is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Ukraine since 2010, and there is no other information available that indicates ASF presence in pigs.	Negligible	3/21		• 1 expert refers to the last outbreak in 2012 in Ukraine, which originated from Krasnodar region of the Russian Federation and was successfully contained • 1 expert claims there is no signs of ASF presence in Ukraine at present. • 1 expert did not provide any rationale
	No outbreaks have been notified in Ukraine since 2010, but there is some information available that indicates ASF presence in pigs.	Low	2/21		• None of experts did not provide rationales
	Some outbreaks have been notified in Ukraine since 2010, and there is information available that indicates ASF presence in pigs.	Moderate	16/21		• 4 experts refer to one officially reported outbreak in Ukraine and 2 of them refer to outbreaks in Russian Federation in vicinity to Ukrainian boarder

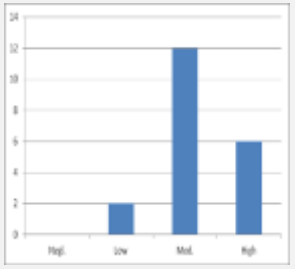
					• 2 experts mentions frequent contacts between the Russian Federation and Ukraine along lengthy boarder as risk for new outbreaks in Ukraine • 2 expert refers to OIE reports • 1 expert refers to unofficial information on additional outbreaks in Ukraine • 7 experts did not provide rationales
	Repeated outbreaks have been notified in Ukraine since 2010, and there is a lot of information available that indicates ASF presence in pigs.	High	0/21	Entropy = 0.31	
13. Disease presence in domestic pigs in Belarus: How likely is it that a domestic pig in Belarus is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Belarus since 2010, and there is no other information available that indicates ASF presence in pigs.	Negligible	0/21		
	No outbreaks have been notified in Belarus since 2010, but there is some information available that indicates ASF presence in pigs.	Low	2/21		None of experts did not provide rationales
	Some outbreaks have been notified in Belarus since 2010, and there is information available that indicates ASF presence in pigs.	Moderate	15/21	 Entropy = 0.34	• 1 expert refers to officially reported outbreaks and to frequent contacts with the Russian Federation • 3 experts mention vicinity to Ukraine and the Russian Federation and permeability of boarder with the Russian Federation as the risk of reintroduction of ASF to Belarus • 1 expert is uncertain about this question • 2 experts claim the spread in Belarus may be larger than officially recognised. 1 of them mentions possibility of spread thru transboundary wild boar and unreported outbreaks in backyard sector. • 8 experts did not provide rationales
	Repeated outbreaks have been notified in Belarus since 2010, and there is a lot of information available that indicates ASF presence in pigs.	High	4/21		• 3 experts refer to media information on additional outbreaks and mortalities in pigs or other unofficial information • 1 expert refers to unofficial communication with local veterinarians
14. Spread by movement of domestic pigs in Ukraine and Belarus considering the proportion of backyard sector versus commercial sector available in these 2 countries: How likely is it that ASFV will spread through movement of domestic pigs in Ukraine and Belarus (Belarus and Ukraine) resulting in direct contact between pigs (including intentional movement through	In all farms in Belarus and Ukraine, biosecurity measures only allow restricted pig movement (e.g. quarantine...) from farm to farm.	Negligible	0/21		
	In most farms in Belarus and Ukraine, biosecurity measures only allow restricted pig movement (e.g. quarantine….) from farm to farm.	Low	5/21		• 1 expert recognises higher risk in backyard farms • 1 expert claims that movement of pigs in the backyard sector and large industrial units is of no importance for disease spread, only traditional free ranging systems in some of the areas • 3 experts did not provide rationales
	In most farms in Belarus and	Moderate	16/21		• 1 expert claims biosecurity is higher in Belarus than in

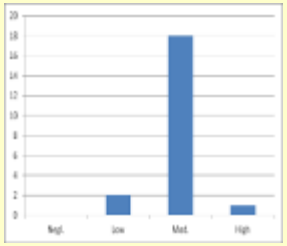
transport or unintentional through free ranging)?	Ukraine, the poor biosecurity measures in place allow pig movements between farms with limited control.			 Entropy = 0.24	Ukraine given the proportion of backyard holdings. • 1 expert claims biosecurity is higher in Ukraine than in Belarus given prompt reaction to ASF outbreaks. • 2 experts mention low biosecurity level in both countries with possible illegal movement of animals and their products • 1 expert mentions differences between industrial and backyard holdings. • 1 expert mentions OIE reports and unofficial information without any specific details • 1 expert`s choice is based on experience extrapolated from the Russian Federation • 9 experts did not provide rationales
	There are no biosecurity measures in place in Belarus and Ukraine, so pig movements are not controlled.	High	0/21		
15. Spread by movement of pork in Ukraine and Belarus considering the proportion of backyard sector versus commercial sector available in these 2 countries: How likely is it that ASFV will spread through movement of pork in Ukraine and Belarus (Belarus and Ukraine) resulting in indirect contact between pigs (for example, swill feeding)?	In all pig farms in Belarus and Ukraine, biosecurity measures do not allow swill-feeding.	Negligible	0/21	 Entropy = 0.27	
	In most pig farms in Belarus and Ukraine biosecurity measures do not allow swill-feeding.	Low	2/21		• None of experts did not provide rationales
	In most pig farms in Belarus and Ukraine, the poor biosecurity measures in place allow swill-feeding.	Moderate	17/21		• 5 experts mention swill feeding as a common practice in U and B, especially in the backyard holdings according to 2 of them and used without thermal treatment according to 1 of them • 2 expert mention higher risk in Ukraine than in Belarus given the proportion of backyard holdings (FAO, 2013) • 1 expert refers to unofficial sources of information without any specific details • 1 expert bases a choice upon personal assumption • 8 experts did not provide rationales
	There are no biosecurity measures in place in the pig farms in Belarus and Ukraine so swill feeding is a common practice.	High	2/21		• None of experts did not provide rationales
16. Spread by movement of people involved in pig keeping sector (backyard, semi-commercial, small holders and industrial) in Ukraine and Belarus: How likely is spread through movement of people involved with pig-keeping in Belarus and Ukraine?	In all farms in Belarus and Ukraine, the good biosecurity measures in place eliminate the possibility of ASFV spread by people involved with pig keeping.	Negligible	0/21		
	In most farms in Belarus and Ukraine, the good biosecurity measures in place eliminate the possibility of ASFV spread by people involved with pig keeping.	Low	4/21		• 1 expert mentions higher risk in western Ukraine given the proportion of backyard holdings with limited biosecurity, as involvement of infected blood is needed to facilitate spread by people. • 3 experts did not provide rationales
	In most farms in Belarus and	Moderate	16/21		• 3 expert mentions differences between industrial and

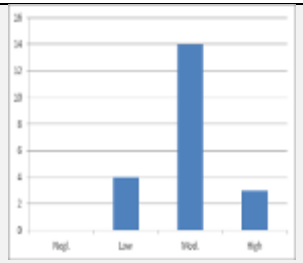
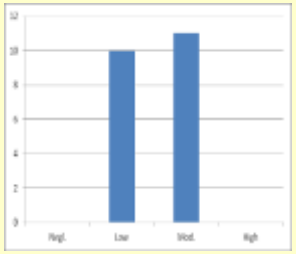
	Ukraine, the poor biosecurity measures in place do not eliminate the possibility of ASFV spread by people involved with pig keeping.				small/backyard holdings (pig keeping vs. pig keeping) • 1 expert bases a choice upon personal assumption • 1 expert refers to unofficial information without any specific details • 1 expert recognises higher risk in Ukraine than in Belarus given different proportion of backyard holdings • 10 experts did not provide rationales
	There are no biosecurity measures in place in Belarus and Ukraine, resulting in an uncontrolled spread of ASFV spread by people involved with pig keeping.	High	1/21	Entropy = 0.29	• None of experts did not provide rationales
17. Spread by movement of people not involved in pig keeping sector, who are less likely to come in direct contact with pigs in Ukraine and Belarus (other than people mentioned in the previous question): How likely is spread through movement of people not involved in pig keeping sector in Belarus and Ukraine?	In all farms in Belarus and Ukraine, the good biosecurity measures in place do not allow people not involved in pig keeping sector to come in contact with pigs.	Negligible	2/19		• None of experts did not provide rationales
	In most farms in Belarus and Ukraine, the good biosecurity measures in place do not allow people not involved in pig keeping sector to come in contact with pigs.	Low	12/19		• 2 expert s mention that probability of spread by people not involved in pig keeping is low due to small number of outbreaks and due to limited contact with animals • 5 experts did not provide rationales • The virus could be on clothes, shoes, hands, though unlikely that this is the major factor of spread • Lot's of people may visit farms…
	In most farms in Belarus and Ukraine, the poor biosecurity measures in place do allow people not involved in pig keeping sector to come in contact with pigs.	Moderate	5/19	 Entropy = 0.38	• 2 expert mentions differences between industrial and small holdings, where in small holding visitors are unconstrained according to 1 of them • 1 expert mentions involvement by consumers unaware of risk, spreading ASFV with products • 1 expert bases a choice upon personal assumption • 1 expert refers to unofficial sources of information without any specific details • 1 expert concludes higher risk in Ukraine than in Belarus given different proportion of backyard sector and therefore low biosecurity. • 7 experts did not provide rationales
	There are no biosecurity measures in place in Belarus and Ukraine, resulting in an uncontrolled contact of people not involved in pig keeping sector with pigs.	High	0/19		
18a. Spread by wild boar in Belarus: How likely is spread through spill-over of ASFV from domestic pigs into wild boar	In all farms in Belarus and Ukraine, the good biosecurity measures in place do not allow wild boar to come in contact with pigs.	Negligible	1/18		

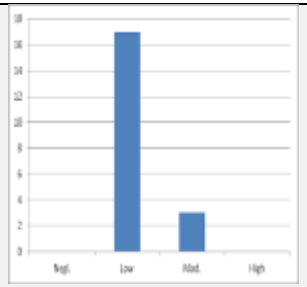
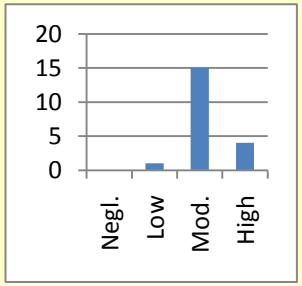
populations and further transmission to domestic pigs?	In most farms in Belarus and Ukraine, the good biosecurity measures in place do not allow wild boar to come in contact with pigs.	Low	12/18		• 2 expert s mention higher risk in backyard sector than in large farms, especially in those in vicinity to the Russian Federation according to 1 of them • 1 expert points out that only free-ranging or scavenging on carcasses or leftovers is required to spill-over from pigs to wild boar.
	In most farms in Belarus and Ukraine, the poor biosecurity measures in place do allow wild boar to come in contact with pigs.	Moderate	5/18	Entropy = 0.34	• 1 expert mentions high densities of wild boar in western areas of Belarus and Ukraine and hunting practices, when pigs can feed on WB carcass leftovers • 2 expert mention differences between regions and production systems • 1 expert concludes higher risk in Ukraine than in Belarus given proportion of low-biosecured farms • 1 expert bases a choice upon personal assumption • 1 expert mentions that WB acts as a dead-end and reintroduction back to domestic pig population exists only in free-range production (anecdotal involvement of straw was never confirmed) • 1 expert refers to unofficial source of information without any specific details • 9 experts did not provide rationales
	There are no biosecurity measures in place in Belarus and Ukraine, resulting in an uncontrolled contact of wild boar with pigs.	High	0/18		• 1 expert refers to backyard sector
18b. Spread by wild boar in Ukraine: How likely is spread through spill-over of ASFV from domestic pigs into wild boar populations and further transmission to domestic pigs?	In all farms in Belarus and Ukraine, the good biosecurity measures in place do not allow wild boar to come in contact with pigs.	Negligible	0/20	Entropy = 0.28 	•
	In most farms in Belarus and Ukraine, the good biosecurity measures in place do not allow wild boar to come in contact with pigs.	Low	7/20		•
	In most farms in Belarus and Ukraine, the poor biosecurity measures in place do allow wild boar to come in contact with pigs.	Moderate	13/20		• Differences in wild boar habitats in U and B…. • Different geograpical distribution of backyard farming and free range farming • Spill-overs into wild boar and vice versa will depend on the interface between the two populations • Wild boar may be a minor contribution to spread of ASFV as compare to illegal movement of pork • Wild boar do not play a role as spread factor for high biosecurity farms
	There are no biosecurity measures in place in Belarus and Ukraine, resulting in an uncontrolled contact of wild boar with pigs.	High	0/20		•

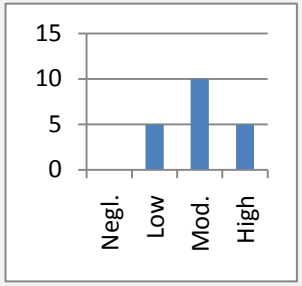
19. Spread by vehicles in Ukraine and Belarus: How likely is spread of ASFV through movement of vehicles between farms (e.g. lorries, cars, tractors, farm machinery) resulting in indirect contact in Belarus and Ukraine?	In all farms in Belarus and Ukraine, the good biosecurity measures in place do oblige vehicles to be disinfected between farm visits and allow vehicles to enter only into restricted areas on the farms.	Negligible	1/21	 Entropy = 0.34	• None of experts provided rationale for their choice
	In most farms in Belarus and Ukraine, the good biosecurity measures in place do oblige vehicles to be disinfected between farm visits and allow vehicles to enter only into restricted areas on the farms.	Low	3/21		• 1 expert notices less risk in case of movement within Belarus and Ukraine but more between Russian Federation and Belarus and Ukraine. • 2 experts refers to minor role of vehicles in ASF spread given low transmissibility of virus (1) and presence of blood required for spread (1).
	In most farms in Belarus and Ukraine, the poor biosecurity measures in place do not always oblige vehicles to be disinfected between farm visits and do allow vehicles to enter the farms.	Moderate	16/21		• 3 experts mention differences between sectors with higher risk associated in backyard and small holdings than in industrial sector (2). 1 of them points out that fomites have been incriminated in secondary spread of ASF in the Russian Federation. • 1 expert refers to unofficial sources of information without any specific details • 1 expert conclusion is based on experience from the Russian Federation. • 11 experts did not provide rationales
	There are no biosecurity measures in place in Belarus and Ukraine, resulting in uncontrolled movement of vehicles in farms and no disinfection between farm visits.	High	1/21		• 1 expert mentions no disinfection programme in place.
20. Spread by feed (other than swill) in Ukraine and Belarus: How likely is spread of ASFV through movement of contaminated feed resulting in indirect contact in Belarus and Ukraine?	In all farms in Belarus and Ukraine, the good biosecurity measures in place do not allow feed to be transported from farm to farm.	Negligible	2/20	 Entropy = 0.51	• 1 expert questions the feasibility of feed contamination with infected blood
	In most farms in Belarus and Ukraine, the good biosecurity measures in place do not allow feed to be transported from farm to farm.	2/20	6/20		• 2 experts mention some risk during outbreaks or if feed comes from endemic areas, especially in small farms and backyard holdings according to 1 of them. • 4 experts did not provide rationales
	In most farms in Belarus and Ukraine, the poor biosecurity measures in place do not always prevent that feed is transported from farm to farm.	Moderate	10/20		• 1 expert refers to evident involvement of feed in outbreaks in Belarus • 1 expert refers to oftenly unknown origin of feed • 1 expert mentions differences between industrial and small holding/backyard sector • 1 expert refers to unofficial information without nay specific details • 1 expert explains that uncontrolled feed movement is present however spread of ASF by feed is not possible • 8 experts did not provide rationales • Low likelihood that feed will be contaminated by infected

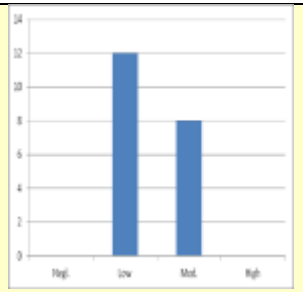
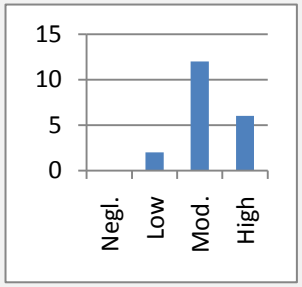
					blood • Infected feed could be thrown away and eaten by free ranging animals • Second outbreak in Belarus was with infected feed
	There are no biosecurity measures in place in Belarus and Ukraine, resulting in uncontrolled movement of feed between farms.	High	2/20		• 1 expert mentions evident role of infected feed in ASF spread
21. Clinical signs in domestic pigs in Ukraine and Belarus: How likely is it that an ASF outbreak in domestic pigs results in noticeable clinical signs in Belarus and Ukraine?	Clinical signs are not present in domestic pigs infected with ASFV in Belarus and Ukraine.	Negligible	0/20		
	Clinical signs are only sometimes present in domestic pigs infected with ASFV in Belarus and Ukraine.	Low	2/20		• None of the experts provided any rationales
	Clinical signs are most often present in domestic pigs infected with ASFV in Belarus and Ukraine.	Moderate	12/20		• 1 expert refers to unchanged genetic structure and results of experimental studies, however mentions field reports on less severe clinical signs. • 1 expert refers to official and unofficial sources of information without any specific details • 6 experts did not provided rationales
	Clinical signs are always present in domestic pigs infected with ASFV in Belarus and Ukraine.	High	16/20	 Entropy = 0.39	• 2 experts refer to genetically unchanged viral structure since 2007 • 2 experts refers to results of experimental studies and/or field observations demonstrating high mortality and evident clinical signs • 3 experts mention that clinical signs may be unspecific, especially if disease is novel in the region according to 1 of them OR if animals are sero-converted according to another. • 1 expert refers to lack of immunity in ASF free countries/region to mask clinical presentations • 5 experts did not provide rationales • Clinical signs not always present. It depends on the route of infection, doses, and prior immunity • Difference history what concerns duration of infection status of country..some countries are infected for 7 years, and others only recently infected • Clinical signs are dependent on the source of infection (if blood involved or not) • No typical signs as in the books • Animals may survive infections • Experimental infections usually use higher ID as in the field. Some experiments with low ID, however show very broad spectrum of clinical signs….. • Animals that have survived and have high titer of AB will

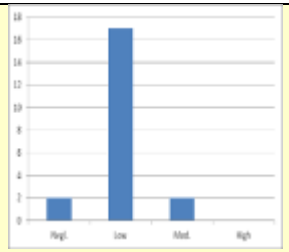
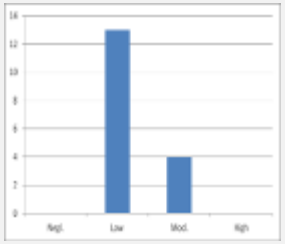
					not be infected, however, those that have low level of AB may become chronic carriers… • Virus shedding only during the viraemic period • Not many indications that there are a lot of surviving animals • Carriers have not yet been identified in Russian Federation, Georgia and Armenia, Belarus and Ukraine • Animals could still spread virus as pig product (even when not shedding) • The Caucasus and Sardinian strain are not so different what concerns pathogenicity • Georgia: both cases with clinical and without clinical signs observed • Armenia: no serosurveillance, but to give an idea, from 10 samples taken from holding with outbreak one year ago.
22. Disease reporting in Ukraine and Belarus: How likely is it that suspected cases in domestic pigs are reported to the veterinary service in Belarus and Ukraine?	In no areas of Belarus and Ukraine, suspected cases are reported to the veterinary services.	Negligible	0/21	 Entropy = 0.22	
	In a few areas of Belarus and Ukraine, suspected cases are reported to the veterinary services.	Low	2/21		• None of experts provided any rationales
	In the majority of the areas of Belarus and Ukraine, suspected cases are reported to the veterinary services.	Moderate	18/21		• 1 expert mentions differences between countries with less reporting in Ukraine • 2 expert mentions differences between regions/countries in regards to access to administration, compensation scheme, proportion of backyard sector, low ASF awareness and experience • 1 expert mentions lack of reporting in backyard sector • 2 experts refer to official report an one to unofficial sources of information without any specific details • 1 expert `s conclusion is based on experience from Russian Federation. • 11 experts did not provide rationales
	In the entire Belarus and Ukraine, all suspected cases are reported to the veterinary services.	High	1/21		• None of the experts provided any rationales
23. Effective control measures in Ukraine and Belarus: In the entire Ukraine and Belarus how likely is it that control measures applied upon case confirmation are effective to contain the outbreak (e.g. rapid stamping out)? Remain the same. No elicitation.	In no areas of Belarus and Ukraine, the Veterinary Services are efficient in rapid outbreak control upon confirmation.	Negligible	0/21		
	In a few areas in Belarus and Ukraine, the Veterinary Services are efficient in rapid outbreak control upon confirmation.	Low	4/21		• 2 experts mention lack of experience with ASF. 1 of them points out differences between Ukraine and Belarus when the other compares situation to the Russian Federation. • 2 experts did not provide any rationales
	In the majority of the areas in Belarus and Ukraine, the Veterinary Services are efficient in rapid	Moderate	14/21		• 3 experts mention differences between countries or regions, with better prepared Veterinary services in Ukraine according to one of them

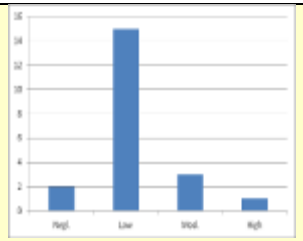
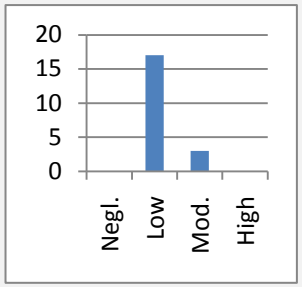
	outbreak control upon confirmation.				• 1 expert mentions efficient control in case of an outbreak but remains sceptical about control of epidemics • 1 expert refers to official and unofficial sources of information without any specific details • 9 experts did not provide any rationales • One outbreak is easy to control, but if the situation will continue as in Russian Federation, it will not be manageable
	In the entire Belarus and Ukraine, the Veterinary Services are always very efficient in rapid outbreak control upon confirmation.	High	3/21	Entropy = 0.38	• 1 expert claims both countries are able to control infection if officially confirmed, however questions control of multiple outbreaks • 2 experts did not provide any rationales
24. Effective tracing in Ukraine and Belarus: How likely is it that prevention and control measures in place will identify dangerous contacts and therewith hamper containment of the outbreak in the Ukraine and Belarus (Belarus and Ukraine)?	In none of the areas in Belarus and Ukraine, the Veterinary Services are efficient in tracing dangerous contacts.	Negligible	0/21		
	In a few areas in Belarus and Ukraine, the Veterinary Services are efficient in tracing dangerous contacts.	Low	10/21		• 1 expert refers to unofficial sources of information without any specific details • 1 expert mentions lack of any tracing system in place • 2 experts refer to lack of experience of VS with ASF or lack of any information about the disease, similarly to the Russian Federation according to 1 of them • 6 experts did not provide any rationales
	In the majority of the areas in Belarus and Ukraine, the Veterinary Services are efficient in tracing dangerous contacts.	Moderate	11/21	Entropy = 0.30	• 2 experts mention differences between countries, with supposedly worse preparedness in Belarus given spread to distant locations • 1 expert`s conclusion is based on effective control of outbreaks • 8 experts did not provide any rationales
	In the entire Belarus and Ukraine, the Veterinary Services are efficient in tracing dangerous contacts.	High	0/21		
25.Active Surveillance in domestic pigs in Ukraine and Belarus: How likely it is that active surveillance in the domestic pig population will take place in Belarus and Ukraine? **What are preventive measures in the country after the outbreaks, to prevent or early detect secondary spread and to have an effective long term response?** • **In risk situation passive surveillance should be carried out very 'actively'**	Nowhere in Belarus and Ukraine active surveillance takes place in pigs.	Negligible	0/20		• 1 expert mentions no information available on any activities • 1 expert questions the role of active surveillance in detection of ASF primary outbreak given high mortality rate
	Only in some areas in Belarus and Ukraine active surveillance takes place in pigs.	Low	17/20		• 2 experts mention some surveillance activities in place on the boarder with the Russian Federation and 1 of them questions the role of active surveillance in detection of ASF primary outbreak given high mortality rate • 1 expert claims there is no active surveillance programme in place • 1 expert mentions possible activities in some districts • 1 expert mentions no information available on planned surveillance

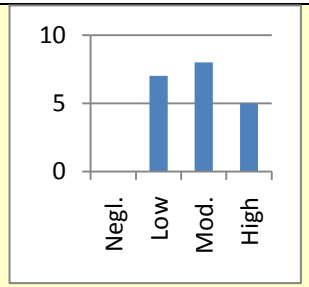
and should be accompanied with compensation and awareness building of farmers…. • **This could be accompanied with serology to detect missed cases and focus the vigilance in specific areas**					• 9 experts did not provide any rationales • Sero-surveillance and tissue samples for PCR is on-going in industrial farms in Belarus • Occasional sample collection happening in Ukraine, and passive surveillance and awareness building is carried out to avoid spread via swill, infected pigs etc. to alert for economic implications of an outbreak.
	In most areas in Belarus and Ukraine active surveillance takes place in pigs.	Moderate	3/20		• 1 expert refers to active surveillance activities to be in place but questions its role in detection of first cases. • 3 experts did not provide any rationales
	Everywhere in Belarus and Ukraine active surveillance takes place in pigs.	High	0/20	Entropy = 0.18	• None of experts provided any rationales
26. Disease presence in wild boar in Ukraine: How likely is it that a wild boar in Ukraine is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Ukraine since 2010 and there is no other information available that indicates ASF presence in wild boar.	Negligible	0/20		• 1 expert refers to OIE reports and expects more surveillance in place • 1 expert mentions that none of wild boar tested was found seropositive and passive surveillance is limited, however questions the role of wild boar as ASF maintenance host • 6 experts did not provide any rationales
	No outbreaks have been notified in Ukraine since 2010 but there is some information available that indicates ASF presence in wild boar.	Low	1/20	 Entropy = 0.30	• 3 experts mention recent case of ASF in wild boar in Ukraine and 1 of them believes ASF will die out in wild boar population given its entry from eastern side, where population of wild boar is not abundant. 1 of them mentions forced migration of WB toward Ukraine due to WB extermination programme in Rostov Oblast and also very low densities of WB in the affected area in Ukraine. • 1 expert refers to 2012 outbreak in backyard sector and unofficial information without any specific details • 1 expert mentions poor control of ASF in wild boar • 1 expert refers to ASF presence on the boarder • 1 expert expects further spread given higher densities. • 3 experts did not provide any rationales
	Some outbreaks have been notified in Ukraine since 2010 and there is information available that indicates ASF presence in wild boar.	Moderate	15/20		• 2 experts refer to the confirmation of ASF in wild boar in Ukraine in January 2014 • Situation has changed, there is a recent notification of 1 infected wild boar • Couple of carcasses found • Scattered distribution of wild boar • Hunting of wild boar in the Russian Federation • More information needed on wild boar density, surveillance activities • 685 sera tested…xxx organs tested and were all negative • There is evidence that prior to the recent detection the WB was free, and stamping out of positive boar has been carried out, but reintroduction possible

					•
	Repeated outbreaks have been notified in Ukraine since 2010 and there is a lot of information available that indicates ASF presence in wild boar.	High	4/20		• None of experts provided any rationales
27. Disease presence in wild boar in Belarus: How likely is it that a wild boar in Belarus is infected with ASFV, based on the frequency of notification of outbreaks and other current available information?	No outbreaks have been notified in Belarus since 2010 and there is no other information available that indicates ASF presence in wild boar.	Negligible	0/20	 Entropy = 0.45	• 1 expert refers to OIE reports and expects more surveillance in place • 1 expert refers to lack of outbreaks in domestic pigs from which ASF could spill over to WB
	No outbreaks have been notified in Belarus since 2010 but there is some information available that indicates ASF presence in wild boar.	Low	5/20		• 1 expert refers to ASF presence on the boarder • 1 expert expects further spread given higher densities. • 1 expert refers to media information on WB population control in Belarus and questions this action. • 1 expert refers to official OIE reports and unofficial information without any specific details • 6 experts did not provided any rationales
	Some outbreaks have been notified in Belarus since 2010 and there is information available that indicates ASF presence in wild boar.	Moderate	10/20		• 1 experts mentions possible infection of WB due to lack of control • 1 expert mention media reports on WB cases in Belarus, which have never been confirmed officially. This infection may have originated from infected transboundary WB from the Russian Federation or from unreported outbreaks in backyard sector in B. • 2 experts did not provide any rationales • No real border with Russian Federation…there is connected WB habitat • Sero surveillance is on-going, and all negative results • Compulsory to send samples from all killed WB for PCR analysis, and results are negative • Difficult passive surveillance, vast forest so difficult to find infected wild boar
	Repeated outbreaks have been notified in Belarus since 2010 and there is a lot of information available that indicates ASF presence in wild boar.	High	5/20		
28. Epidemiological role of wild boar in Ukraine and Belarus, taking into account population densities: What is the risk that ASFV spreads in the wild boar population in Belarus and Ukraine due to direct or indirect contact?	ASFV will not spread in the wild boar population in Belarus and Ukraine.	Negligible	0/20		• None of experts provided any rationales
	ASFV will spread in the wild boar population in Belarus and Ukraine to a limited extend.	Low	12/20		• 2 experts conclusion is on basis of low densities of wild boar • 3 experts notice different densities of wild boar with western and southern tendency to increase • 1 expert refers to official and unofficial information without any specific details

					• 2 experts did not provide any rationales
	ASFV will spread efficiently in the wild boar population in Belarus and Ukraine.	Moderate	8/20	Entropy = 0.29	• 1 expert refers to presence of ASF on the boarder with the Russian Federation • 2 experts mention of possibility to spread in higher densities, but not maintenance according to 1 of them • 1 expert mentions higher contact rate in Belarus given higher population density • 6 experts did not provide any rationales • Spread is linked to the density of the wild boar population , when the density is low, the chance for spread is low • The wild boar distribution is patchy • No good quantitative WB density information available • A sick WB will even move less
	ASFV will spread very efficiently in the wild boar population in Belarus and Ukraine.	High	0/20		• None of experts provided any rationale
29. Clinical signs in wild boar in Ukraine and Belarus : How likely is it that an ASF outbreak in wild boar results in noticeable clinical signs in Ukraine and Belarus (Belarus and Ukraine)?	Clinical signs are not present in wild boar infected with ASFV in Belarus and Ukraine.	Negligible	0/20	 Entropy = 0.39	• 1 expert reasons it is difficult to observe clinical signs in the wild, especially if unspecific • 1 expert bases on lack of current outbreak-cases
	Clinical signs are only sometimes present in wild boar infected with ASFV in Belarus and Ukraine.	Low	6/21		• 1 expert refers to lack of surveillance programmes in wild boar • 2 experts did not provide any rationale
	Clinical signs are most often present in wild boar infected with ASFV in Belarus and Ukraine.	Moderate	12/20		• 1 expert refers to lack of genetic changes in viral genome • 1 expert mentions clinical signs are always present but could be unspecific • 1 expert refers to official and unofficial information without any specific details • 3 experts did not provide rationales • In experimental infection there is no difference in susceptibility between WB and DP • No reason to differentiate WB and DP
	Clinical signs are always present in wild boar infected with ASFV in Belarus and Ukraine	High	6/20		• 2 experts refer to experimental results demonstrating high mortalities and severe clinical signs but 1 of them expects some unspecific symptoms as well, though virus has not changes • 1 expert argues that there is no immunity in population, therefore clinical signs should be evident • 1 expert argues that WB is as susceptible as DP and expects high mortalities • 6 experts did not provide any rationale
30. Epidemiological role of wild boar in Ukraine and Belarus, taking into account population densities :	Sick/dead wild boar infected with ASFV will not be found in Belarus and Ukraine.	Negligible	2/21		• None of experts provided any rationales

How likely it is that dead/sick wild boar infected with ASFV will be found in Ukraine and Belarus (Belarus and Ukraine)?	Sick/dead wild boar infected with ASFV will only sometimes be found in Belarus and Ukraine.	Low	17/21	 Entropy = 0.27	• 1 expert refers to no active surveillance programme in place • 4 experts reason with large forest size, low WB population density or poor presence of people in forests • 2 experts mentioned scavenging as a limiting factor • 1 expert refers to unofficial sources of information without any specific details • 1 expert mentions some surveillance activities • 9 experts did not provide rationales
	Most often, sick/dead wild boar infected with ASFV will be found in Belarus and Ukraine.	Moderate	2/21		• 2 experts mentioned commercial hunting or hunting management in place, however passive surveillance is limited only to hunting season according to 1 of them
	Sick/dead wild boar infected with ASFV will always be found in Belarus and Ukraine.	High	0/21		
31. Disease reporting by hunters or game wardens in Ukraine and Belarus: How likely is it that suspect cases in wild boar are reported to the veterinary service in Belarus and Ukraine?	In no areas of Belarus and Ukraine, suspect cases are reported to the veterinary services.	Negligible	0/17	 Entropy = 0.24	• 1 expert mentions no information provided from hunters up to now. • 2 experts provided no rationale
	In a few areas of Belarus and Ukraine, suspect cases are reported to the veterinary services.	Low	13/17		• 1 expert mentions negative perception of implications following the reporting and is unsure about awareness of hunters or game wardens • 1 expert mentions probable fraudulent practices among hunters e.g. hiding • 1 expert concludes based on presence of clinical signs • 10 experts provided no rationale • As long as hunting is on-going, the hunters will report cases in Ukraine (e.g. 685 sera and 648 tissue samples were received in 2013) • It is compulsory to send samples from shot boar or boar found dead (e.g. on road), however not very many samples are received in Belarus • Compliance will depend on the control measures implemented in the area
	In the majority of the areas of Belarus and Ukraine, suspect cases are reported to the veterinary services.	Moderate	4/17		• 1 experts based this choice on internet source (but no further specification) • 2 experts reason that there is a high awareness of hunters (both countries and high risk), and they will report • 1 expert did not give a rationale
	In the entire Belarus and Ukraine, all suspect cases are reported to the veterinary services.	High	0/17		• 1 expert mentions possible reporting to veterinary services, but not to OIE
32. Active surveillance in wild boar in Ukraine and Belarus: How likely is it that active surveillance in the wild boar population will take place in	Nowhere in Belarus and Ukraine active surveillance takes place in wild boar.	Negligible	2/21		• 1 expert questions usefulness of active surveillance in detection of primary outbreaks • 1 expert did not provide any rationale
	Only in some areas in Belarus and Ukraine active surveillance takes	Low	15/21		• 1 expert does not understand the question • 1 expert reasons with sometimes unspecific clinical sign

Belarus and Ukraine? Remains the same. No elicitation	place in wild boar.				• 1 expert mentions no surveillance in place • 1 expert questions usefulness of depopulations of WB in Belarus • 1 expert doubts there is any surveillance in place and expects active surveillance schemes to be developed for WB • 10 experts provided no rationale • See previous discussion
	In most areas in Belarus and Ukraine active surveillance takes place in wild boar.	Moderate	3/21	Entropy = 0.39	• None of experts provided any rationales
	Everywhere in Belarus and Ukraine active surveillance takes place in wild boar.	High	1/21		• None of experts provided any rationales
33. Hunting for wild boar in Ukraine: What is the chance that the hunting regime can contribute to spread of ASFV into the wild boar population in Ukraine?	The performed hunting does not lead to spread of ASFV into the wild boar population.	Negligible	0/20		• 1 expert refers to low hunting rate and low spread through hunting in respect to natural virus spread
	The performed hunting does lead occasionally to spread of ASFV into the wild boar population.	Low	17/20	Entropy = 0.18	• 3 experts reason that hunting is not forbidden in Ukraine, and widely practiced by villagers (pig keepers), and can facilitate virus spread • on the other hand, 1 expert says that it can decrease the WB density and it may help to prevent the introduction, or at least the spread within the wild boar population • 10 experts did not provide any rationale • Hunters leave tissues and blood behind, which may infect other boar • It is a known fact that hunting can increase spread of infectious diseases • Currently, the hunting regime applied in U is aiming at keeping the population level stable (so no depopulations • The purpose of the current regime is to keep also the population at their normal territory (so it should not increase migration) •
	The performed hunting does regularly lead to spread of ASFV into the wild boar population.	Moderate	3/20		• 1 expert mentions that some hunters keep BY pigs and do not clean the area from carcases after shooting • 3 experts provided no rationale
	The performed hunting is the main driver of spread of ASFV into the wild boar population.	High	0/20		
34. Hunting for wild boar in Belarus: What is the chance that the hunting regime can contribute to spread of ASFV into the wild boar population in Belarus?	The performed hunting does not lead to spread of ASFV into the wild boar population.	Negligible	0/20		• None of experts provided any rationale
	The performed hunting does lead occasionally to spread of ASFV into the wild boar population.	Low	7/20		• 3 experts reason that hunting is not forbidden in Belarus, and widely practiced by villagers (pig keepers), and can facilitate virus spread • on the other hand, 1 expert says that it can decrease the WB

				 Entropy = 0.47	density and it may help to prevent the introduction, or at least the spread within the wild boar population • 10 experts did not provide any rational
	The performed hunting does regularly lead to spread of ASFV into the wild boar population.	Moderate	8/20		• 1 expert reasons hunting may spread ASFV to bordering countries, while limiting spread within the country • 1 expert mentions that some hunters keep BY pigs and do not clean the area from carcases after shooting • 1 expert mentions that emergency depopulation in the radius of 20 km from infected farms can increase spread in Belarus • 2 experts provided no rationale • Depopulation campaign is on-going in Belarus in the whole territory • It is not allowed to do normal hunting • Depopulation may stimulate illegal poarching of wild boar, which is difficult to control • Currently there is no infection in WB, and there is therefore no spread of the virus in the population • If WB depopulation in Belarus, this may attract WB from Russian Federation • It is difficult to sustain depopulation (high reproduction rate)
	The performed hunting is the main driver of spread of ASFV into the wild boar population.	High	5/20		

APPENDIX B: UPDATED RISK PATHWAYS

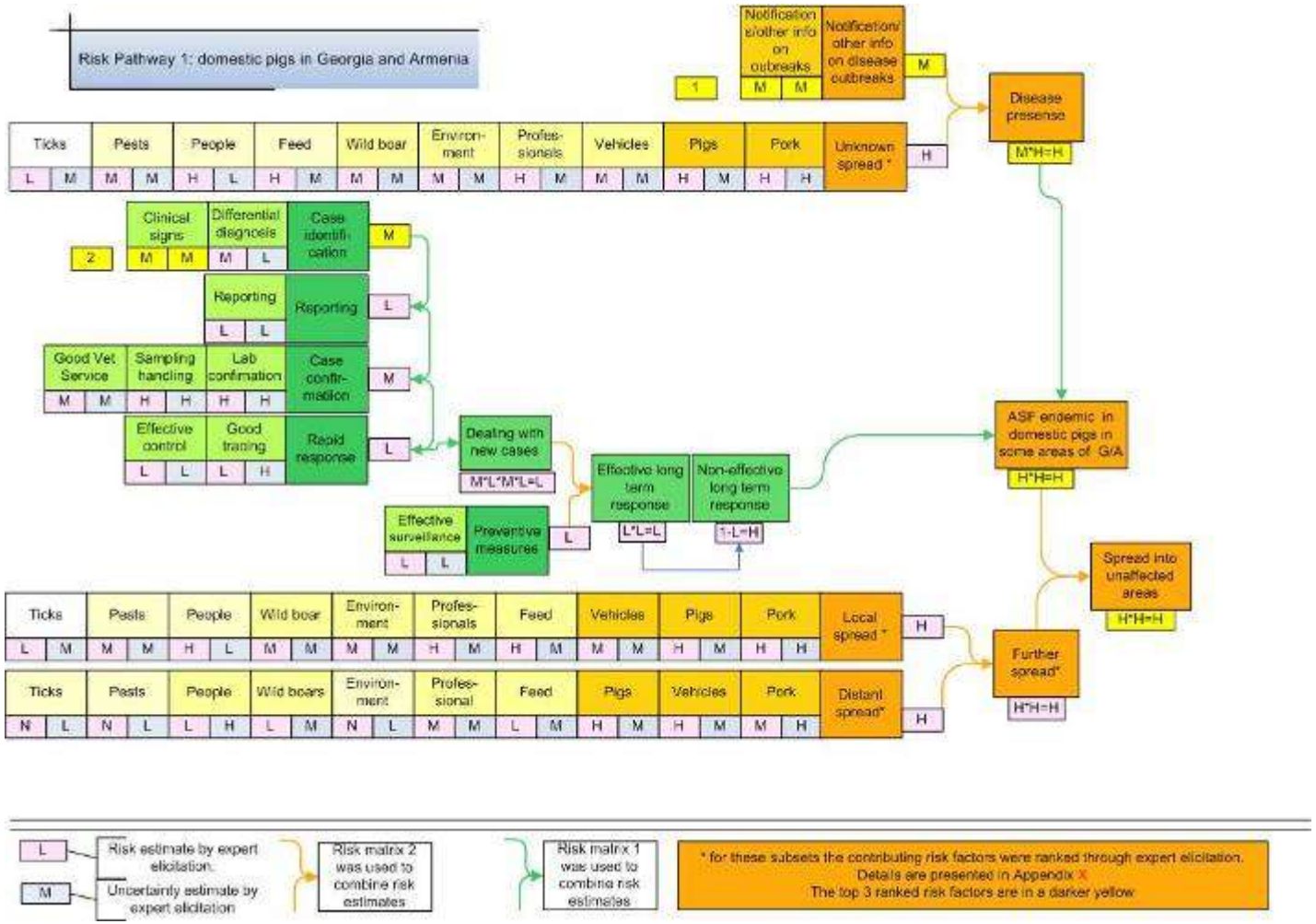


Figure 6: Risk pathway 1: domestic pigs in Georgia and Armenia

See EFSA AHAW Panel (2010a) for the detailed explanation of the model and matrices.

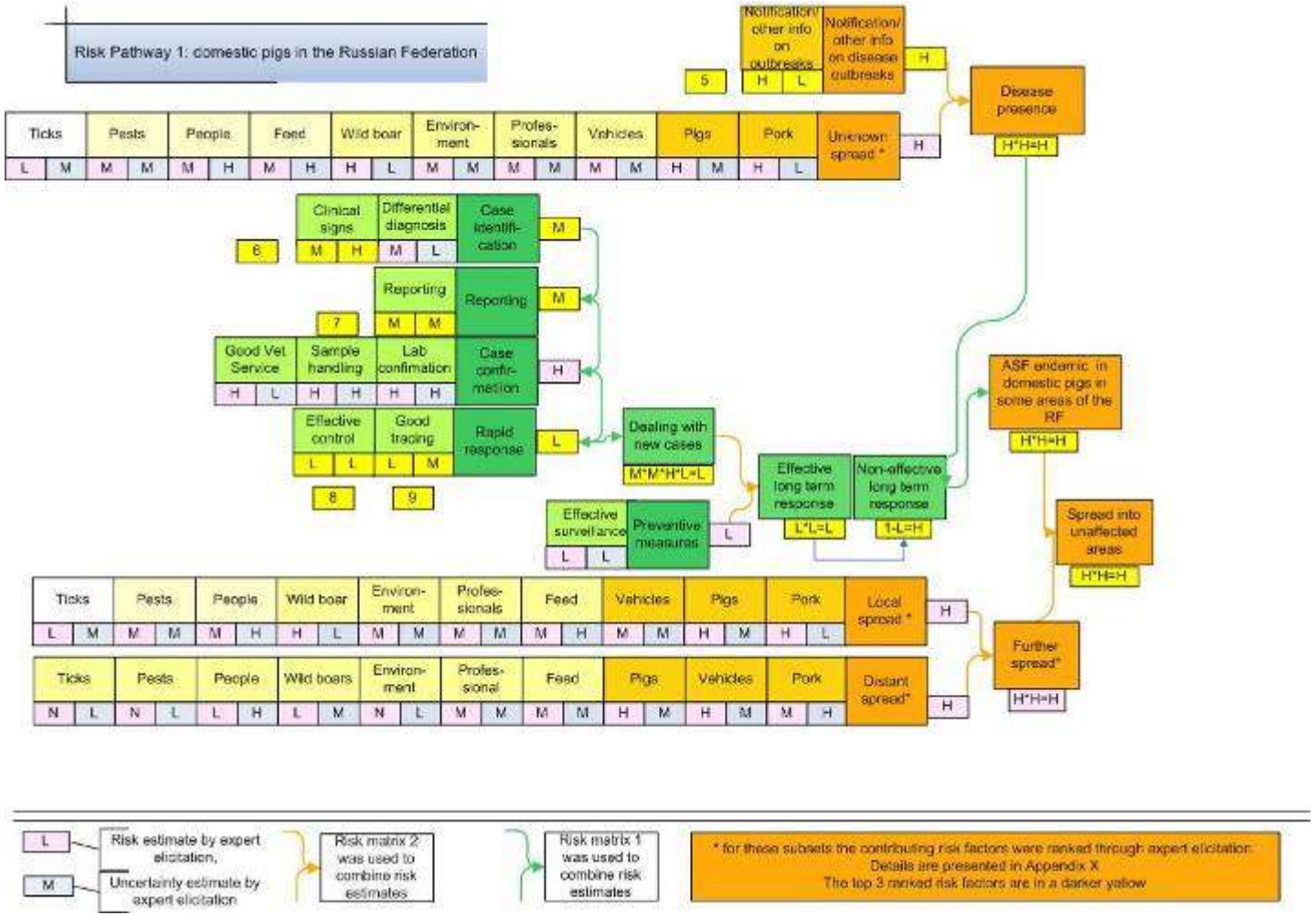


Figure 7: Risk pathway 1: domestic pigs in The Russian Federation

See EFSA AHAW Panel (2010a) for the detailed explanation of the model and matrices.

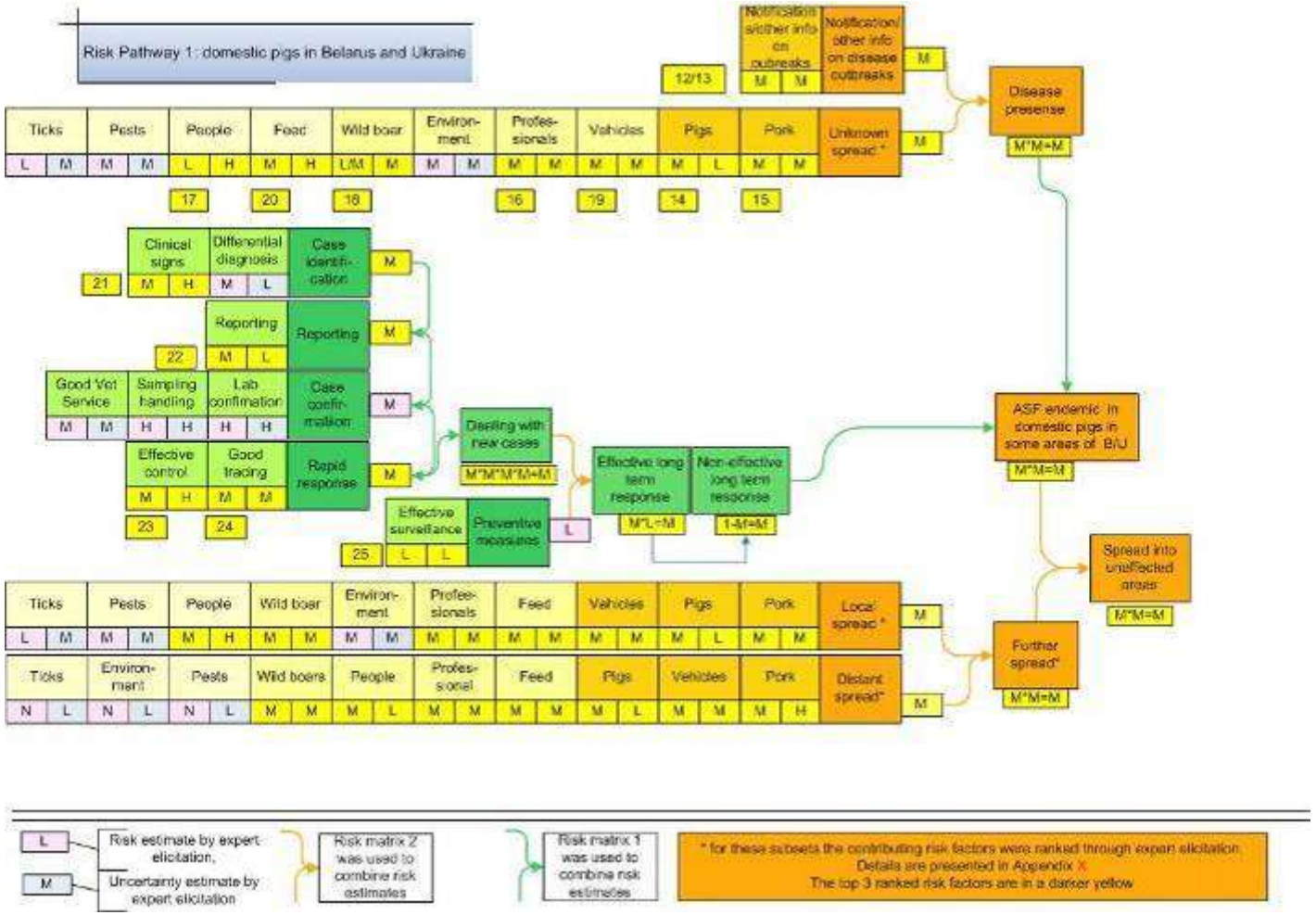


Figure 8: Risk pathway 1: domestic pigs in Ukraine and Belarus

See EFSA AHAW Panel (2010a) for the detailed explanation of the model and matrices.

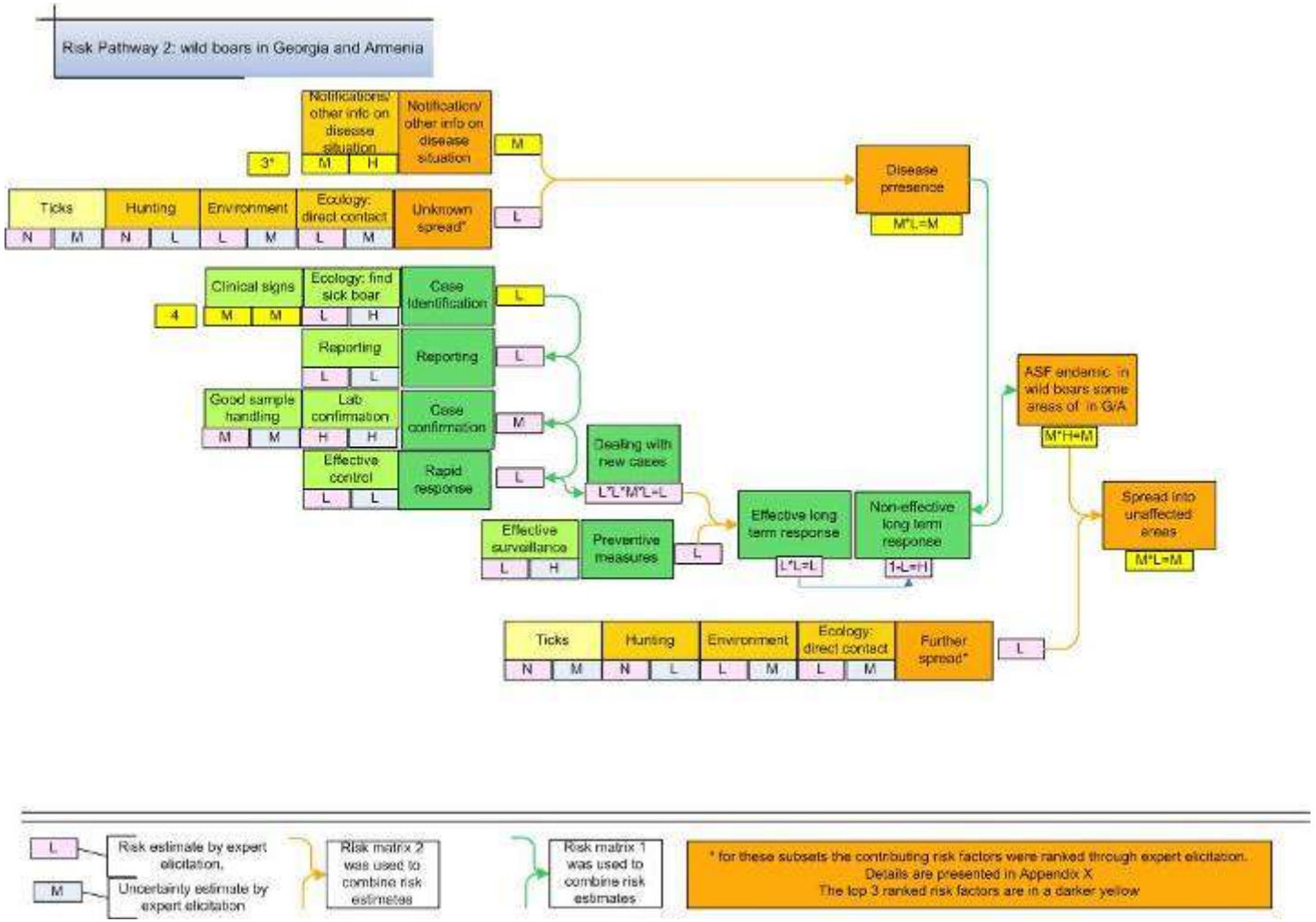


Figure 9: Risk pathway 2: wild boar in Georgia and Armenia

See EFSA AHAW Panel (2010a) for the detailed explanation of the model and matrices.

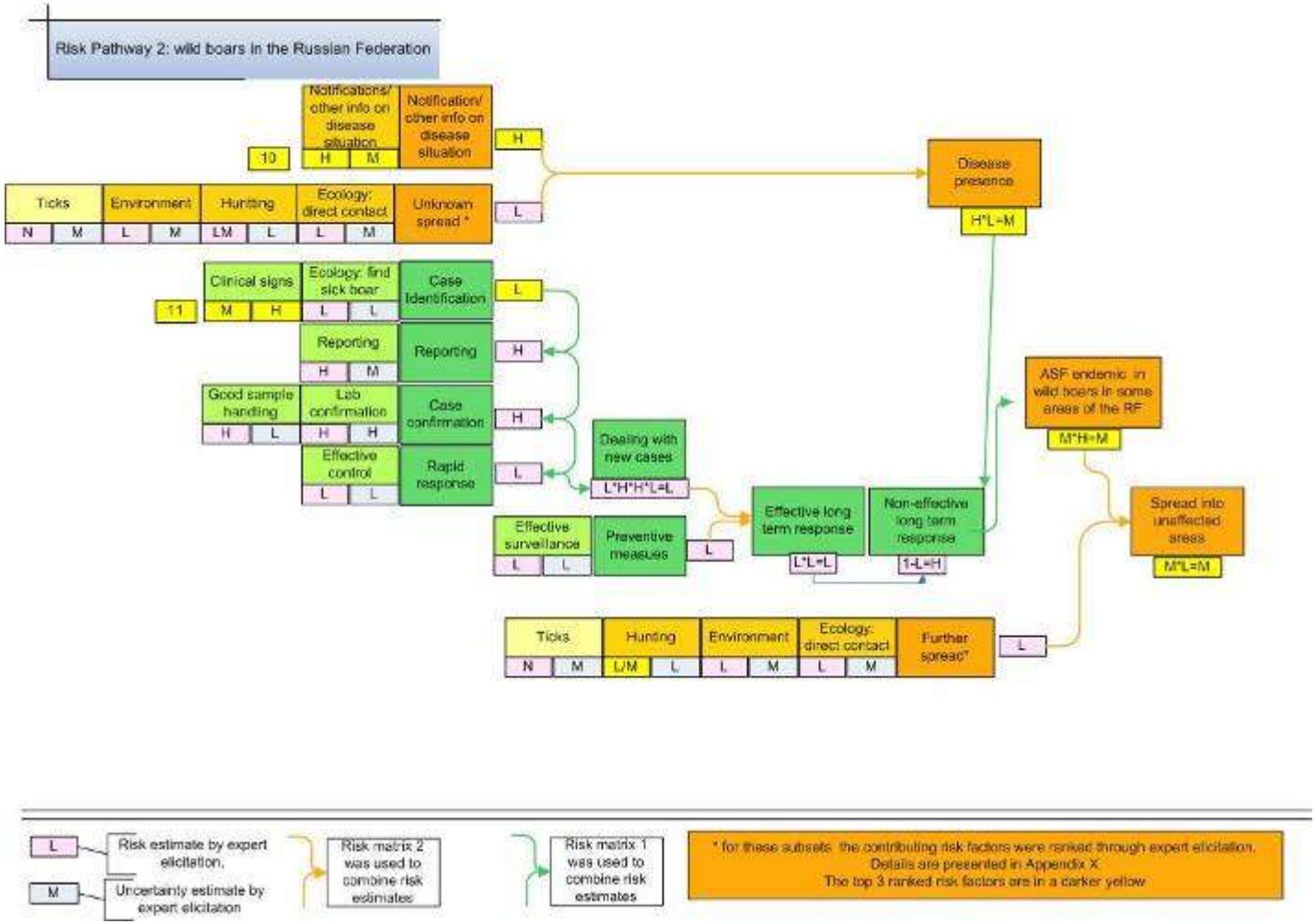


Figure 10: Risk pathway 2: wild boar in the Russian Federation

See EFSA AHAW Panel (2010a) for the detailed explanation of the model and matrices.

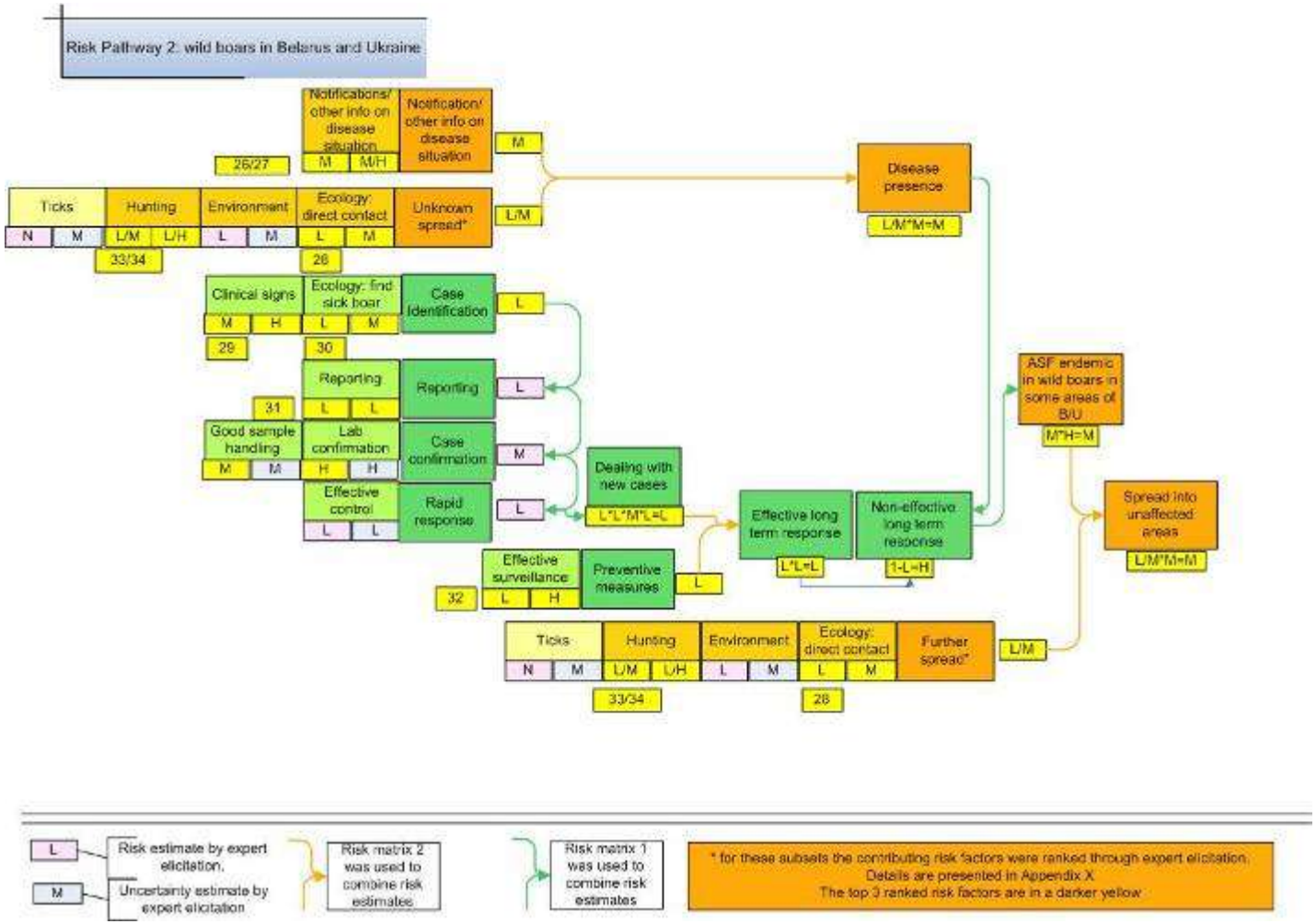
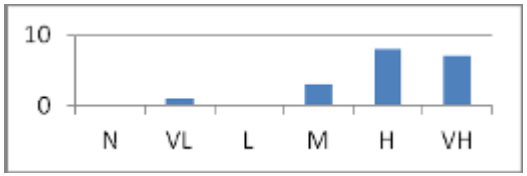
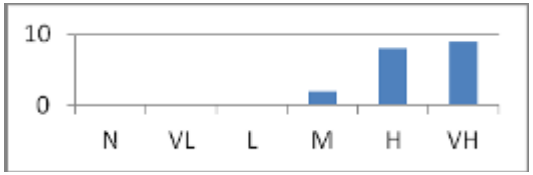
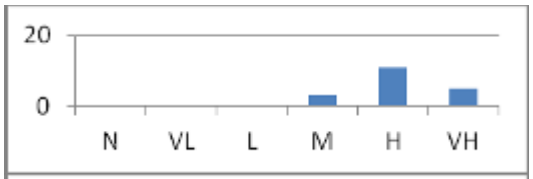
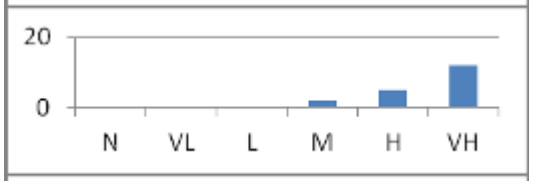
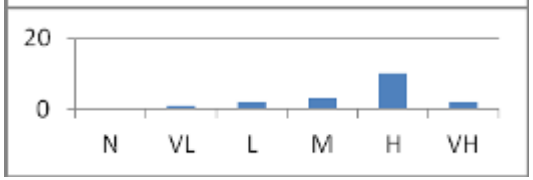
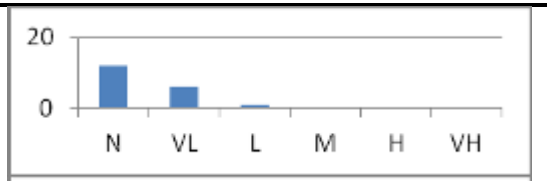
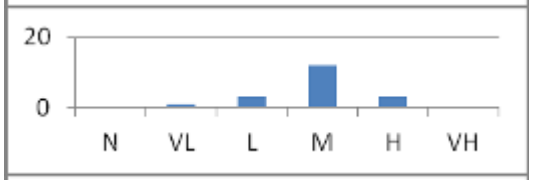
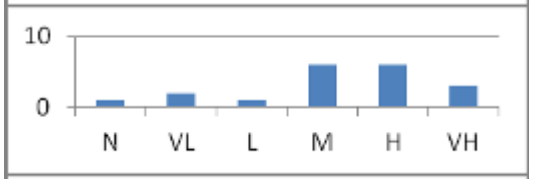
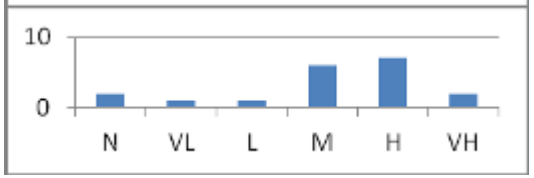
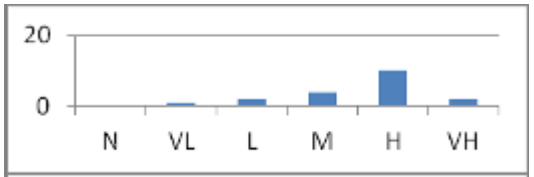
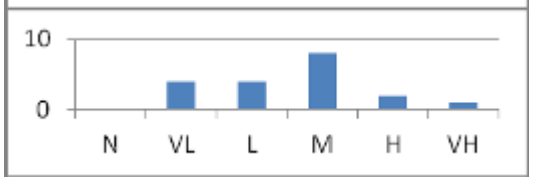


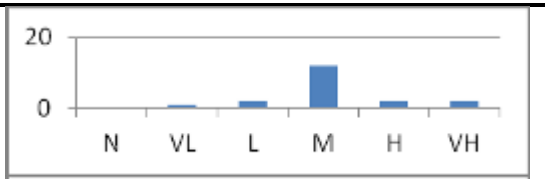
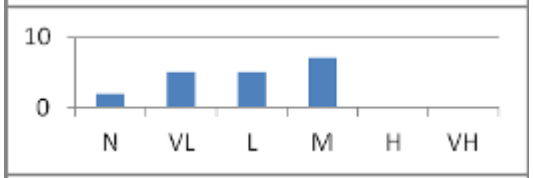
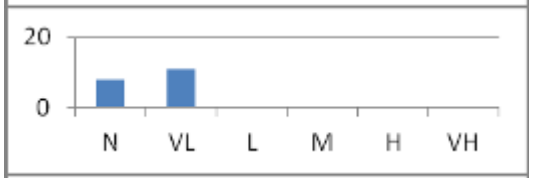
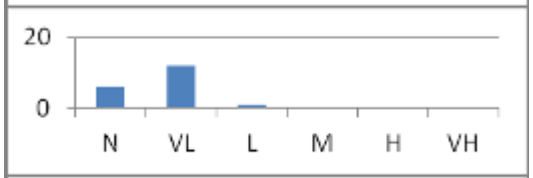
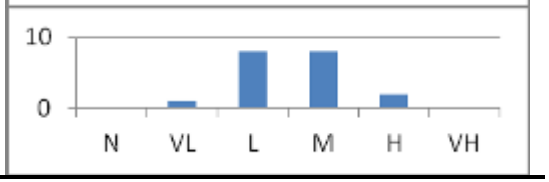
Figure 11: Risk pathway 2: wild boar in Ukraine and Belarus

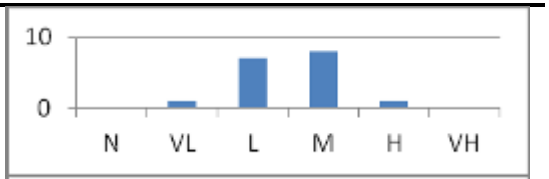
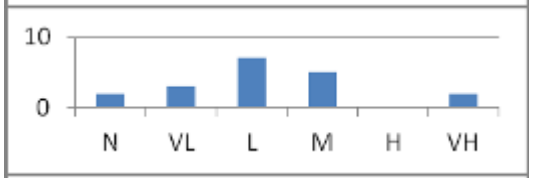
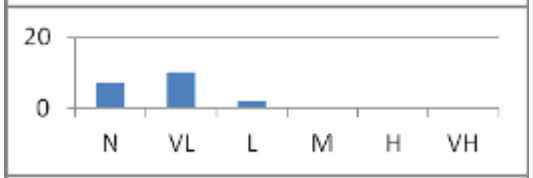
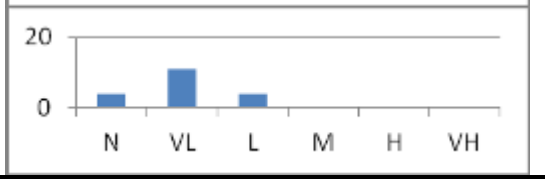
See EFSA AHAW Panel (2010a) for the detailed explanation of the model and matrices.

APPENDIX C: DETAILED OUTCOMES OF RAKING OF MATRICES ACCORDING TO THEIR RISK OF BEING CONTAMINATED/INFECTED WITH ASFV AND MAINTAIN INFECTIOUS ASFV AT THE MOMENT OF CROSSING THE EU BORDER

Matrix of ASFV	Negli-gible	Very low	Low	Mode-rate	High	Very high	Final rank	Graph
Live animals								
Wild boar (transported)	0	1	0	3	8	7	H	
Domestic pigs (transported)	0	0	0	2	8	9	H	
Fresh meat								
Chilled meat	0	0	0	3	11	5	H	
Frozen meat	0	0	0	2	5	12	VH	
Skin fat	0	1	2	3	10	2	H	
Meat products								

Meat cooked for 70 °C for 30 min	12	6	1	0	0	0	N	
Naturally smoked meat	0	1	3	12	3	0	M	
Salted, dried meat (e.g., salted and dried hams, shoulders, loins…)	1	2	1	6	6	3	M	
Salted, fermented, dried (+/- spiced) meat (e.g. pepperoni, salami,…)	2	1	1	6	7	2	M	
Vehicles								
Vehicles for animal transport-contaminated inside	0	1	2	4	10	2	H	
Any vehicles-contaminated outside	0	4	4	8	2	1	M	
Persons								

People involved with pig keeping or wild boar (e.g. farmers, vets, hunters)	0	1	2	12	2	2	M	
Non- professional in pig sector (e.g. tourists business, family…)	2	5	5	7	0	0	L	
Slurry	0	1	3	7	6	2	M	
Vegetables	8	11	0	0	0	0	VL	
Crops	6	12	1	0	0	0	VL	
Animal feed	2	5	2	7	2	1	M	
	0	1	8	8	2	0	M	

Fomites	0	1	7	8	1	0	M	
Pets	7	9	2	1	0	0	VL	
Pest (rodents)	2	9	5	2	1	0	VL	
Ticks	2	3	7	5	0	2	L	
Bloodsucking insects	7	10	2	0	0	0	VL	
Hay and straw	4	11	4	0	0	0	VL	

GLOSSARY AND ABBREVIATIONS:

HB high biosecurity pig sector: specialized, industrial pig holdings with generally a high level of biosecurity.

LB: low biosecurity sector: pig holdings with a low to non-existent level of biosecurity.

AHAW Panel	EFSA Panel on Animal Health and Welfare
ARRIAH	All-Russian Institute for Animal Health
ASFV	African Swine Fever Virus
dpi	days post inoculation
EFSA	European Food Safety Authority
EKE	Expert Knowledge Ellicitation
FAO	Food and Agriculture Organization of the United Nations
OIE	World Organisation for Animal Health
WAHID	World Animal Health Information Database