



## African swine fever spread in the Russian Federation and the risk for the region

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### 1. INTRODUCTION

African swine fever (ASF) is a highly contagious viral infection of pigs that is transmitted through direct contact, ingestion of contaminated feedstuffs and via certain tick species. ASF has a serious socio-economic impact on people's livelihood, international commercial trade and protein-food security. Feral pigs (escaped domestic species) and European wild boar (*Sus scrofa*) are equally susceptible to ASF, which makes it very difficult to eliminate the infection once ASF becomes endemic in these populations. In Africa, ASF causes unapparent infection in three species of wild pigs: warthogs (*Phacochoerus africanus*), bush pigs (*Potamochoerus larvatus*) and Red River Hogs (*Potamochoerus porcus*). Humans are not susceptible to ASF infection.

The potential distribution of the infection is transcontinental wherever swine are raised and, therefore, most countries free of the infection take serious measures to prevent its entry. The disease is endemic in domestic and wild porcine species in most of sub-Saharan Africa and the Italian island of Sardinia in the Mediterranean. In areas where the infection occurs, pig production is sustainable only through adopting high biosecurity measures on individual holdings or through the accreditation of an ASF free zone.

Outbreaks of ASF in the Caucasus region were first reported in 2007 and the disease has spread since across the south of the Russian Federation, where pig density is

high, and very close to the borders with Ukraine and Kazakhstan. In October 2009, an isolated outbreak was detected in Leningrad Oblast, around 2 000 km north of the previously infected area and less than 200 km away from Finland and Estonia. There is a risk that the disease will spread further to Eastern Europe or other areas where swine are raised, either through the uncontrolled introduction of infected pork meat or through the movement of infected wild boar.

FAO has issued an alert and warned countries about the higher risk of introduction, because of the above dynamics and because once established, ASF is very difficult to eliminate and it can have a very severe economic impact. There is no treatment or effective vaccine available against the ASF virus. Therefore, the most effective protection against ASF in free areas depends on preventing the introduction of the virus.

### 2. ABOUT THE VIRUS AND THE DISEASE

ASF shows no age or gender preference. Pigs become infected mainly through the oro-nasal route after contact with infected pigs or through feeding on virus-containing pork products or other contaminated products (swill and garbage waste). In areas where competent vectors of the soft tick *Ornithodoros* genus exist, transmission via these vectors can be important for virus persistence in an area. Maintenance of the ASF virus in domestic pigs in the absence of *Ornithodoros* ticks is mainly dependant on the existence of sufficiently large, continuous populations of pigs in a high density and with a high reproductive rate to ensure constant availability of naive hosts for new infections and further spread. Aerosol transmission has been shown to occur only over very short distances. Spread via fomites - contaminated vehicles, equipment, instruments, clothing - and even insects occurs when there are high levels of environmental contamination. Water-borne transmission is most unlikely because of dilution of the virus.

ASF is caused by a DNA virus, *Asfivirus*, currently the sole member of the *Asfarviridae* family. The ASF virus, in a suitable protein environment, is stable over a wide range of temperatures and pH. When not protected, the ASF virus is rapidly inactivated by sunlight and desiccation. As a result of its tolerance to a wide pH range (1.9 – 13.4), only certain disinfectants are effective against it. The agent is relatively stable in excretions of infected pigs, in pig carcasses, and in some pig meat products and fresh pig meat. Putrefaction does not necessarily inactivate the virus. It may remain infective in faeces for at least 11 days and in bone marrow for months. The ASF virus is resistant to the decrease of pH which accompanies the meat maturing process and it is not inactivated by freezing and thawing. The ability of the

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ASF virus to remain infective in edible products such as chilled meat (at least 15 weeks and probably longer if frozen) and from three to six months in cured hams and sausages that have not been cooked or smoked at a high temperature, has important implications for the spread of ASF. Undercooked, dried, smoked and salted pork and blood or carcasses and carcass meal derived from pigs in an outbreak or endemic setting must be regarded as potentially infective if fed to pigs and/or discarded in communal waste sites where pigs may feed. However, cooked or canned hams are safe, as long as they have been heated through at 70°C for more than 15 minutes.

The incubation period varies from five to 15 days. Although different serotypes cannot be identified, ASF virus strains differ in virulence, leading to acute, sub-acute and chronic forms of ASF. Clinical disease is usually peracute or acute, when morbidity and mortality rates within an affected holding may approach 100 percent. In pigs which clinically recover, viraemia may persist for several weeks. Recovered animals present a risk since the virus has been isolated from tissues up to six months post-infection.

The development of high fever (>40°C) is usually the first clinical sign, which is accompanied by depression and loss of appetite. Sows may abort at all stages of pregnancy (Note: and be a source of virus to other pigs in the holding). However, from clinical examination, ASF can only be suspected. Pathological findings revealing extensive haemorrhages in lymph nodes, spleen and kidneys may be additional indicators of the presence of ASF. A final diagnosis can only be made through

laboratory testing. Detailed instructions for laboratory diagnostic procedures for ASF can be found in the OIE *Manual of Standards for Diagnostic Tests and Vaccines for Terrestrial Animals - Chapter 2.1.12* [[http://www.oie.int/eng/normes/mmanual/A\\_00035.htm](http://www.oie.int/eng/normes/mmanual/A_00035.htm)].

After infection with the ASF virus, domestic pigs may shed infective amounts of virus for 24–48 hours before clinical signs appear. During the acute stage of the disease, enormous amounts of the virus are shed in all secretions and excretions and high levels of the virus are present in tissues and blood. Pigs that survive the acute disease may remain infected for several months, but do not readily shed the virus for more than 30 days.

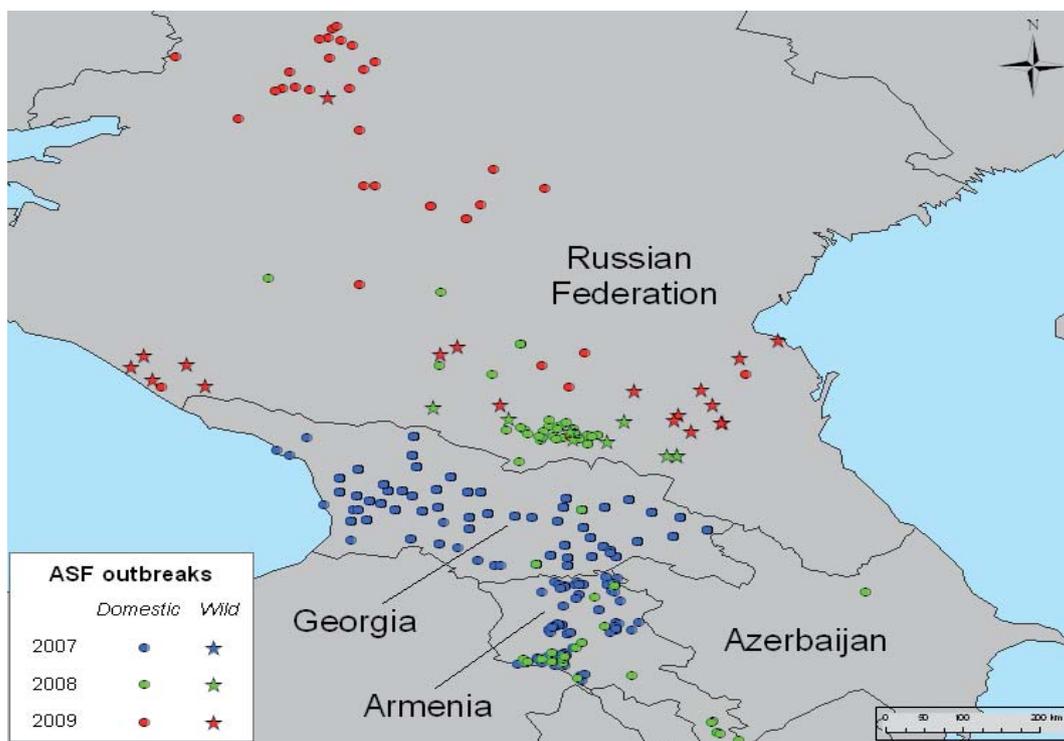
Antibodies against ASF start being detectable in serum 7–12 days after clinical signs appear and persist for a long time post-infection, possibly for life, in both pigs and warthogs. They do not fully protect against subsequent infection in domestic pigs, although a degree of immunity to infection with homologous strains of the virus has been reported. Serologically positive sows transmit antibodies to piglets through colostrum. In sub-acute and chronically infected pigs, virus replication continues even in the presence of antibodies.

### 3. ASF SITUATION IN THE CAUCASUS REGION AND THE RUSSIAN FEDERATION

#### GEORGIA

Although ASF was reported to the OIE on 5 June 2007, the first clinical cases had been observed prior to this date

Figure 1. African swine fever outbreaks in the Caucasus and the Russian Federation since 2007



Note: The map does not show the outbreaks in Orenburg and Leningrad Oblasts

before May 2007 in the area surrounding the port of Poti, on the eastern shore of the Black Sea. All evidence so far indicates that the virus was introduced into Georgia by improperly disposed of waste from international ships carrying contaminated pork or pork products. Since most pigs in Georgia are traditionally kept in a free range, scavenging system, access to garbage dumps with food waste from these ships provides for a plausible explanation for ASF introduction. Afterwards, the disease spread firstly eastwards and then northwards following the main transportation routes with most of the country's regions reporting outbreaks.

This was the first official report of ASF occurrence in the Caucasus region. Sequence analysis of the Georgian ASF virus isolate revealed a close relationship to virus strains from Southeast Africa (Mozambique, Madagascar and Zambia).

There have been no outbreaks reported since March 2008. Some of the affected regions have already started re-populating backyard pigs, so the risk of re-infection will increase again. In terms of surveillance activities, in November-December 2009, blood samples will be sent from all regions of Georgia for ELISA testing.

#### ARMENIA

Armenia first reported ASF on 6 August 2007 in the northern districts bordering Georgia. The source of the ASF virus entry into Armenia was probably from an extension of the ASF epidemic in Georgia. It may have entered Armenia through legal or illegal movement of pigs and pig products, or from the movement of free-ranging pigs or wild boar across the border. Most outbreaks were reported in the northern marzes (regions) bordering Georgia. Since May 2008, there have been no further officially confirmed ASF outbreaks.

Current surveillance is focusing on four previously infected marzes (Lori, Tavush, Syunik and Vajoc Dzor), characterized by forested areas where pigs are bred in free-range systems.

#### RUSSIAN FEDERATION

Outbreaks have been reported mainly in backyard pigs, but also on some commercial farms and in wild boar. On 4 December 2007, the Russian Federation reported to the OIE their first ASF outbreak since the 1970s. The outbreak affected five wild boar found dead in early November along the Argoun and the Shatoy-Argoun rivers in the Chechnya Republic, bordering Georgia. Another two wild boar tested positive in the Republic of Chechnya during the first half of 2008. At the end of June 2008, the disease was first detected in domestic pigs in the southern region of Severnaya, in the Osetiya-Alaniya Republic. Although the precise details of its introduction into the Russian Federation are unknown, it is likely to be related to the outbreaks in neighbouring Georgia.

During the summer of 2008, the disease spread across different oblasts and republics north of the Caucasus (43 outbreaks between June and the end of October 2008): Orenburg Oblast (very close to the

border with Kazakhstan), the Ingushetiya Republic and Stavropol Kray. No further wild boar samples tested positive during this period. The rest of 2008 registered only one outbreak in captive wild boar in the Kabardino-Balkarskaya Republic, before the disease peaked again in the first half of January 2009 in Stavropol (3) and Krasnodar Krays (1) in farmed and backyard pigs and wild boar. From March to July 2009, 12 outbreaks were reported in pigs (in Rostov Oblast, Stavropol Kray and Severnaya Osetiya-Alaniya Republic) and eight in wild boar (Chechnya Republic and Kabardino-Balkarskaya Republic). After almost two months with no reported activity the disease reappeared in late September 2009 with outbreaks in pigs in Rostov Oblast (16), Kalmykiya Republic (2), Stavropol Kray (1) the Severnaya Osetiya-Alaniya Republic (1) and in wild boar in Dagestan (2) and the Chechnya Republic (1).

On 1 October 2009, an outbreak started on the farm of a military unit in Mga Village, Leningrad Oblast, about 2 000 km north of the previously affected areas in the south. It is believed that ASF spread through the import of meat and meat products from somewhere in the southern part of the country.

#### AZERBAIJAN

The only reported ASF outbreak in Azerbaijan occurred on 28 January 2008 in the village of Nic, Gabala District (north-west of the country, about 180 km east of the Georgian border). The majority of the inhabitants of Nic are Christian, explaining the relatively high number of pigs (4 600) in the village compared to other villages. The pigs are typically kept in backyard holdings and temporarily left outside during the day on pasture/communal land. The pigs are kept mainly for family-consumption or small-scale local trade. The local veterinary services estimated that the ASF virus was introduced into Nic either by contaminated pork (or pork products) from Georgia or by infected wild boar.

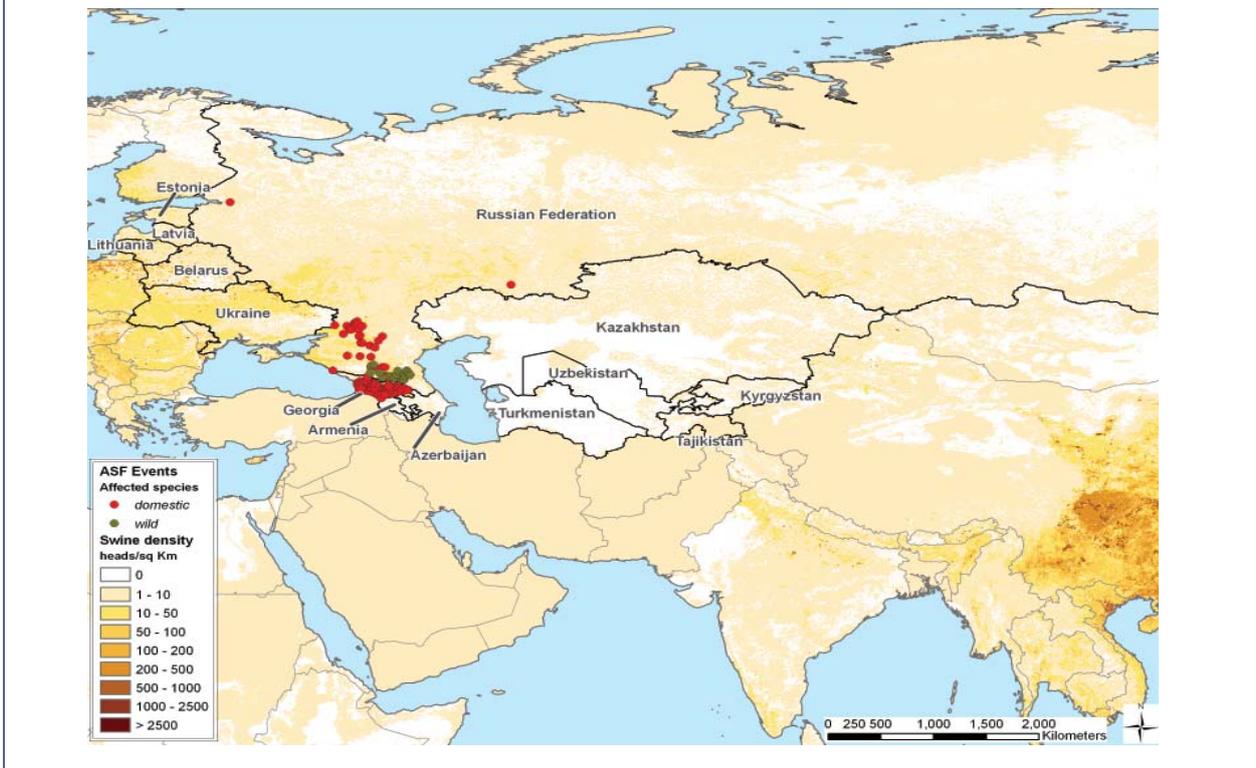
### 4. THE PIG SECTOR

In the Caucasus region, the Russian Federation and the former USSR countries west of the Russian Federation, the importance of commercial, industrialized pig production is variable across countries. However, backyard rearing of pigs is a very common and is a traditional practice in rural areas of all these countries. It represents an important source of meat for the population in the countryside and often generates valuable cash income. Backyard pigs are usually slaughtered at home. Traditionally, backyard pigs are traded either on free markets or by direct sale with potential customers. The impact of swine diseases on livelihoods, particularly for the poorer smallholders is severe, particularly in the absence of proper compensation schemes.

#### CAUCASUS

Population estimates in Armenia range from 300 000 to over one million pigs, primarily located in the north

Figure 2. African swine fever outbreaks and swine density in the Caucasus and the Russian Federation since 2007



of the country. In Georgia, the highest pig densities are found in the east and western parts of the country. Pig breeding in Armenia and Georgia is seasonal because of the cold winters, with few if any piglets born during that time of year. The peak period for pig slaughtering is for the Christmas/New Year markets. Therefore, pig inventories are at their lowest in January, with most of the remaining animals being adult breeders, and at their highest during the summer months (June-August), when animal numbers will be several times that of January. Moreover, in the absence of a herd registration or animal identification system, it is most likely that the inventories are under-estimations of the actual census.

Pig production systems vary across the Caucasus countries, but the majority of pigs are kept in small backyard holdings, where pigs roam free and scavenge during the day and return to their housing at night to be fed. There are also some semi-professional farms holding a few hundred pigs in full confinement on specialized premises. However, a commercial pig production system with high standards of bio-security is almost absent. There are few formal pig slaughterhouses and most butchering is done on the premises of origin, even on the larger commercial farms.

In Azerbaijan and Chechnya, premises housing swine are scarce, since the population is mainly Muslim and pork consumption is consequently limited to Christian minorities. However, about 10 000 pigs are kept in Azerbaijan and the country is planning to increase pig production tenfold in the coming years.

In the Russian Federation, free ranging of pigs is banned. In the South Federal Region, which covers 585

500 km<sup>2</sup>, there are 3.97 million pigs (6.78 pigs/km<sup>2</sup>), based on a report by the All Russian Research Institute of Animal Health (ARRIAH) and the Federal Service for Veterinary and Phytosanitary Surveillance (FSVPS).

In Ukraine, 59 percent of swine are households (non-professional pig holdings with one to two pigs) and the rest are commercial holdings. Households are characterized by low biosecurity levels, while

Table 1. Swine populations in the region

Country	Swine population
Armenia	300 000 - 1 000 000*
Azerbaijan	20 000
Belarus	3 842 000 (2008)*
China	494 400 000 (2007)
Estonia	346 000
Finland	1 435 000
Georgia	510 000
Latvia	417 000
Lithuania	1 127 000
Moldova	400 000 (2008)*
Romania	6 815 000 (2007)
Russian Federation	15 128 888
Turkey	1 400**

Source: FAO GLIPHA

\*Figure obtained from various local sources;

\*\*There are several geographical gaps in the data from Turkey

commercial production holdings are have a medium to high level of bio-security.

In the Republic of Moldova, most swine are in the north and central part of the country, mainly kept in small households and medium scale pig-raising farms, with a low biosecurity level.

In Belarus, unlike in Ukraine and Moldova, two-thirds of the swine population is concentrated in commercial, medium to large, integrated farms. Nevertheless, one million swine are kept in small-scale subsistence (backyard) holdings.

### 5. MAIN CHALLENGES IN THE RUSSIAN FEDERATION AND THE RISK FOR THE REGION

Although there is no elaborate National Contingency Plan for the progressive control of ASF, the FSVPS has developed a set of guidelines and an action plan to contain ASF and prevent its further spread within the Russian Federation. According to national legislation, local veterinary services (provinces, autonomous republics, etc.) of the Federation are in charge of veterinary services and do not report to FSVPS, but to the regional governor. The FSVPS sent out guidelines on prevention and control of ASF and organised meetings and seminars involving local authorities at various levels. However, in practice, these local authorities do not always implement all required measures, such as strict quarantine or biosecurity measures, to early detect and respond to ASF outbreaks.

Animal identification and traceability systems do not permit monitoring of all pig movements and trade

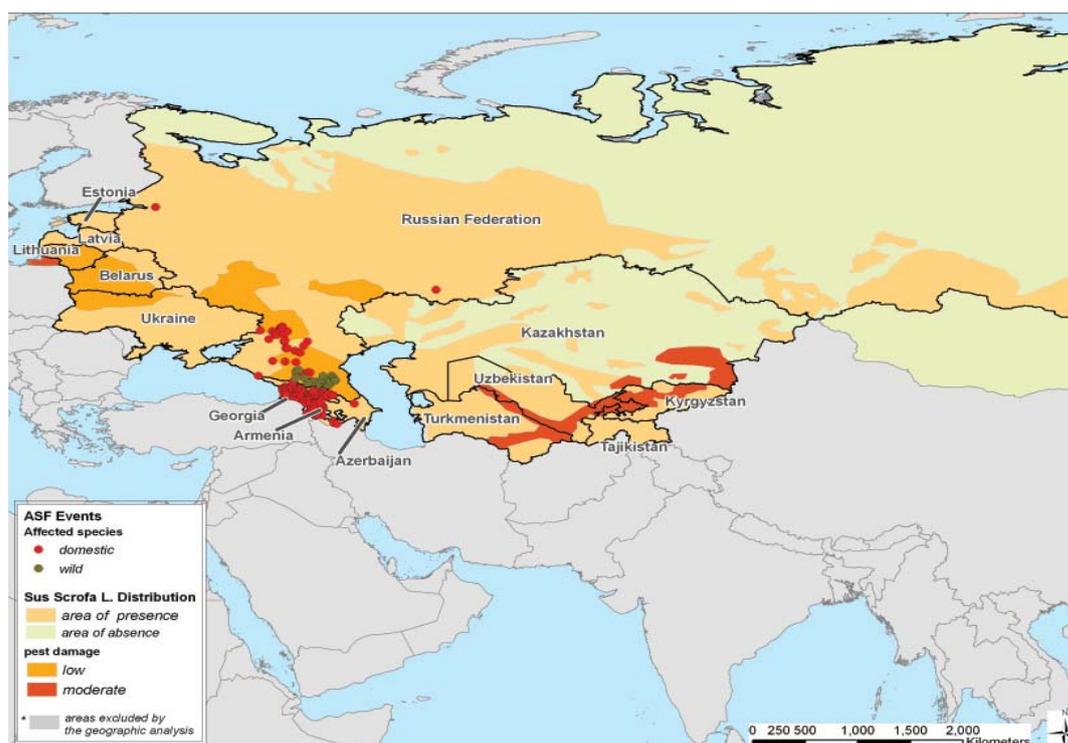
of pork, by-products and pork-containing products. It is believed that there is a huge volume of unauthorized trade and transport. The latter is believed to have been the route of introduction of ASF into Leningrad Oblast.

A further challenge is that sometimes there is a lack of cooperation and trust between pig owners and the local authorities/veterinary services. In some instances, compensation has been inadequate and swine owners have lost trust in fair and timely compensation. This may lead to outbreaks not being reported and pigs being emergency-slaughtered for home consumption or for sale at local markets, or the carcasses are just dumped in nearby woods. Spot-checks have revealed the virus in detained meat products that were being transported or offered for sale, the origin of which was wrongly declared, in order to avoid the restrictions imposed by the authorities.

Swill feeding is common practice for backyard swine farms. More awareness and education campaigns on ASF prevention measures for swine breeders and veterinarians are needed.

There is little known about the roles of wild boar in the spread and persistence of ASF in the Caucasus and Russian Federation. Positive (generally dead) wild boar have been regularly found in large areas of the Chechnya and Ingushetia Republics suggesting that wild boar may play an important role in the epidemiology of the infection. Wild boar seem to contribute to the spread of the virus, since their movement between regions and countries cannot be controlled. Although wild boar usually do not migrate, they will move if pressed to do so, e.g. by extreme weather conditions or during the mating

Figure 3. Map of distribution and pest damage caused by wild boar (*Sus scrofa L.*) in the region



season (when wild boar density is low). The infection can also spread, as observed for Classical Swine Fever (CSF), where there is continuity in the geographical distribution of the wild boar. Where wild boar are absent or in the presence of natural/artificial barriers, the infection will not spread further.

Therefore, wild boar distribution and population size estimates can be applied to predict the potential spread of the virus. Unfortunately, there are few available data on wild boar population, distribution and density. The distribution of wild boar is closely linked to the forested areas they inhabit, swamps and along rivers. There is a continuous distribution of wild boar from the Russian Federation to the west. While wild boar density is very high in parts of Western Europe, the available information on Eastern Europe and the Caucasus indicates very low densities, usually less than one head per km<sup>2</sup>. In the South Federal Region of the Russian Federation, it is estimated that there are 40–100 wild boar at a density of 0.01 wild boar/km<sup>2</sup> (based on a report by ARRIAH and the FSVPS). The speed of the spread of the epidemic into new areas is related to wild boar density; the higher the density, the faster the dissemination. Density may also be critical for the potential endemic persistence of the virus in the environment. In Armenia and Georgia, wild boar are protected precisely because of their low density (although illegal hunting occurs). For a disease with a lethality as high as that observed for ASF, it is reasonable to assume that a high wild boar density is needed to maintain the infection, which it appears is not the case in the region. A tentative wild boar distribution map is shown in Figure 3. At present, the geographical distribution of wild boars in the area of concern is quite homogeneous, with possible corridors located in Ukraine and the Baltic countries.

Wild boar can mix with domestic pigs, particularly when the latter are kept under low biosecurity and in free range settings. In times of scarce feed, wild boar are more likely to approach farms. The habitats of domestic pigs and wild boar overlap, in particular during late summer and early autumn, when wild boar descend to the inhabited bottom of the valleys to feed on fruits and walnuts and where also domestic pigs are free

ranging. In late autumn, wild boars remain confined to the forests.

In addition to the above difficulties, several potential tick vectors (*Ornithodoros*) are present in the Caucasus region: *O. alactagalis*, *O. pavlovskyi* and *O. lahorensis*. Some authors consider them as part of the *Ornithodoros erraticus* group. Current knowledge suggests that only the *Ornithodoros erraticus* group is able to transmit the virus in Eurasia. No “mechanical” transmission by ixodid (hard) ticks is expected to occur, as these ticks generally feed on the host once only to drop and moult. It is believed that the virus cannot survive in the tissues of the newly moulted tick. However, no studies have been carried out under laboratory conditions using ixodid ticks as vectors. Should the three encountered *Ornithodoros* species act as competent vectors, additional efforts would be needed to adjust certain household and commercial practices, further complicating the control of infection; infection in these ticks may persist for several years or even decades.

The presence of such ticks in and around pig pens, their feeding habits and vector competence is currently being investigated by FAO Technical Cooperation Projects in Armenia and Georgia. So far, no ticks in pigsties or shelters have been encountered, nor have ASF antibodies in wild boar been detected, but sampling is still ongoing.

In conclusion, the chances of ASF becoming endemic are high. If not contained, ASF may readily spread to other countries in the region. The countries south and east of the Caucasus region (Turkey, Kazakhstan and Iran) are predominantly Muslim with negligible pig populations other than in some isolated Christian communities. The countries at highest risk would be Finland, the Baltic States, Ukraine and Belarus to the west and China to the east. The consequences could be catastrophic.

There are two main risk factors determining the spread of ASF in Europe:

- a) Introduction of infected pork meat, mainly by pig workers and other personnel travelling within Europe.
- b) Continuous wild boar distribution from the Russian Federation to Ukraine and to the west.

## PREVENTION AND CONTROL MEASURES FOR ASF AND OTHER INFECTIOUS DISEASES OF SWINE

No vaccines or drugs are available to prevent or treat ASF infection. Therefore, it is particularly important that ASF-free areas are maintained free by preventing the introduction of the disease. All control and eradication measures applicable are based on classical disease control methods, including surveillance, epidemiological investigation, tracing and stamping out of infected herds (not just single individual animals that show clinical signs). These measures are combined with strict quarantine and biosecurity measures and animal movement control.

### Prevention

**Import quarantine policy:** The OIE Terrestrial Animal Health Code (2007 edition, Chapter 2.6.6) provides guidelines for the safe importation of domestic and wild pigs, pork and pork products, pig semen, embryos and ova and other products incorporating pig tissues, such as pharmaceuticals. Attention should be paid to providing adequate regulatory and quarantine services to intercept foodstuffs and other risk materials containing pig meat or products being brought

into the country at international airports, seaports and border crossing points. This should include checking of luggage, including personal belongings countries that are at particularly high risk for the entry of ASF. Any confiscated materials should be disposed of safely by deep burial or incineration, as should all food waste from international aircraft and ships, and not dumped where it can be accessed by scavenging animals.

**Swill feeding controls:** Swill feeding is a high risk practice, as several diseases can be introduced into an otherwise healthy swine population. Pigs should not be fed swill that might contain remains of pigs. Communication campaigns should be aimed at pig owners, so that they understand the dangers of swill feeding and opt to boil swill for 30 minutes and allow it to cool before feeding it to their pigs. It is advisable to place a ban on swill feeding, although compliance at household level is rather unlikely. On any farm with high biosecurity, swill feeding should be forbidden.

**Containment of pigs:** The development of properly constructed pig pens should be encouraged to reduce the numbers of scavenging, free-ranging pigs accessing garbage and having contact with feral pig populations or wild boar, particularly in areas which are considered to be at high risk for the entry of ASF. However, traditional ways of keeping pigs in many countries will not be changed overnight as many producers will not find it worthwhile to confine their pigs.

**Awareness:** Pig farmers and field personnel should be made aware of ASF, be able to recognize it and know what to do and where to report if they suspect ASF.

**Biosecurity:** Farmers should be encouraged to enhance biosecurity levels: number of visitors to be kept to a minimum, perimeter fencing, removal of effluent, pig-loading and unloading facilities located outside the perimeter fences and cleaning and disinfection of pig-carrying trucks after unloading. Perimeter fencing will prevent the spread of disease from domestic to feral pigs and vice versa. Under ideal settings, double fencing (at least one metre apart) is preferred. The access of wild pigs to domestic food scraps should be prevented. Village settings, where pigs may roam freely, present additional biosecurity challenges, although the same biosecurity principles apply. Equipment and premises should be periodically cleaned and disinfected. Sharing of equipment between farms/villages should be discouraged, unless proper cleaning and disinfection is performed. Pig owners/workers should avoid contacting other pigs or piggeries and the use of dedicated work clothing and foot gear strictly promoted. Replacement breeding stock should come from trusted sources that deal in healthy animal trade. Casual visitors, particularly those who may have contact with pigs, should not be allowed. A sign at the farm/village entrance advising visitors not to come close to pigs is also recommended. Entrails and other discarded parts from slaughtered pigs should be disposed of in an appropriate manner. When the disease is present in an area, decontamination equipment should be made available at village and premises entry and exit points (disinfectant, brush and a bucket of water or a foot bath).

## CONTROL

**Public awareness:** ASF outbreak information should be well publicised, emphasising the dangers of swill feeding, particularly by small pig holders. Commercial farmers should be encouraged to enhance farm biosecurity levels. An early warning system encouraging farmers to inspect susceptible animals regularly and to report suspicious lesions and unusual deaths promptly should be implemented in every state or region and at national level. Enhanced public awareness is essential to reassure the public that meat products coming from healthy pig herds is safe for consumption. Ensuring the cooperation of pig owners is enhanced through information/awareness campaigns and village level meetings. Civil authorities should also be on alert and given periodic epidemiological information.

**Surveillance:** Intensive surveillance based on clinical inspection, necropsy, serology and owner or hunter reports should be done on all suspect cases, involving all infected premises and their dangerous contacts for at least 40 days after the last date of possible transmission (the maximum incubation period). Passive surveillance and reporting should be encouraged among pig owners through awareness campaigns. Whenever an infected pig holding is identified, the origin of the disease (trace-back) and contacts (trace-forward) should be investigated. In order to determine the extent of infection, it is also advisable to carry out retrospective examinations of slaughterhouse records (for high condemnation rates due to fever or lesions) and of samples sent to laboratories from ASF-like outbreaks.

**Quarantine and movement control:** Quarantine is to be strictly imposed on all suspected or infected premises as soon as possible. No movement of pigs, pig products and other potentially infected materials should be allowed off the property until an investigation and diagnosis has been accomplished. No one should leave a farm without changing clothes and footwear. In a free-ranging or village situation, pigs should be enclosed.

A restricted area (RA), usually of a 3 km radius, includes the affected (infectious) premises and some or all of the dangerous contacts and suspect premises, and a control area (CA) is a buffer zone around the RA. The implementation

of RAs will prevent disease spread, because movement on the most likely affected premises is restricted. Movement of potentially contaminated materials can be allowed within a CA but not outside, unless previously approved by the veterinary authorities. Premises of different status may have different movement restrictions, e.g. total prohibition of movement, movement of pigs to slaughter only, or movement to another property only if previously inspected and tested.

**Zoning:** If the disease is endemic in only part of a country and it is possible to establish diseased and disease-free zones and enforce tight controls on the movement of pigs and products between zones, then zoning is an important component towards progressive elimination or eradication efforts.

**Stamping out and disposal:** All infected and in-contact pigs must be humanely slaughtered. Culling or “stamping out” is often rejected by pig owners when there is no compensation programme in place, and this may contribute to dissemination of the disease through uncontrolled or illegal movement of diseased animals. The carcasses of destroyed pigs must be disposed of in a safe manner after stamping out is completed. Carcasses must be burnt or buried deeply, on-site if possible. This may prevent consumption by feral pigs, scavenging animals, or carcasses dragged away from the disposal site. The disposal of very large numbers of pigs in a short time presents environmental and logistic problems. More information on on-site slaughter and disposal procedures is available in the FAO Manual on procedures for disease eradication by stamping out (<http://www.fao.org/DOCREP/004/Y0660E/Y0660E00.HTM>).

**Compensation:** Compensation is key to encourage early reporting. The lack of adequate compensation for culled animals (in terms of timing and quantity), may lead to outbreaks not being reported, and to emergency slaughter by farmers either for their own consumption, for sale at local markets, or inappropriately disposal of the carcasses in areas accessible to other domestic, feral or wild swine.

**Cleaning and disinfection:** The cleaning of organic matter from sheds, equipment, vehicles, etc. is an important step before disinfection. Vehicles and personnel (shoes, clothing and equipment) should be disinfected on entering and leaving farms. The proven disinfectants are detergents, hypochlorites, alkalis and glutaraldehyde. It is important to ensure that the use of disinfectants meets regulatory requirements, as some of these disinfectants may have residual effects or prove damaging to the environment. Equipment which cannot be easily disinfected should be either replaced or put aside and exposed to sunlight.

**Vector control:** Certain blood-sucking insects, namely *Stomoxys calcitrans*, but also the tse-tse fly *Glossina morsitans*, can mechanically transmit the ASF virus within herds. Hence, an insect control programme may be implemented to halt or prevent this.

**Tick control:** Elimination of *Ornithodoros* ticks from old pigsties is a huge challenge, because of tick longevity and endurance. Ticks can resist for long periods without eating, hidden in cracks that are not reached by acaricides. It is recommended not to house pigs in infested buildings, to isolate the pigsties and even destroy and rebuild these in another location.

**Sentinel animals and restocking:** Depopulated premises should not be restocked for at least 40 days following cleaning and disinfection. Sero-negative sentinel swine should be used should be closely monitored for at least 6 weeks while being monitored clinically and serologically to detect any re-infection.

#### **Wildlife control**

If ASF were to be established in the feral pig or wild boar population it would be very much more difficult, if not impossible, to eliminate. Accordingly, the strategy should be to minimize contact between feral pigs and domestic pigs, preferably through double fencing of piggeries, elimination or reduction of the numbers of feral pigs in areas where domestic pigs are held, and immediate disposal of carcasses, entrails or other discarded body parts to prevent its consumption by feral pigs or other scavengers.

If, despite the methods above, the disease became endemic in wild boar, there is controversy about the best ways to control it. Hunting pressure may be counter-productive, since it may increase the size of the home-range and force long-distance movements. Besides, hunting management does not always reduce the population of wild boar. Supplementary feeding, while maintaining wild boar within a known, well-defined area and limiting dispersal, will increase the opportunity for close contact and disease transmission. Where hunting is regulated, hunters and hunting clubs can be important collaborators of the veterinary services in the surveillance efforts.

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