Standing Group of Experts on African swine fever in the Baltic and Eastern Europe region

under the GF-TADs umbrella

Eleventh meeting (SGE ASF11) - Warsaw, Poland, 24-25 September 2018

Update on the domestic / Wild interface in ASF infected areas

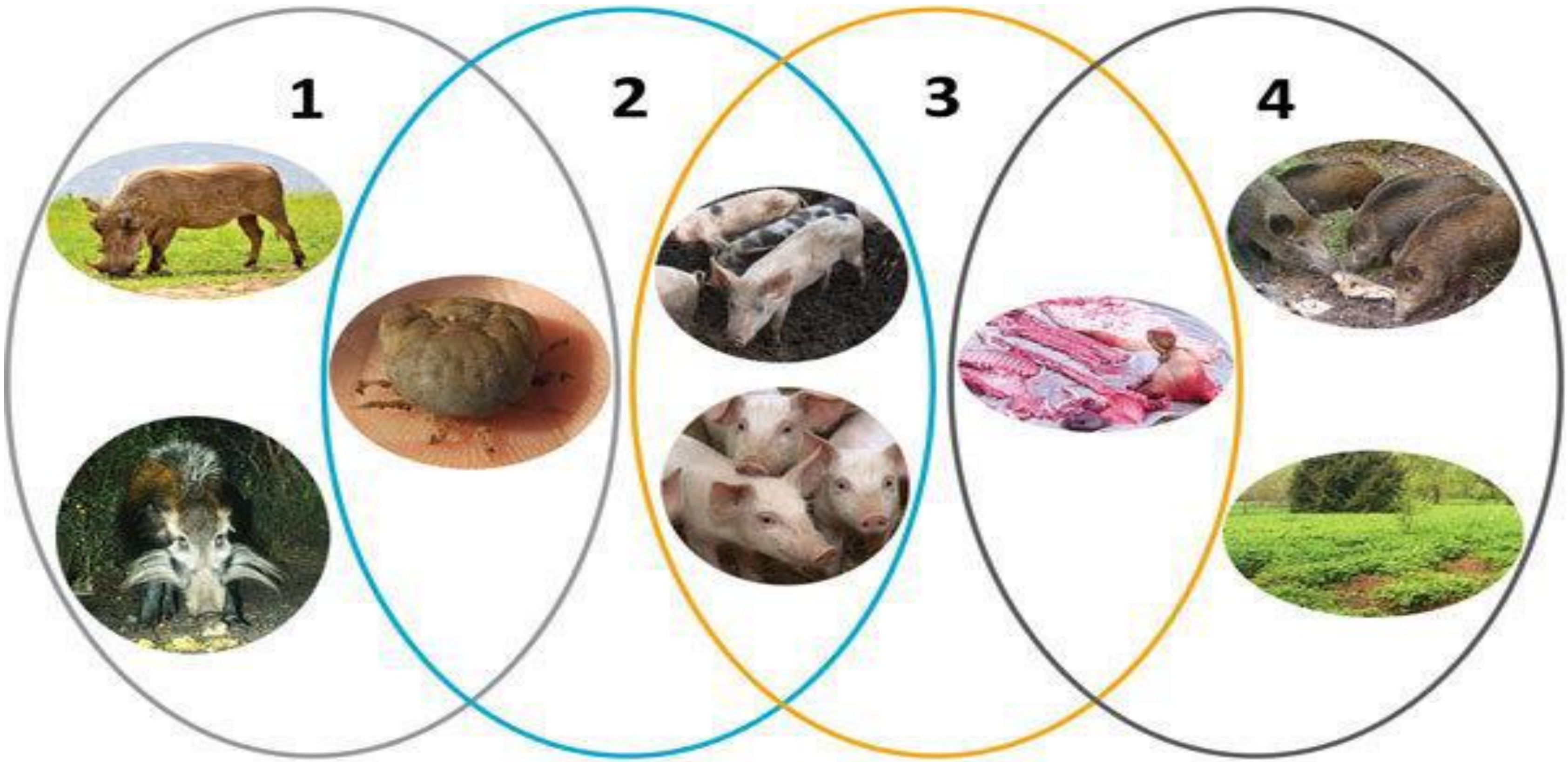
Alexey Igolkin

ASF reservoir and susceptible animals

O. erraticus, spread in Iberian (Spain)

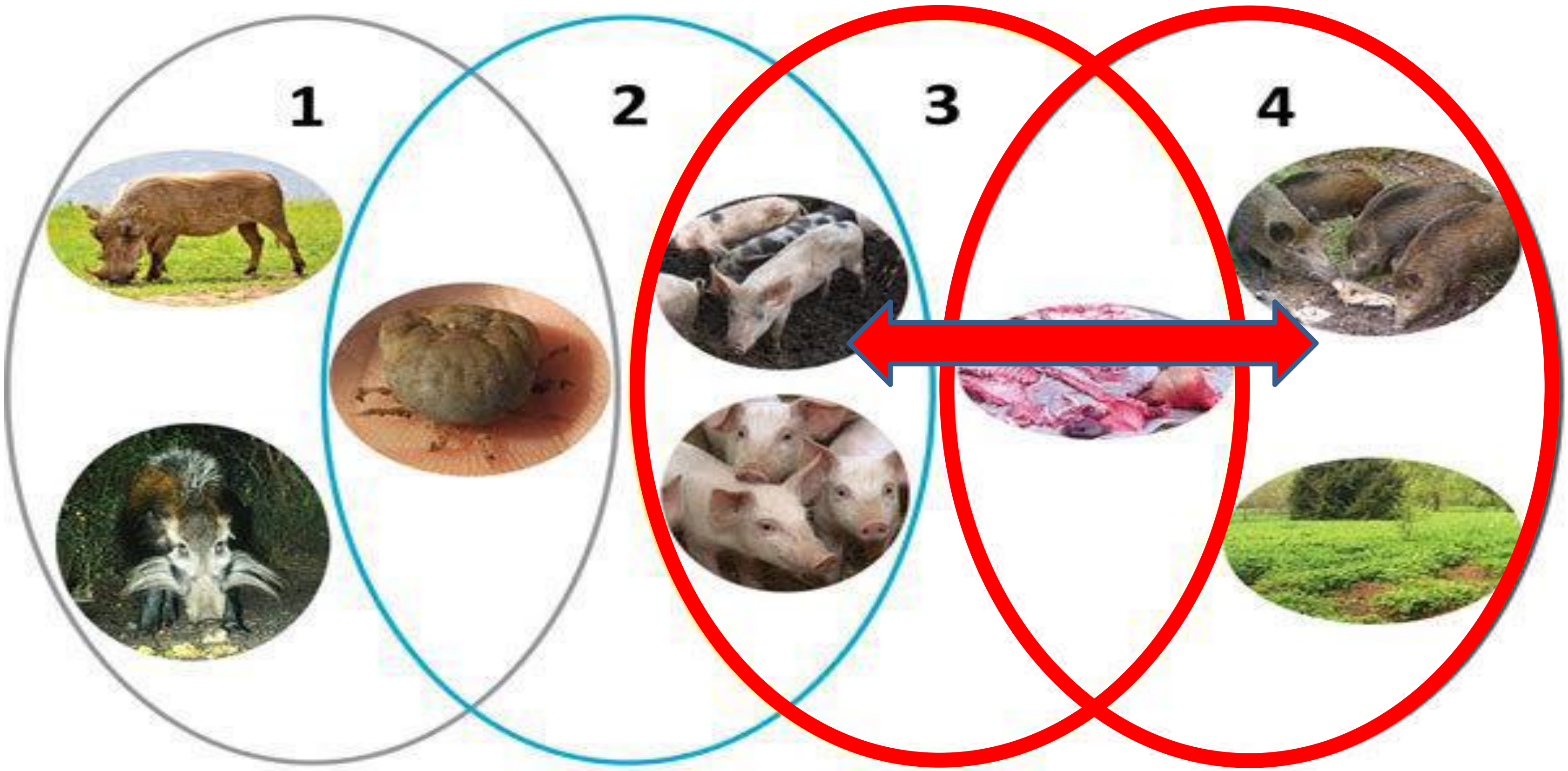
O. moubata spread in the south and East of Africa

Epidemiological cycles of ASF and main transmission agents:



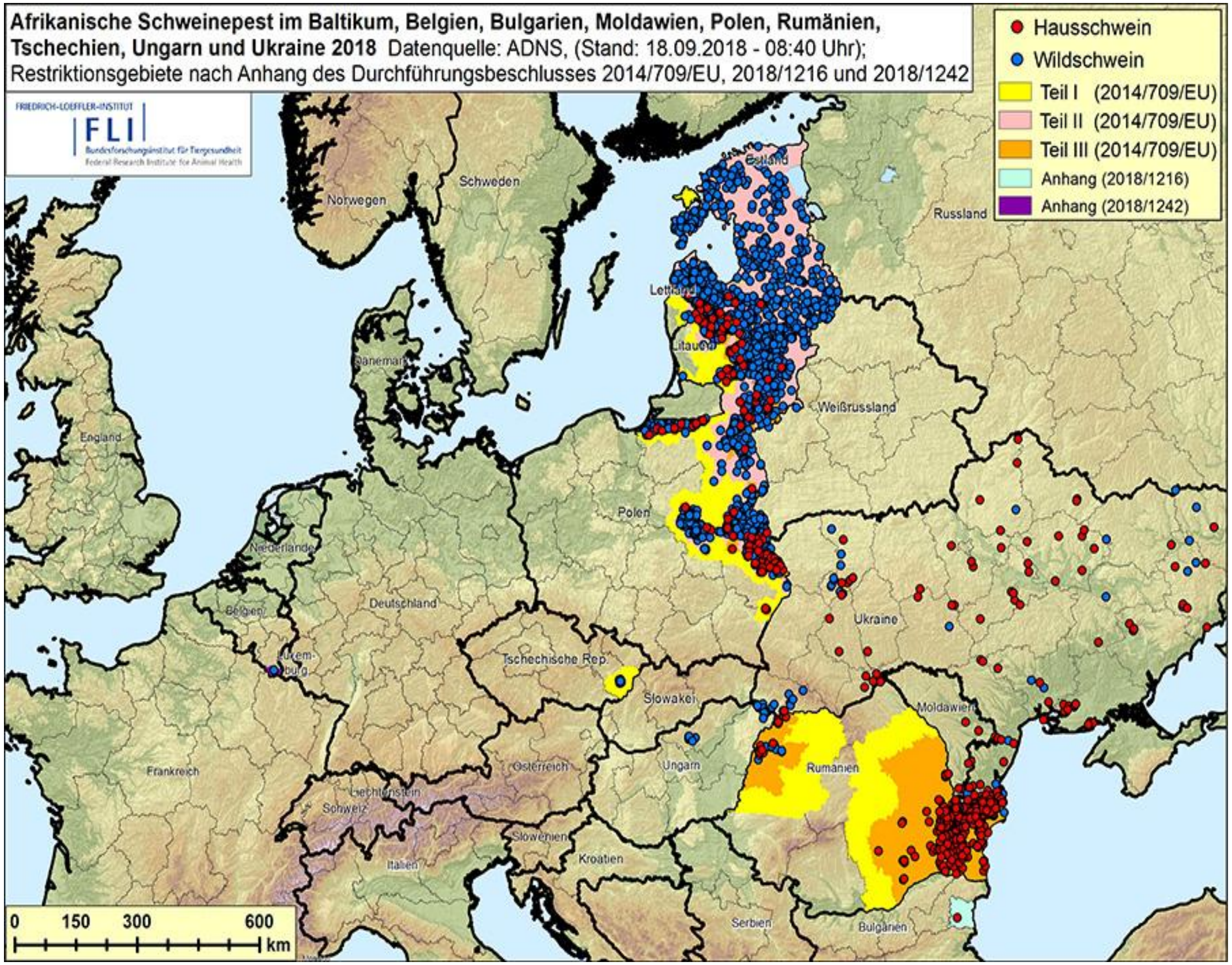
Chenaiset al., EmergInfect Dis. 2018 Apr;24(4):810-812.

Epidemiological cycles of ASF and main transmission agents:



Chenaiset al., EmergInfectDis. 2018 Apr;24(4):810-812.

ASF epidemic situation in European Region



- ASF disease dynamics have proven to be complex and difficult to control in WB

- DP ASF prevalence remains 5%

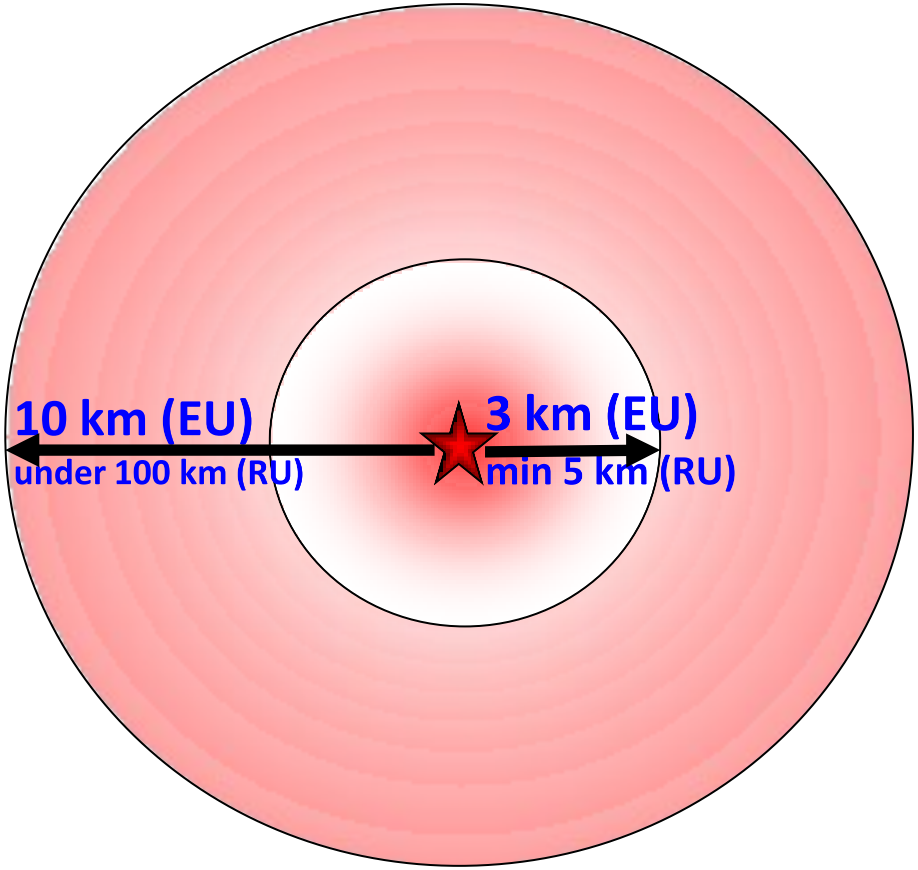
- a pattern of local persistence

- slower than expected dynamic spatial spread is evident, estimated at an average of 1–2 km/month

(EFSA, 2017)

Guidance on ASF prevention and eradication

- ✓ Stamping-out
- ✓ Quarantine
- ✓ Zoning
- ✓ Monitoring



Factors affecting the wild boar and its habitat

Good/Bad for WB

- Climate (warm/long cold winter)
- Geography (forest and plains/vast rivers)
- Ecology (crop fields/ infection diseases)
- Management (feeding, lack of awareness/ eradication, hunting, barriers, biosafety measur
- Demography (low and unpopulated areas /high people density, wide roads)
- Behavior

Way of transmission ASF in wild boars

- *Direct transmission between infected and susceptible wild boar*
- *Indirect transmission through carcasses in the habitat*
- *Indirect transmission through other potential vectors?*
- *Indirect transmission through the environment?*

Direct transmission between infected and susceptible wild boar

What do we need to know?

- EXCRETION: Virus excretion by urine/saliva

  low-> low dose
- Contacts within one group of animals high -> possibly higher dose
- Transmission between groups? Rather low…

(Iglesias et al., 2015; Pietschmann et al., 2015)

The level of accumulation of the virus in animal fluids

Quantification of African swine fever virus (ASFV) in blood, secretions and excretions of infected domestic pigs with currently circulating strains in Caucasus, Ea

Sample type	ASFV strain	Inoculation	Maximum of virus titres detected	References
Blood	Lithuania LT14/1490 isolated from wild boar	Intramuscular 10 HAD_{50}/ml	$10^{6.4}$ to $10^{8.7}$ HAD_{50}/ml at 6 dpi	Gallardo and others 2015a
		Contact	$10^{6.4}$ to $10^{8.7}$7 HAD_{50}/ml at 14 dpi	
	Georgia 2007/1 isolated from domestic pig	Intramuscular 10^2 HAD_{50}/ml	10^6 to 10^8 HAD_{50}/ml from 5 dpi	Guinat and others 2014
		Contact	10^6 to 10^8 HAD_{50}/ml from 10 dpi	
	Russia Kashino 04/13 isolated from wild boar	Intranasal 5×10^3 HAD_{50}/ml	$10^{7.5}$ HAD_{50}/ml at 7 dpi	Vlasova and others 2015
		Intranasal 50 HAD_{50}/ml	$10^{6.5}$ to $10^{7.5}$ HAD_{50}/ml from 7 dpi	
		Contact	$10^{6.5}$ to 10^7 HAD_{50}/ml from 15 dpi	
	Russia Boguchary 06/13 isolated from domestic pig	Intranasal 5×10^3 HAD_{50}/ml	$10^{6.5}$ to $10^{7.5}$ HAD_{50}/ml from 9 dpi	Vlasova and others 2015
		Intranasal 50 HAD_{50}/ml	$10^{6.5}$ to 10^7 HAD_{50}/ml from 5 dpi	
		Contact	10^7 HAD_{50}/ml at 13 dpi	
	Russia K 08/13 isolated from wild boar	Intramuscular 5×10^3 HAD_{50}/ml	$10^{6.5}$ to 10^7 HAD_{50}/ml from 7 dpi	Vlasova and others 2015
		Intramuscular 50 HAD_{50}/ml	$10^{6.5}$ to 10^7 HAD_{50}/ml from 9 dpi	
Nasal fluid	Georgia 2007/1 isolated from domestic pig	Intramuscular 10^2 HAD_{50}/ml	Intermittent detection, 10^2 to 10^4 HAD_{50}/ml from 6 dpi	Guinat and others 2014
		Contact	Intermittent detection, 10 to 10^2 HAD_{50}/ml from 7 dpi	
Rectal fluid	Georgia 2007/1 isolated from domestic pig	Intramuscular 10^2 HAD_{50}/ml	Intermittent detection, 10 to 10^2 HAD_{50}/ml from 5 dpi	Guinat and others 2014
		Contact	Intermittent detection, 10 to 10^2 HAD_{50}/ml from 12 dpi	

dpi Day post-infection, HAD_{50}/ml 50 per cent haemadsorbing doses per ml

Guinatet al., 2016

Preservation of ASF virus

Material	duration	method	Reference
Feces (4-6°C)	160 days	Bioassay (i.m.)	Kovalenko, 1972
Feces (4°C-RT)	3 months	Virus isolation (low titers)	S. Blome and Dietze, 2011 (FAO report)
Feces (4°C)	8 days	Virus isolation	Davies et al., 2015
Feces (37°C)	3-4 days	Virus isolation	Davies et al., 2015
Urine (4°C)	15 days	Virus isolation (low titers)	Davieset al., 2015
Urine (21°C)	5 days	Virus isolation (low titers)	Davieset al., 2015
Urine (37°C)	2-3 days	Virus isolation (low titers)	Davieset al., 2015
Urine (4-6°C)	60 days	Bioassay (i.m.)	Kovalenko1972

Apparently

HIGH within a group (within stable) permanent contact
oral uptake of a high virus dose *(>1000 HAU)*
parenteral transmission

Probability of infection (Poi)

LOW between groups (open system…e.g. forest)
low virus dose *(<100 HAU)*

FLI,2018

Indirect transmission through carcasses in the habitat

What do we need to know?

- Tenacity: How long are carcasses infectious?
- Availability: How long is the process of natural decomposition of a wild boar until they „disappear“?
- What happens with the left-overs(bones)?
- Contact: Do wild boar eat their dead fellows/ what do they do when they find a dead fellow?

Preservation of the virus in the organs of an animal

Material	duration	method	Reference
Blood	140 days in the dark	Bioassay	Montgomery et al., 1921
Blood	>6 years at 4-6°C	Bioassay (i.m.)	Kovalenko et al., 1972
Blood	> 90 days	Virus isolation (high titers)	S.Blome and Dietze, 2011
Spleen	240 days(6-8°C)	Bioassay (i.m.)	Kovalenko et al., 1972
Spleen	>90 days	Virus isolation (high titers)	S. Blome and Dietze,2011
Muscle	155 days(6-8°C)	Bioassay (i.m.)	Kovalenko et al., 1972
Muscle	183 days		McKercher,1987
Muscle	90 days	Virus isolation (low titer)	S. Blome and Dietze, 2011
Fat	123 days	Virus isolation	McKercher,1987

Example of natural decomposition of a wild carcass in summer in the forest (with access to scavenger animals) A, B= Day 1, flies lay eggs in little carcass holes
C = Day 6, massive larvae invasion
D = Day 9 process almost finalized. Only small islet of larvae activity; bones almost spread .

FLI, 2018

ASF in Wild boar habitat

If wild boar eat infected carcasses – *probability of infection must be very high!*

Wild boar were more interested in the soil underneath and in vicinity of the carcasses

Indirect transmission through potential arthropod vectors (mechanical or virus reservoir?)

What do we need to know?

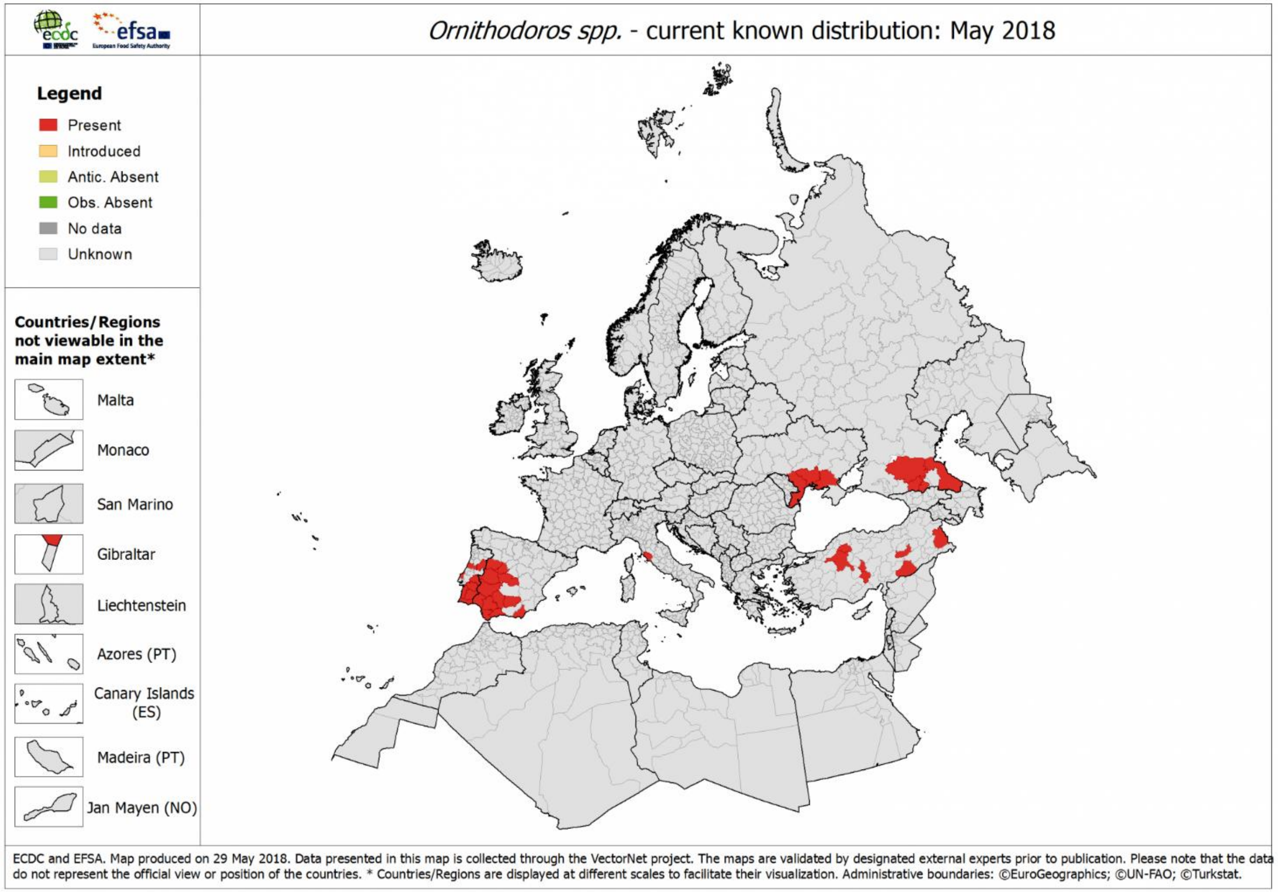
- Invasive vectors: Ticks, biting flies, mosquitoes, lice
- Maggots:

- Do wild boar take them up from carcasses?
- Are they infectious *(Forth et al., 2017)*

- Other scavenging species:

- Fox, wolf, birds, others?

Ornithodorus competent vector



https://ecdc.europa.eu/en/publications-data/ornithodoros-spp-current-known-distribution-may-2018

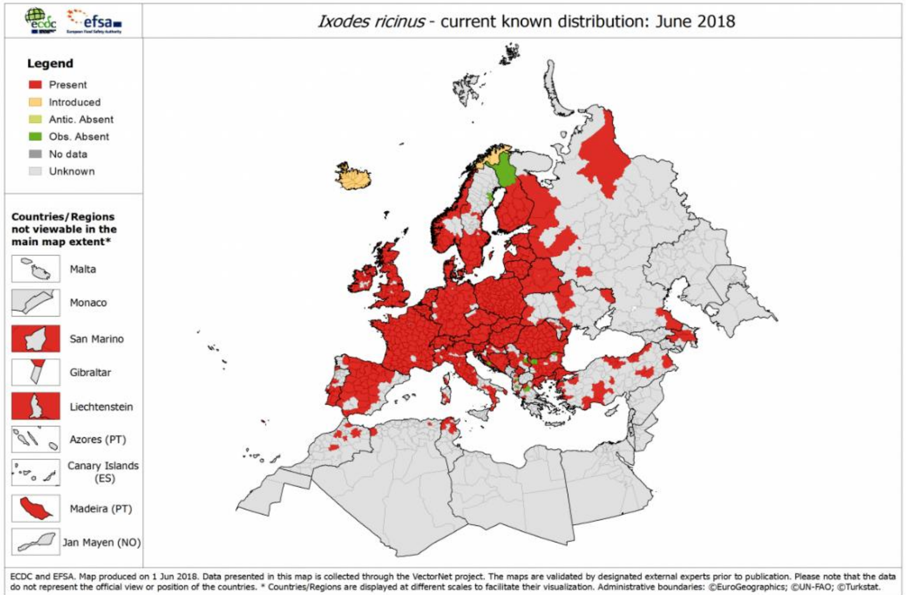
AFRICA

O. Moubata
O. Savignyi
O. Porcinus

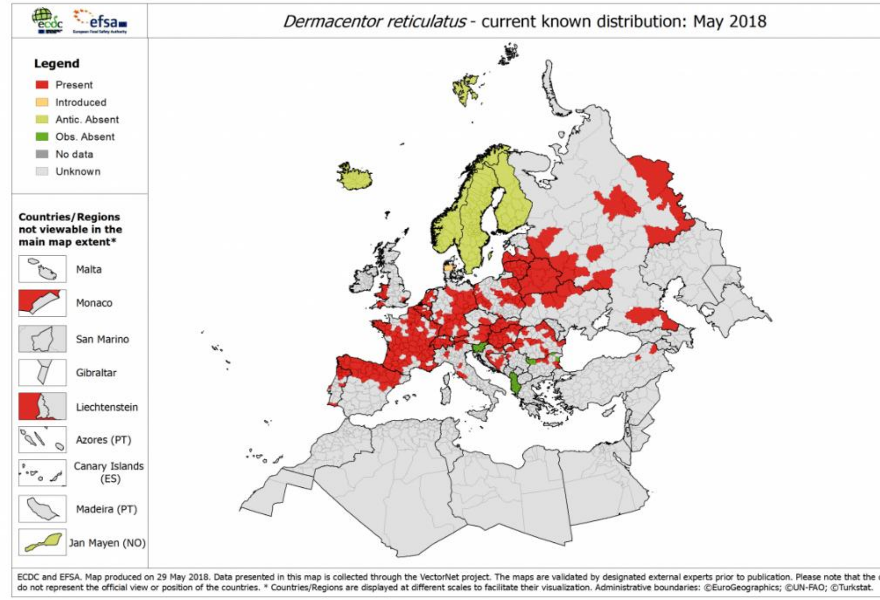
EUROPE:

O. Erraticus
(Vector competency is lower)

Distribution of ticks in Europe



https://ecdc.europa.eu/en/publications-data/ixodes-ricinus-current-known-distribution-june-2018



https://ecdc.europa.eu/en/publications-data/dermacentor-reticulatus-current-known-distribution-may-2018

Investigation in ticks and other blood sucking arthropods

- Investigation in ticks in Estonia and Russia – no ASFV detection
- Investigation in Cullicoides – no ASFV detection

(Please contact L. Zani, J. Forth, A. Viltrop or S. Blome for more information)

- Role of Biting flies: *Stomoxys* found to be short distance mechanical vector, *(Melloret al., 1987; Oelsenet al., 2018. "Role of Tabanids?")*
- Role of lice *(Mechanical vector? Anecdotally ASFV active up to 20 days (Botija and Badiola, 1966)*
- Flies collected on ASF-affected farms in Lithuania tested negative for ASFV *(EC 2014 b)*






Indirect transmission through the environment
What do we need to know?

- Bones: How long are bones (bone marrow) infectious?

Material	duration	method	Reference
Bone marrow	94 days	Virus isolation	McKercher,1987
Bone marrow	188 days (6-8°C)	Bioassay (i.m.)	Kovalenko et al., 1972

- Soil: What is the role of soil?

Experiments are running at the FLI (Dr. Carolina Probst carolina.probst@fli.de)

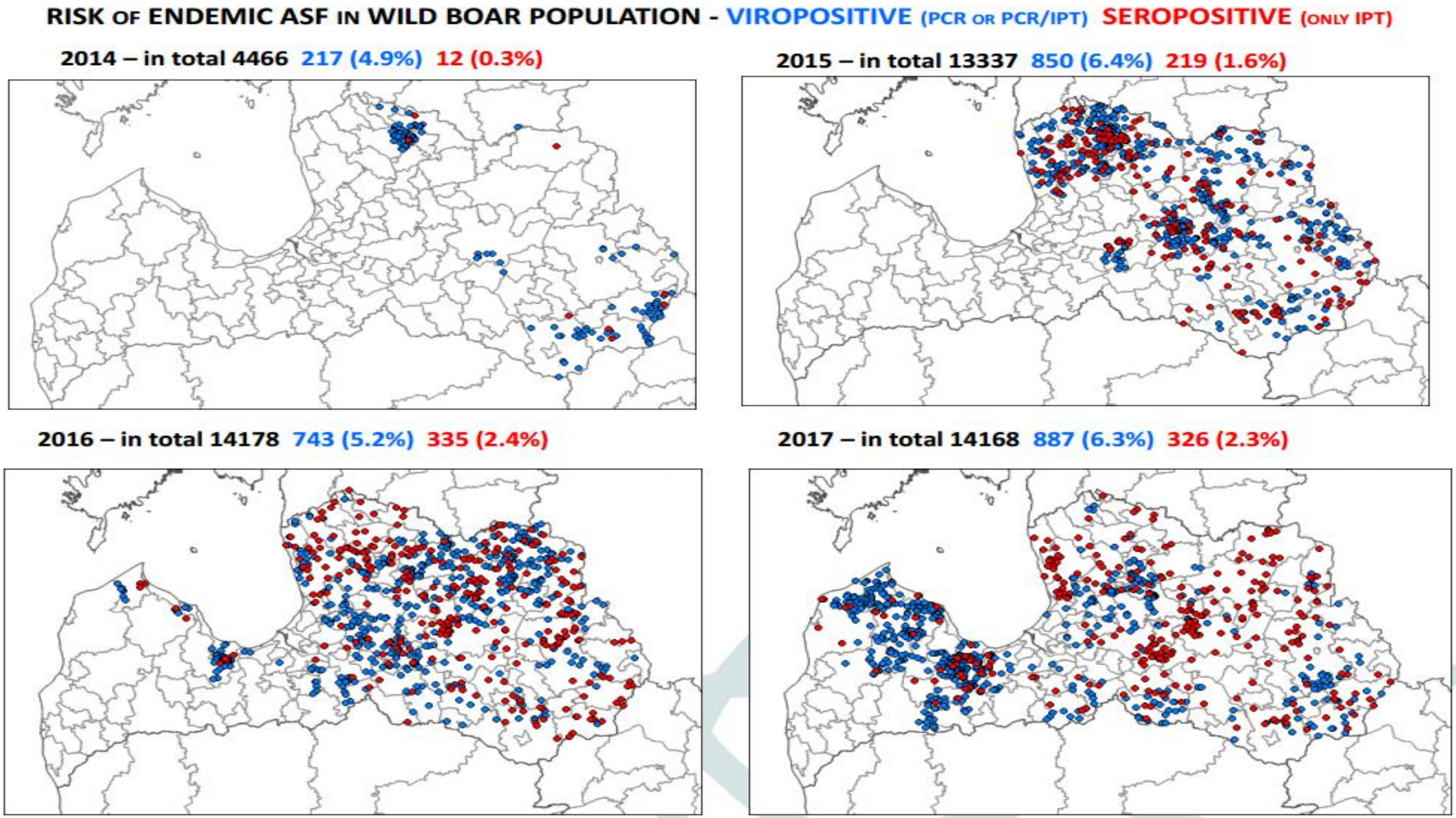
Preservation of the ASF virus

Material	duration	method	Reference
Blood on wooden plank under soil	81 days	Bioassay (i.m.)	Kovalenko, 1972
ASF-Blood on wooden plank on soil	192 days	Bioassay (i.m.)	
ASF-Blood on clay brick under soil	112 days	Bioassay (i.m.)	
ASF-Blood contaminated sand	81 days	Bioassay (i.m.)	
ASF-Blood contaminated soil	112 days	Bioassay (i.m.)	
ASF-Blood contaminated water 1:100	176 days	Bioassay (i.m.)	
ASF-Blood contaminated water 1:1000	<17 days	Bioassay (i.m.)	

FLI, 2018

But: No virus isolation possible from soil beneath positive carcasses and viral genome Load very low (PCR) *(Nurmoja andZani et al., 2018)*

ASF seroprevalence in Europe. For example….Latvia



EURL, 2018

Biosecurity on hunting

Hunting with dogs is an effective method of reducing population density

Photos: V. Guberti

Biosecurity on hunting

Hunting with dogs is an effective method of reducing population density….but!!

Photos: V. Guberti

Biosecurity during hunting/collection of samples

Photos: Thomas Patzelt; FLI

Biosecurity during hunting/ collection of samples

Photos: Thomas Patzelt; Alexey Igolkin

Biosecurity during hunting/ collection of samples

Photos: Thomas Patzelt; FLI

Biosecurity during collection of samples from carcasses

Photos: Thomas Patzelt; FLI

ASF in Wild boar population. First summary

- **The prevalence of the virus** in the infected wild boar population: **1-6.5%**
- **Seroprevalence** in the shot WB: **0.5-2.5%**
- **Incubation** period: 3-5 days
- **Mortality**: 90-95%
- **78% of WB**, found dead, are **the source of the virus**
- **50 km / year** is average **speed**, but the virus also continues to exist in previously infected areas
- **The virus spreads** in accordance with the **geographical extent of the wild boar population**

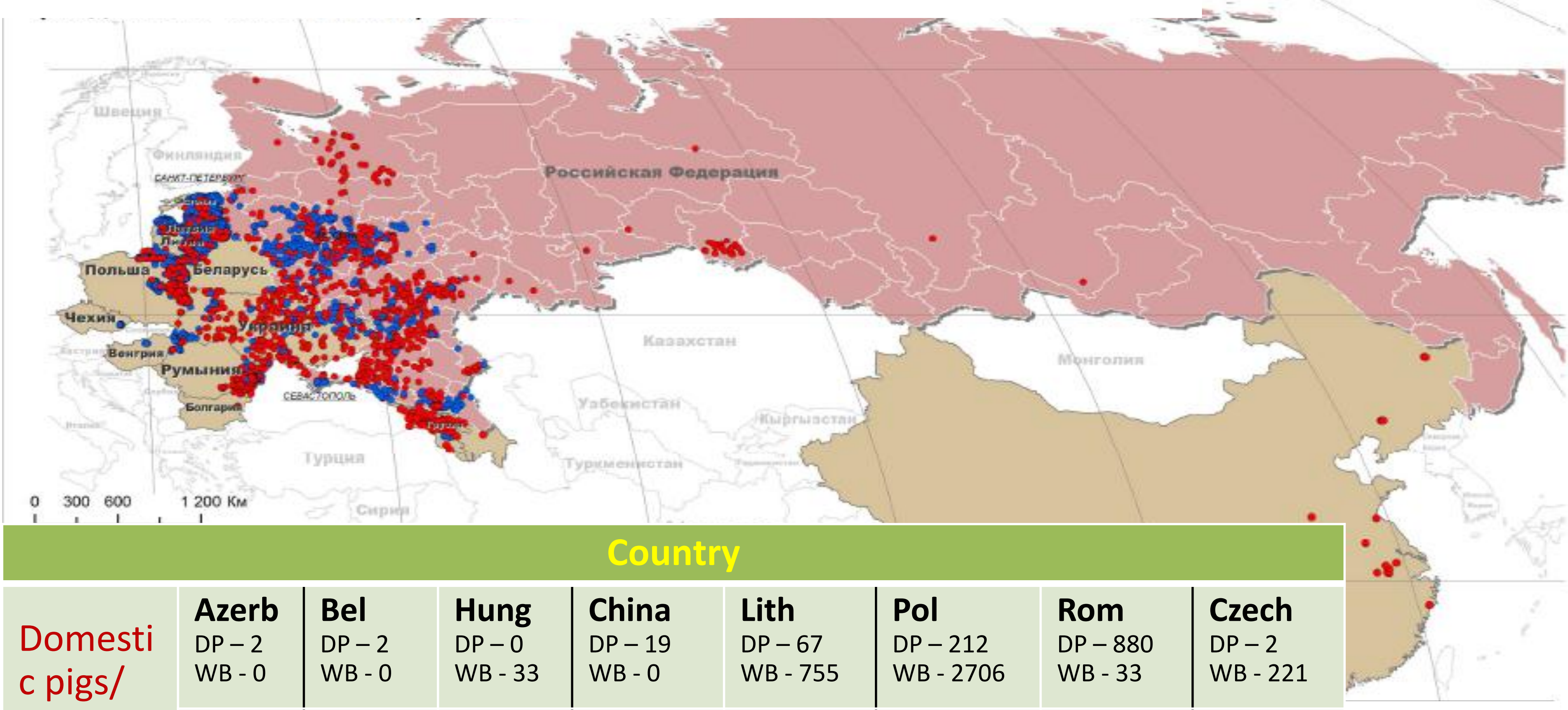
Transmission to domestic pigs

Epidemic situation of ASF,

OIE data 2007-2018

Карта составлена информационно-аналитическим центром Управления ветнадзора Россельхознадзора. Дата составления: 17.09.2018

срочных сообщений ветслужб субъектов РФ
каза МСХ РФ №189)



	Country							
Domestic pigs/ wild boar	**Azerb** DP – 2 WB - 0	**Bel** DP – 2 WB - 0	**Hung** DP – 0 WB - 33	**China** DP – 19 WB - 0	**Lith** DP – 67 WB - 755	**Pol** DP – 212 WB - 2706	**Rom** DP – 880 WB - 33	**Czech** DP – 2 WB - 221
	Arm DP – 25 WB – 3	**Bulg** DP – 1 WB - 0	**Georg** DP – 60 WB - 0	**Latvia** DP – 60 WB – 2613	**Mold** DP – 21 WB - 4	**Rus** DP – 830 WB – 544	**Ukr** DP – 325 WB - 89	**Est** DP – 18 WB - 1034

Transmission to domestic pigs

What do we need to know?

- **Direct contact** (infected wild boar to susceptible domestic pig)
- **Indirect contact**

– Infected wild boar products (uncooked meat), feeding uncooked swill (hunting?)

– Contaminated fomites (?): surfaces of vehicles, equipment or animal worker clothing-> unknown impact

– Biosecurity (hunter/ farm)

– Contaminated bedding material, fresh grass, seeds *(EC 2014a)*

– Specific feed

– Blood sucking arthropods?

- **Social attitudes and economic considerations** *(Vergne et al., 2016)*

– lack of disease awareness

– moving pigs…. (**including illegal**)

Direct contact

- Susceptible pigs housed in direct contact with infected wild boar became infected after 6-12 days *(Gabriel et al., 2011; Pietschmann et al., 2015*
- Even when susceptible pigs were separated from the infectious wild boars in an adjacent pen without direct, the transmission occurred after 21 days.

Preservation of the ASF virus in meat products

Material	duration	method	Reference
Pork products	16 days (22 -27 °C)	Virus isolation (low titre)	Kolbasov et al., 2011.
	84 days (4-6°C)	Virus isolation (low titre)	Kolbasov et al., 2011.
	118 days (-18 to -20 °C)	Virus isolation (low titre)	Kolbasov et al., 2011.
Heated ham	<5 days	Virus isolation negative (5 d)	Mc Kercher 1978
Salami/ pepero ni sausage	<30 days	Virus isolation negative (30 d)	Mc Kercher 1978
Iberian Ham	112 days	Virus isolation	Mebuset et al. 1993
Serrano ham	140 days	Virus isolation	Mebuset et al. 1997

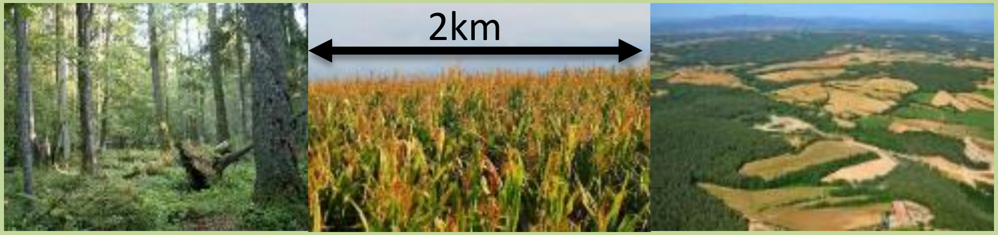
EASTERN EUROPE SCENARIO (RF)

NOTIFICATIONS

30% WB

70% DP

LANDSCAPE SCENARIO FOR ASF OCCURRENCE (Bosch et al., 2016):



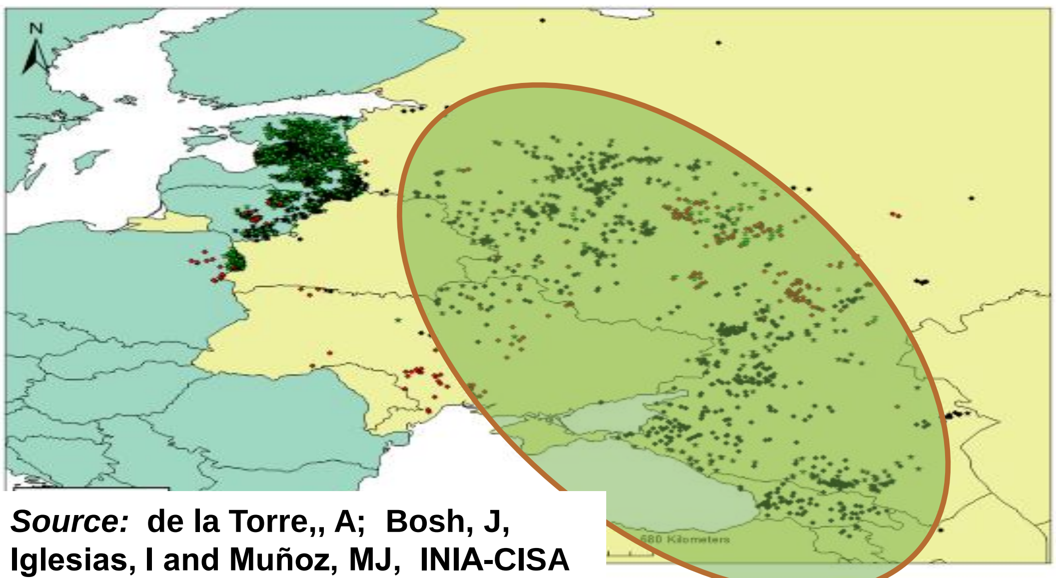
NATURAL AREAS	AGRICULTURAL AREAS	
	MONOCULTIVES	AGROFORESTRY MOSAIC
30%	21%	40%
1DP:2WB	4DP:1WB	3DP:1WP

HOSTS:

- DOMESTIC PIG = major role in local and long ASF transmission (Vergne et al., 2015)
- WILD BOAR = secondary role but actively involved in ASF introduction and local spreading and able to transmit the disease in absence of domestic pigs (Iglesias et al., 2015)

RISK FACTORS:

- production systems (no fencing, swill feeding of infected pork…)
- ASF spills easily from systems to wild boar through carcasses into the environment.

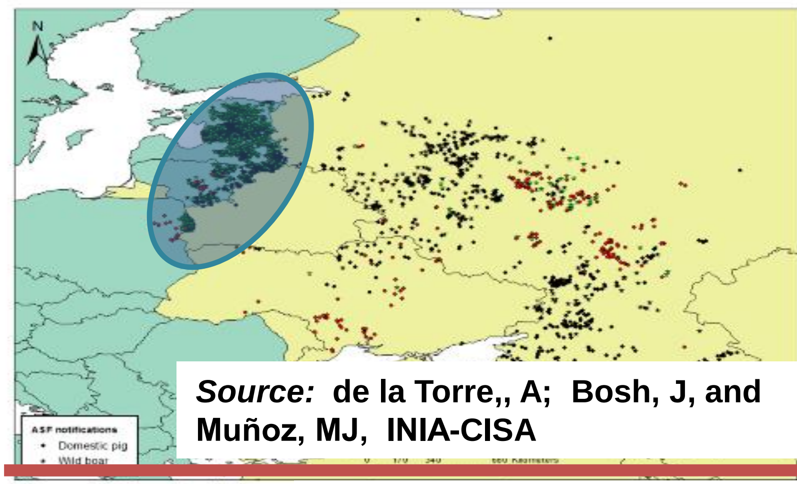


Source: **de la Torre,, A; Bosh, J, Iglesias, I and Muñoz, MJ, INIA-CISA**

EUROPEAN UNION SCENARIO

LANSCAPE SCENARIO FOR ASF OCCURRENCE (Bosch et al., 2016):

NATURAL AREAS	AGRICULTURAL AREAS	
	MONOCULTIVES	AGROFORESTRY MOSAIC
73%	9%	12%
25WB:1DP	7WB:1DP	12WB:1DP



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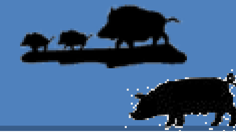
% NOTIFICATIONS



95% WB

5% DP

HOSTS:

- WILD BOAR= plays a major role in multiple disease introduction and local transmission

RISK FACTORS:

- ASF Introductions by WB movements
- WB: WB transmission probably by several routes (direct contact, environmental contamination, contaminated feed).
- WB management: feeding habits, depopulation/hunting
- DP: Breaches in biosecurity in DP farms (indirect/direct contact with infected WB; swill feeding; illegal trade)

ASF OCCURRENCE (Bosch et al., 2016):

- NATURAL AREAS: 70% (20WB:1DP
- AGRICULTURAL AREAS: around 30% of notifications (10WB:1DP))

Thank you for attention !

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