Better Training for Safer Food

Initiative

AFRICAN SWINE FEVER

BTSF

Belgrade, Serbia 6-8/11/2018

Food safety

The problem of having ASF in wild boar

- According to the EU legislation the size of the infected wild boar population area will be at least 200 sqkm
- The wild boar infected area will enforced for at least 24 months
- In the area the domestic pig population is under restriction (stand still, biosecurity, surveillance etc.) and goes immediately out of the market

Virus prevalence in infected wild boar population: **1-4,5%**

Sero-prevalence in hunted WB: **0,5-2%**

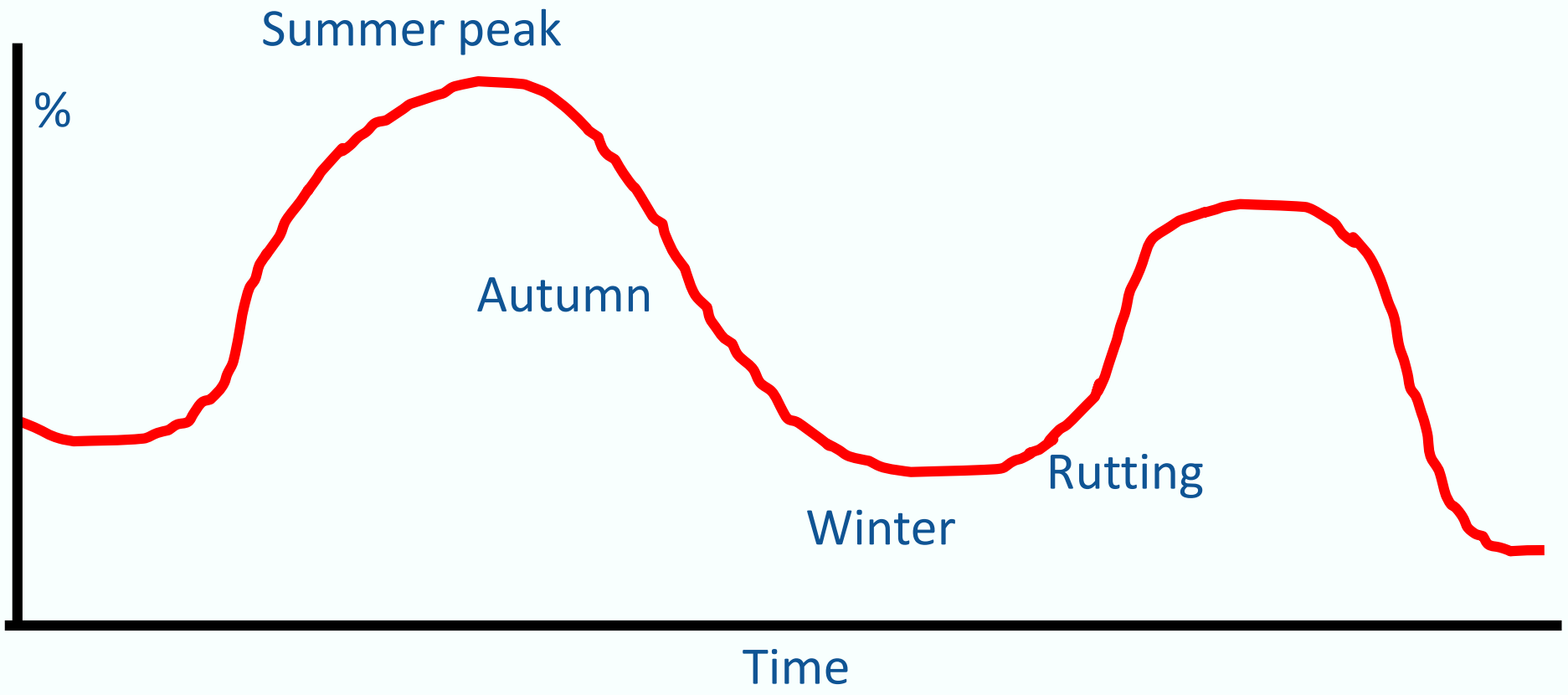
Incubation **3-5 days**

Lethality **90-95%**

70-80% found dead wild boar are virus

≈ 50 km/year is the average speed, but the virus lasts also in old infected areas

The virus **spreads** through the **geographical continuity of the wild boar population** RATHER THAN of wild boar migration



Higher prevalence in summer: new born animals, insectes?
Lower prevalence in winter: virus survives in carcasses
Increasing prevalence: rutting period ?

ROLE OF INSECTS AND CARACASSES NO TICKS

Maggots could increase contacts between wild boar and infected carcasses but they have been never positive to the virus (only DNA presence but no virus): enhanced summer transmission

Scavenging insects: long attraction for wild boar, increased probability of direct contact with infected carcasses

Carcasses: virus maintenance in the environment; direct transmission to the susceptible animals

Role of insects and caracasses no ticks

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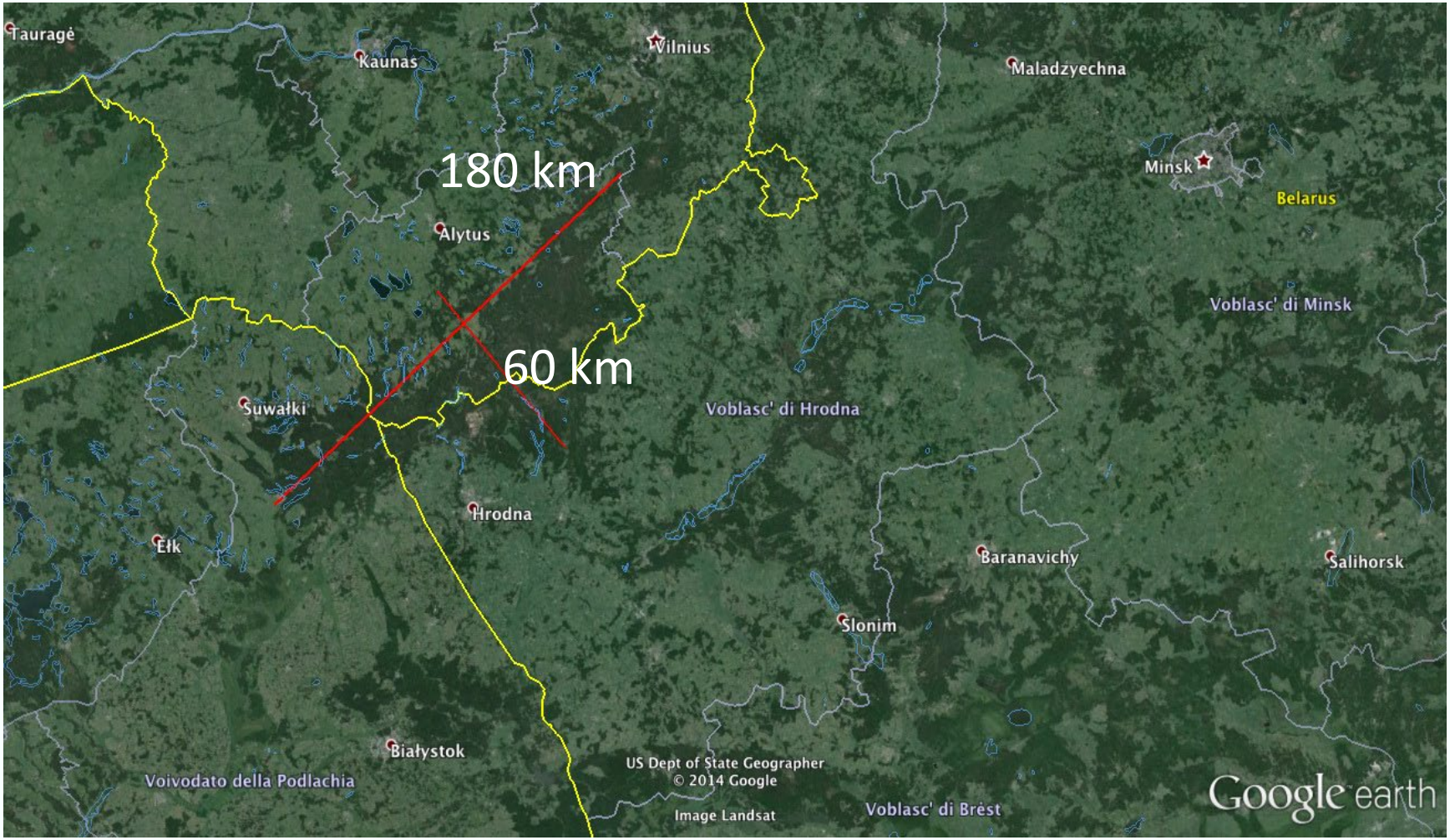
- **Carcasses**: virus maintenance in the environment; direct transmission to the susceptible animals

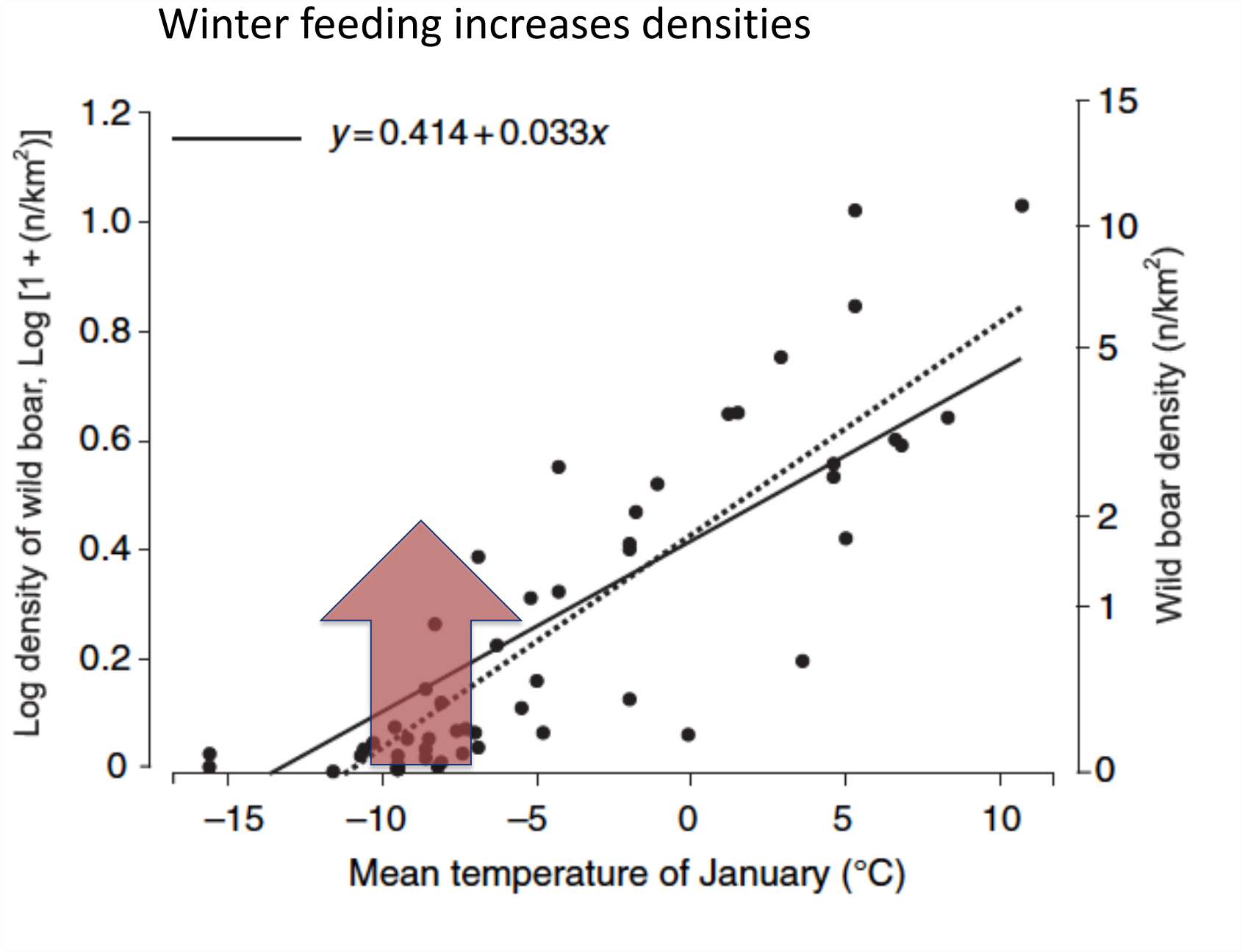
Risk of spread after introduction of the virus

- Delayed diagnosis
- Wild boar population size and density
- Forest connectivity
- Inappropriate hunting methodologies
- Lack of biosecurity measures applied during hunting
- Infected wild boar carcasses available for healthy wild boars
- Poaching

Geographical continuity



Winter feeding increases densities

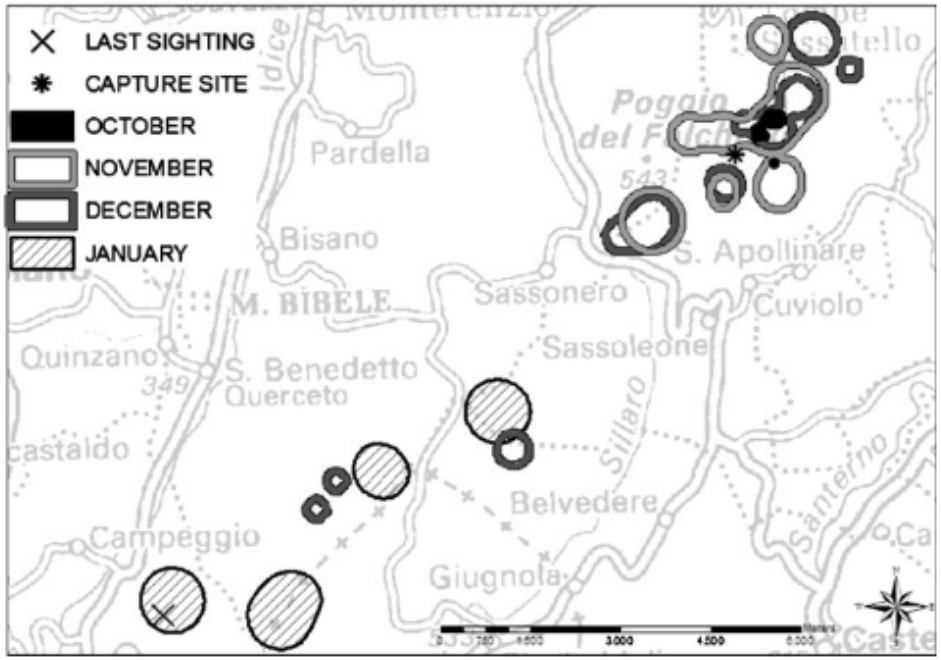


Hunting and wild boar movement

- Drive hunting with dogs: increase of range size during the hunting season

Season	100% MCP				95% kernel				50% kernel			
	Median	Q_3–Q_1	Mean	SE	Median	Q_3–Q_1	Mean	SE	Median	Q_3–Q_1	Mean	SE
Pre-hunting	80	104	88	25	66	156	98	39	4	14	10	3
Hunting	428	1360	825	358	221	696	457	192	23	68	45	16
Post-hunting	195	544	358	151	189	488	284	99	20	88	45	20

Home range displacements during the hunting season (up to 15 km)



Eur J Wildl Res (2010) 56:307–318
DOI 10.1007/s10344-009-0314-z

ORIGINAL PAPER

Do intensive drive hunts affect wild boar (*Sus scrofa*) spatial behaviour in Italy? Some evidences and management implications

Laura Scillitani · Andrea Monaco · Silvano Toso

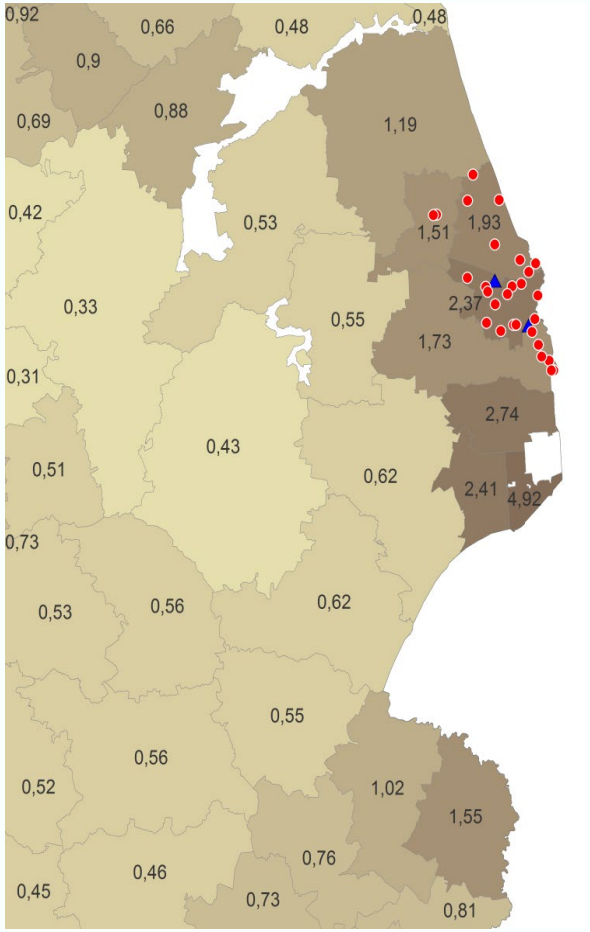
Driven hunt with dogs – effective method to reduce the population density

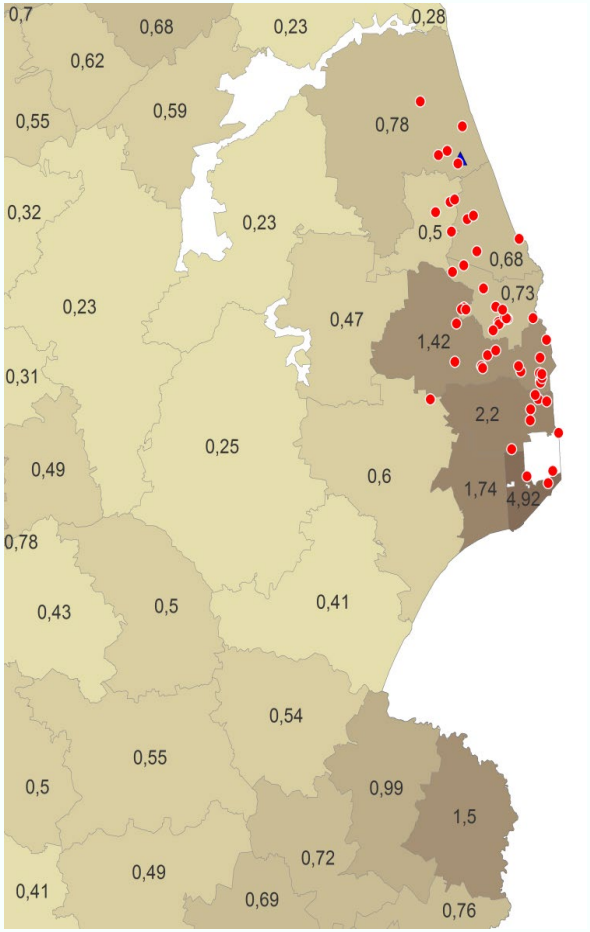
Density dependent spread

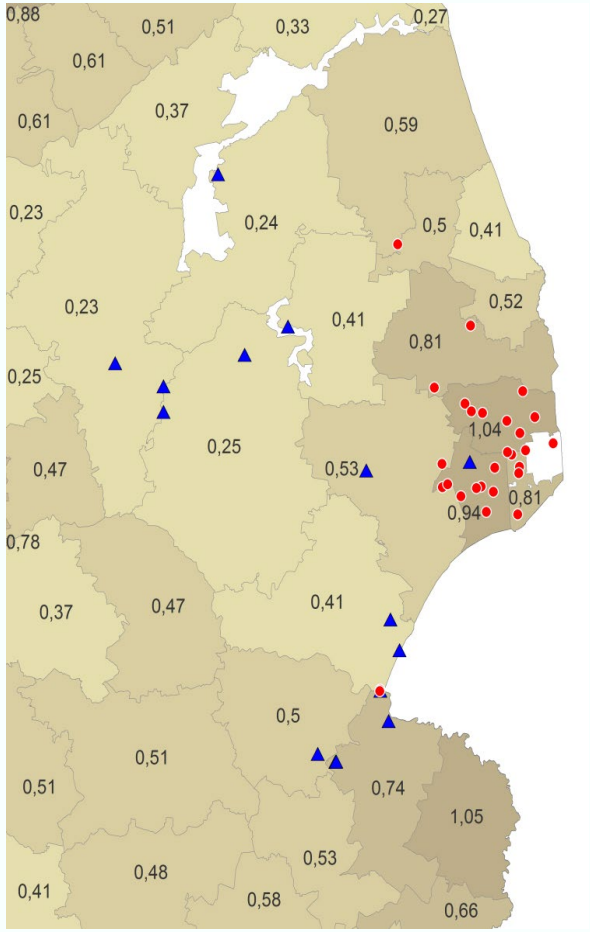
- The number of NEW INFECTED wild boar is proportional to the wild boar population size

- The duration of the epidemic is proportional to the wild boar population size

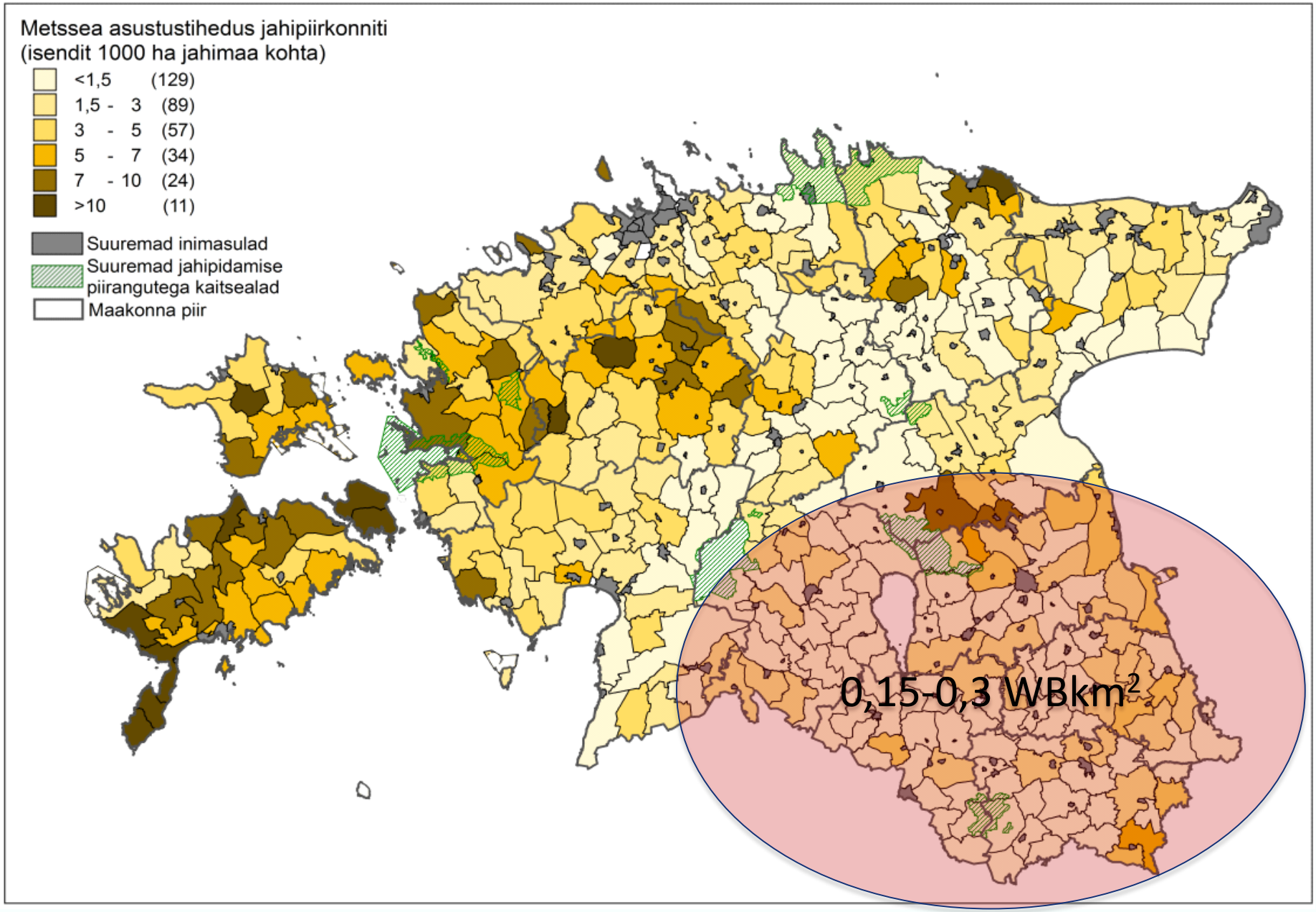
Poland: tendency to spread within areas with wild boar density > 1 individual/km^2







2014 – 30 cases **2015 – 53 cases** **2016 – 28 cases**



Density of wild boars (individuals per 10 km^2 of hunting ground) in hunting districts by hunters estimations (census) in spring 2016.

ASF in wild boar

A density dependent transmission during summer-autumn (new born and adult animals)….insects?

Virus survival during winter with few (or many) infected carcasses according to the local ecological situation

A mixed transmission: density dependent and frequency dependent => NO THRESHOLD

ASF in wild boar

The question is:

Which is the wild boar density that prevent the contact between a susceptible wild boar with an infected carcass?

An ASF virus will overwinter in a infected carcass……3-4 months…and the virus will appear again during the late spring in alive susceptible individuals

EU STRATEGY

(SEE EFSA, 2015)

- Reduce the wild boar population size through targeted hunting of adult females
- Detection of – at least - 50% infected carcasses and their safe disposal
- Ban of winter/sustaining artificial feeding

Strategy applied - for at least - 100 km in front of the detected case

It is a medium term strategy that accepts the presence of the virus for a certain number of years

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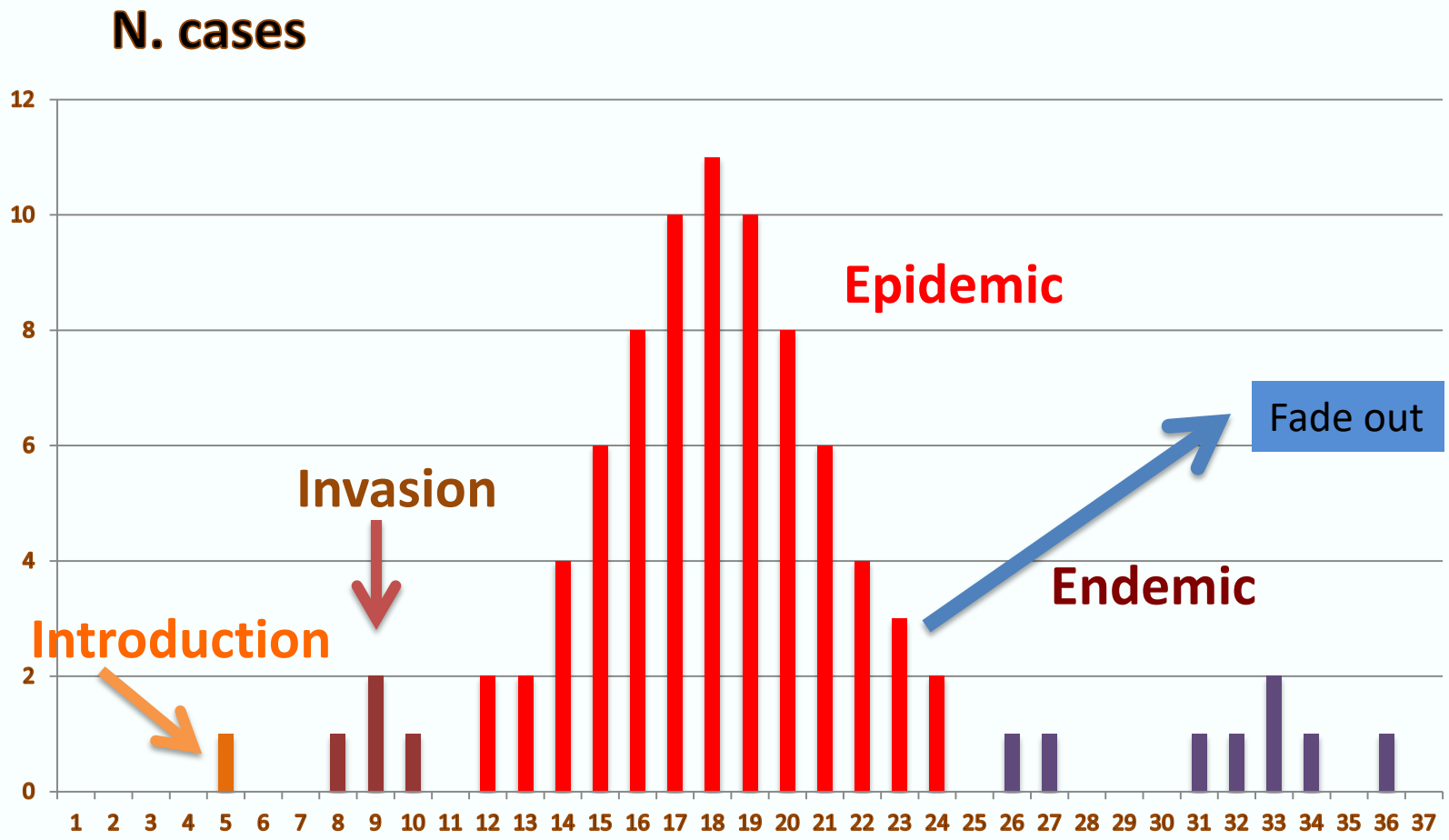
The 4 phases of a transmissible disease



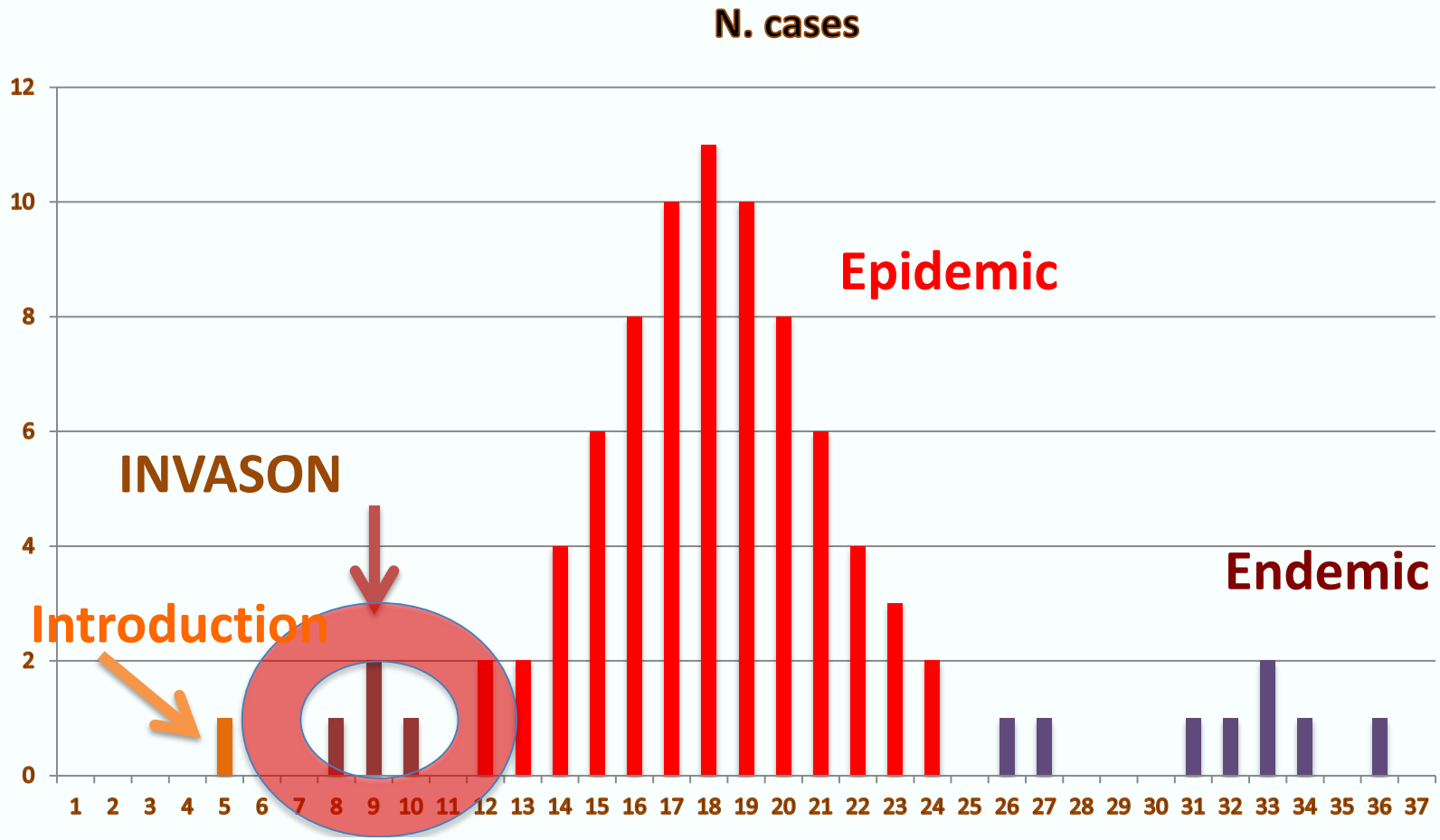
Introduction phase

- An infectious animal (sandwich, infected blood etc.) arrives in a free area;
- Difficult to be prevented;
- Fence the border?
- Hunt every wild boar crossing the border?
- What else?
- FEASEABILITY? SUSTAINABILITY?

REALITY: the virus arrives

Saint Severino, protector of borders (410-482)

INVASION


N. cases
12
10
8
6
4
2
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Epidemic
INVASON
Endemic
Introduction

The invasion phase initiates when

- A minimum number of susceptible wild boar is available for the virus
- This specific minimum number is defined as: Host **threshold** density for infection invasion (Nt);
- The infection of this minimum number of susceptible – available - hosts is the starting point of any epidemic

What about this Threshold?

- Nt exists when the infection spreads in a density dependent pattern;
- Nt is a deterministic threshold (a precise N. of individuals…that could be espressed also by density i.e. 0,5/1000ha);
- It is simply the number of WB, no gender and age classes have to be considered/known;
- Nt addresses preventive measures aimed in reducing the wild boar population size **BEFORE** the arrival of the infection; **FREE AREAS**

Is it possible to prevent the invasion phase?

In **free areas** it is COULD be possible to prevent the invasion phase (and thus avoiding the epidemic) managing the wild boar below the THRESHOLD DENSITY (Nt)

EFSA, 2017 through a stochastic model

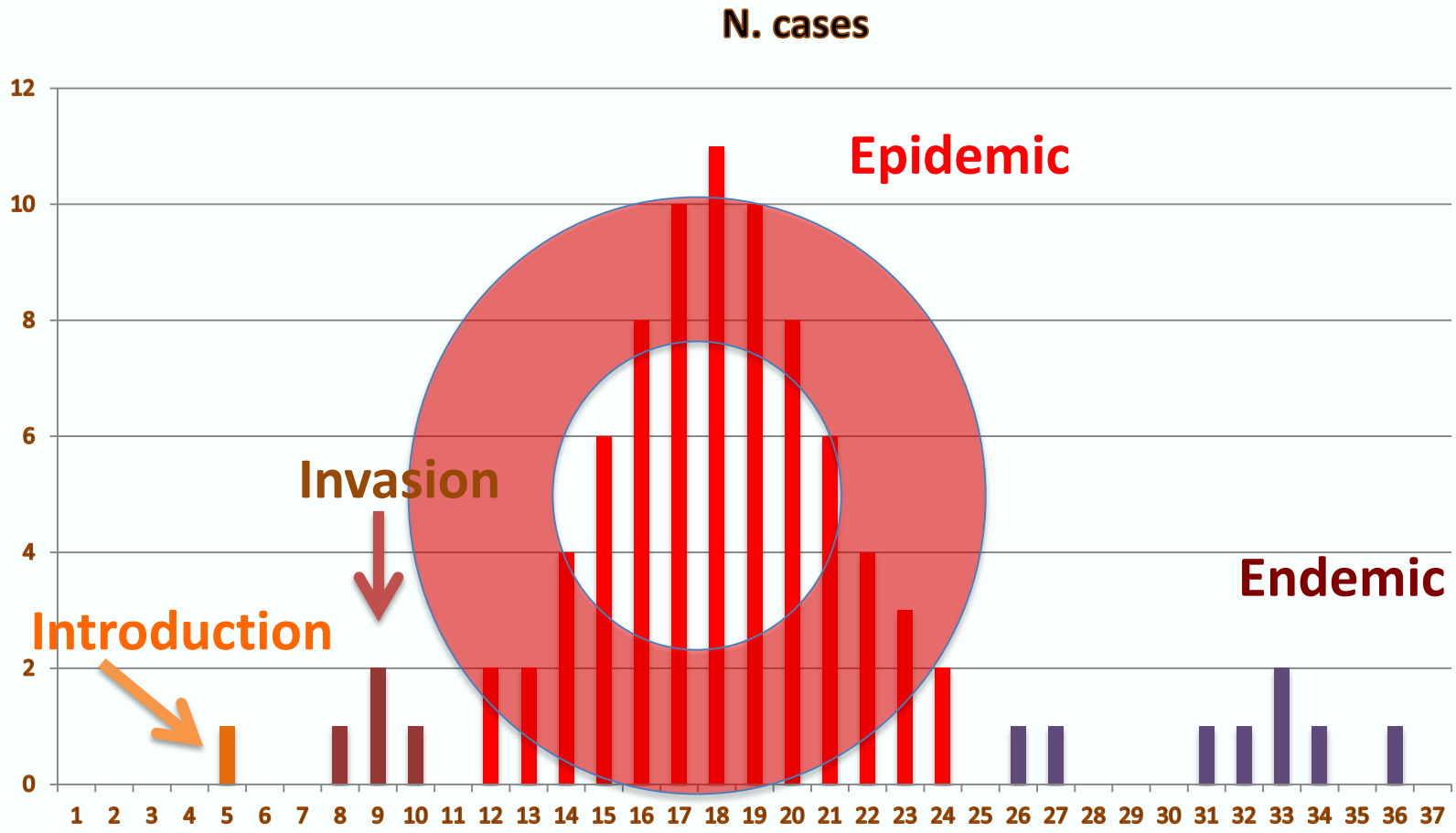
Nt and percentages

- The most widespread mistake is to set a “average” percentage of animals that has to be eliminated;
- 70% (rabies derived) is considered a magic number;
- 70% of 10WB/Kmsq = **3** left in the forest
- 70% of 4WB/kmsq = **1** left
- 70% of wild boar estimated in March = **35%** in winter (usual hunting bag!!!)

Can we prevent ASF managing the wild boar population at the threshold?

- Deterministic (exact) Nt estimation;
- Alternative approach: EFSA (stochastic)
- Precise host population size estimates:
- Zlin=> initial estimate 2WB/kmsq Final estimate 9WB/kmsq
- Feasibility
- BY NOW ALL ACTIONS IMPLEMENTED WHEN THE VIRUS ARRIVES: NO PREVENTION….BUT …REACTION

Epidemic


N. cases
12
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Epidemic
Invasion
Introduction
Endemic

The epidemic phase

- The infection spreads in the wild boar population: the chain of infection is fully activated;
- The intensity and the duration of the epidemic results from the interaction between the two populations (host and infection agent) driven by wild boar population size and density;

Epidemic phase: considerations

- Wildlife diseases are detected during the epidemic phase and rarely (if ever) during the invasion phase; **1 detected positive = 3-6 in the forest**
- Countries ask for a threshold to be reached during the epidemic:
- BUT during the epidemic TECHNICALLY THERE IS NOT A THRESHOLD

Is the epidemic phase manageable?

NO!!!

- The infection rate is always higher than any hunting rate
- Hunting will favour an artificial endemic evolution of the infection with **VIRUS PREVALENCE HIGHER THAN NATURAL**
- Hunting will increase the probability to geographically spread the disease (100 year of wildlife diseases management) field studies, ;

EPIDEMIC PAHSE

- Do nothing
- PASSIVE surveillance
- Do not get tired of surveillance;
- Be accurate when collecting data;
- Be patient and wait the end of the epidemic revealed by surveillance;

Probability to eradicate

$p=(1/R_0)^{N.infectious}$

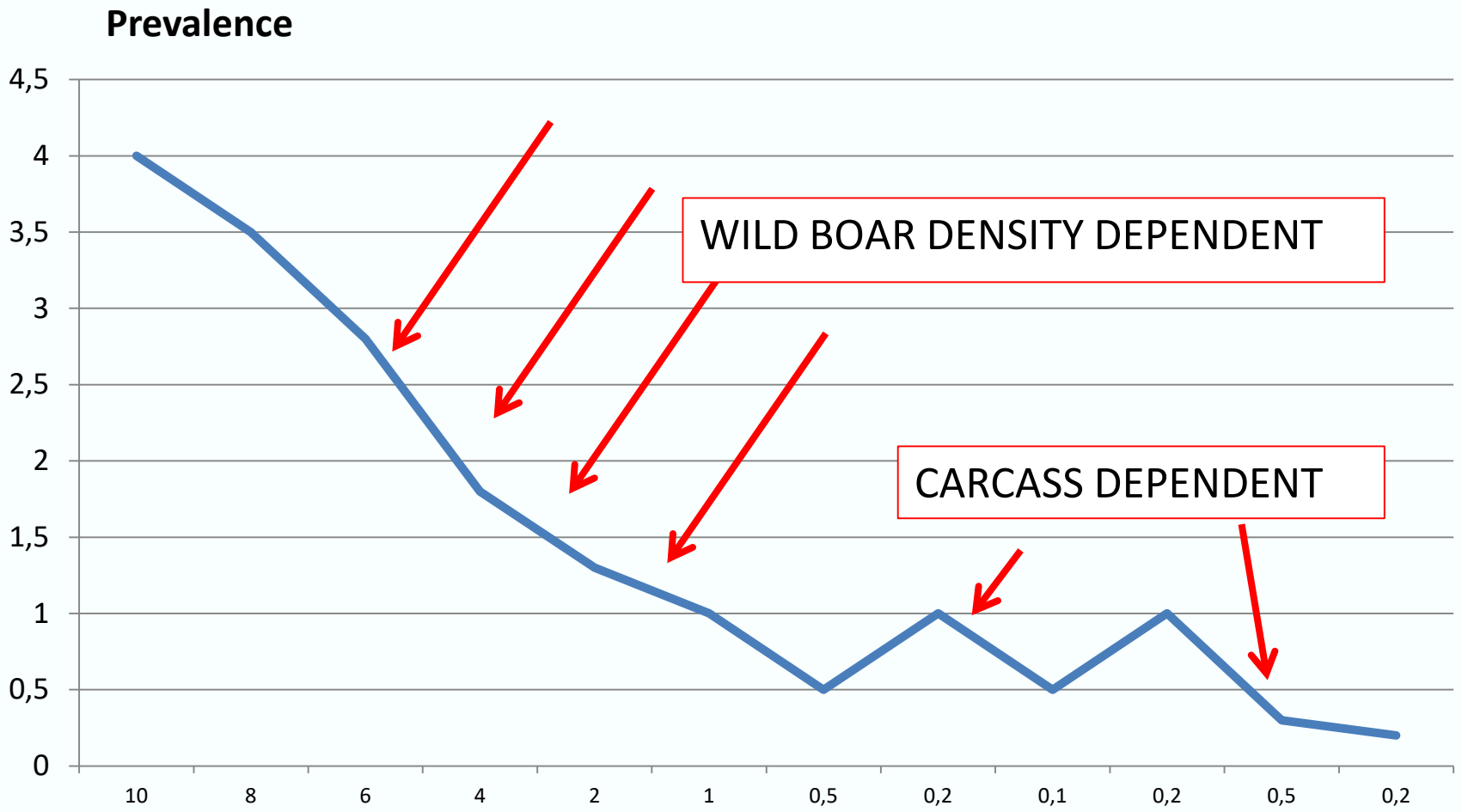
Zlin, R_0 ~1,5

$p =(1/1,5)^1 =$ **67%** (**1** infected wild boar)

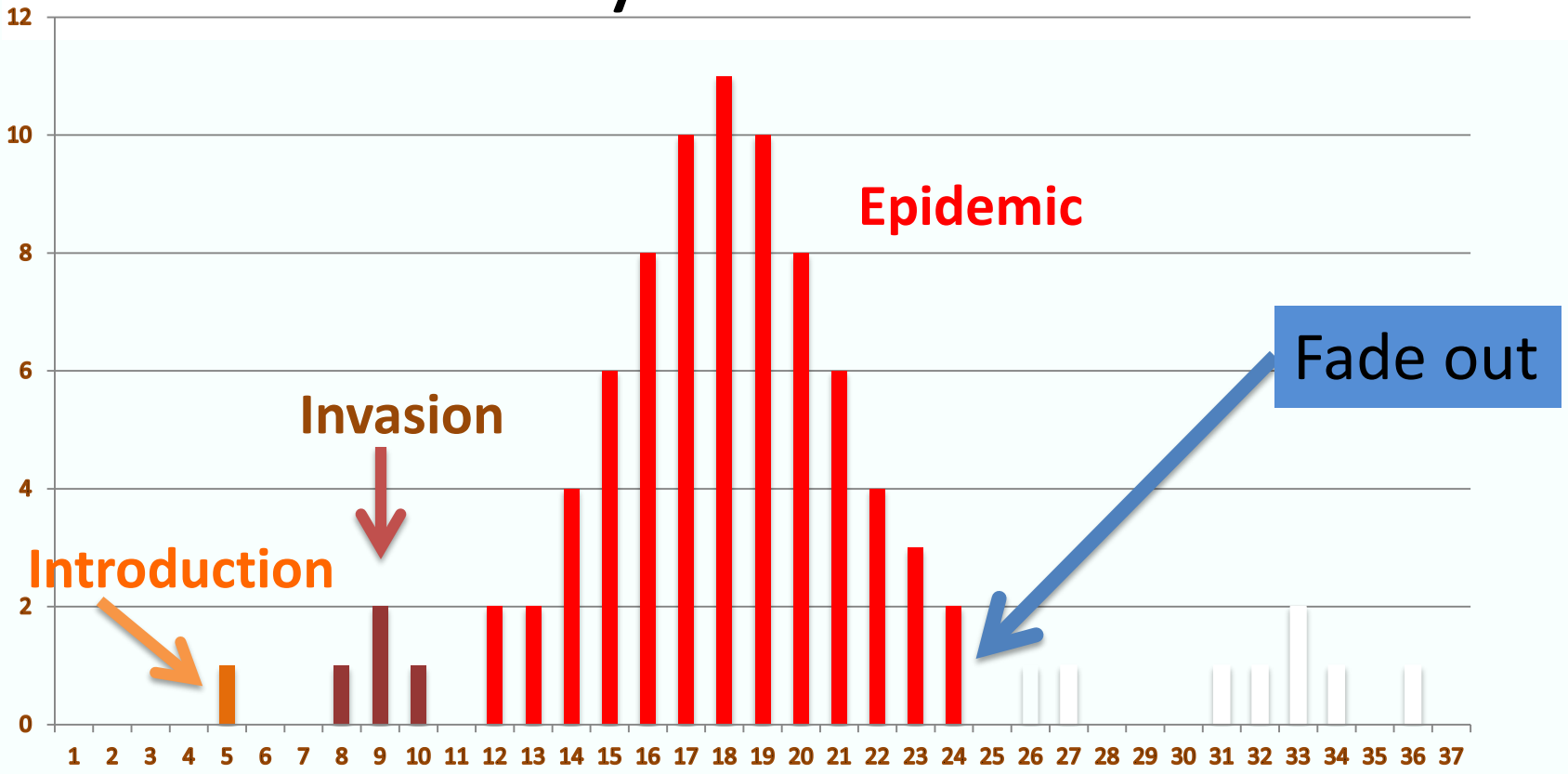
$p =(1/1,5)^5 = 13\%$

$p =(1/1,5)^{10} =$ **2%** (**10** inf. wild boars)

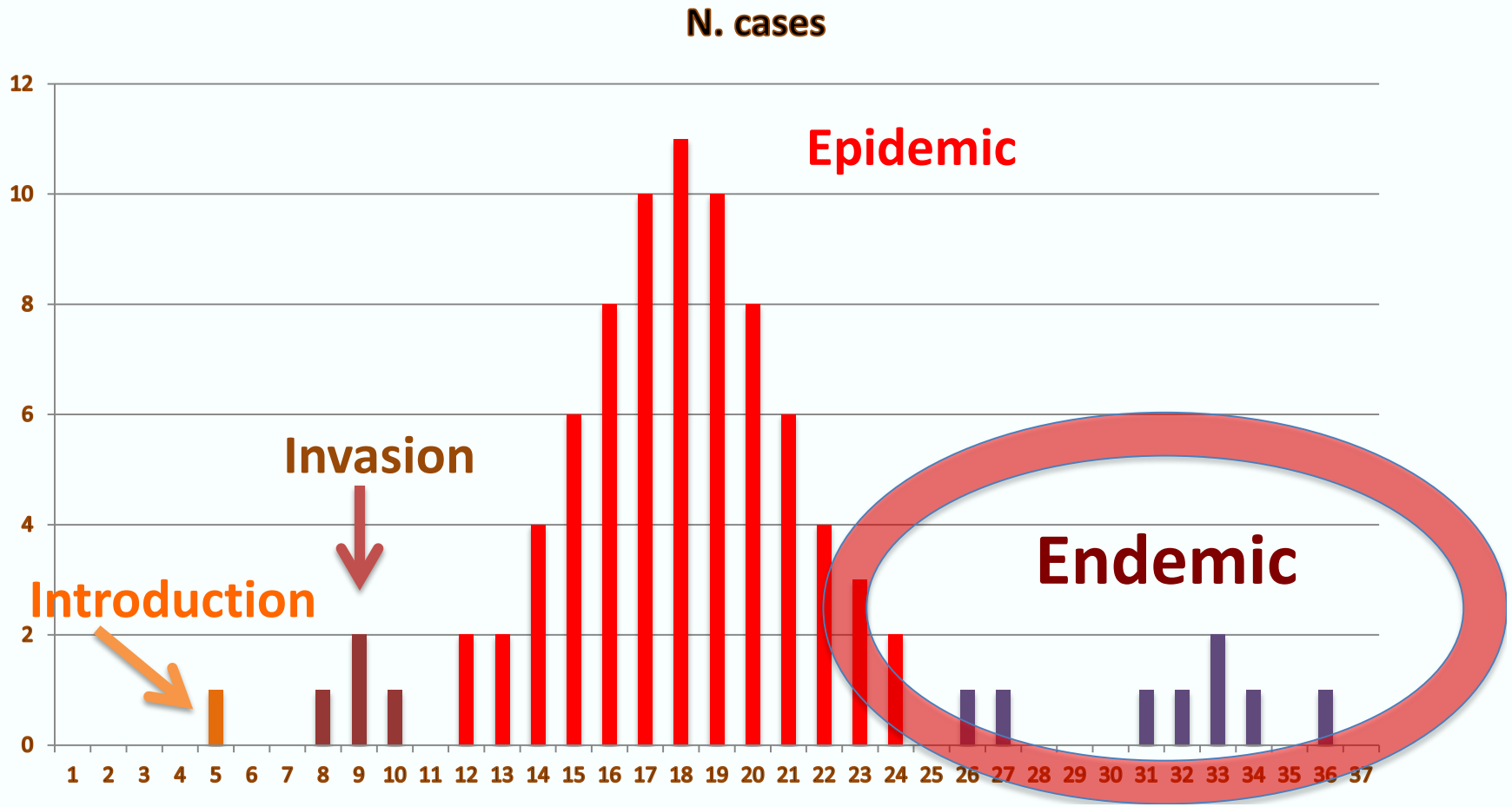
ASF in not a simple density dependent infection.
The ultimate persistence of the virus is guaranteed by carcasses
The virus itself kills most of the animals



Rarely the infection fades out spontaneously
a lucky but rare event



Epidemic evolved endemic



Why an epidemic evolves endemic?

A WILD BOAR CRITICAL COMMUNITY SIZE (CCS) is still present;

- It is the minimum size of a population with its specific demographic parameters that allows virus persistence;
- IT IS NOT a NUMBER of individuals…is a SUB-POPULATION

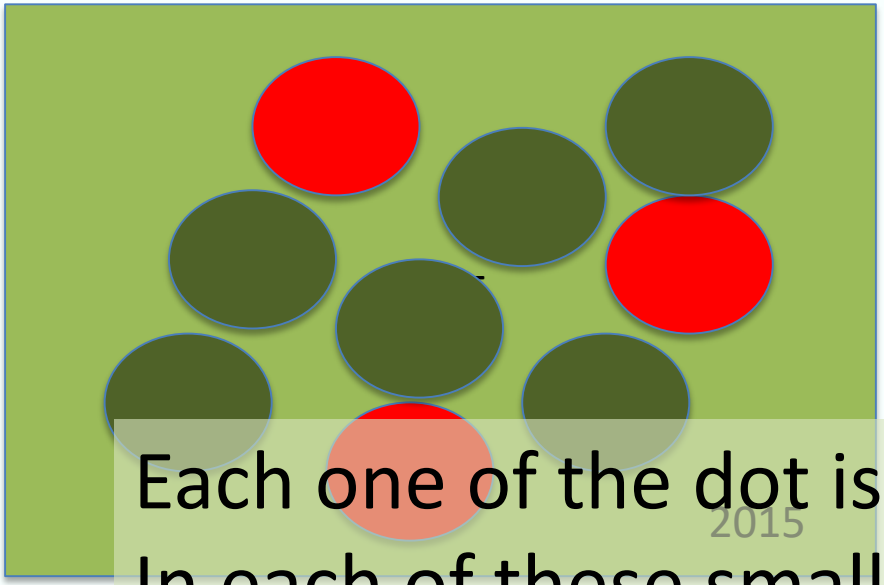
CCS: depends on:

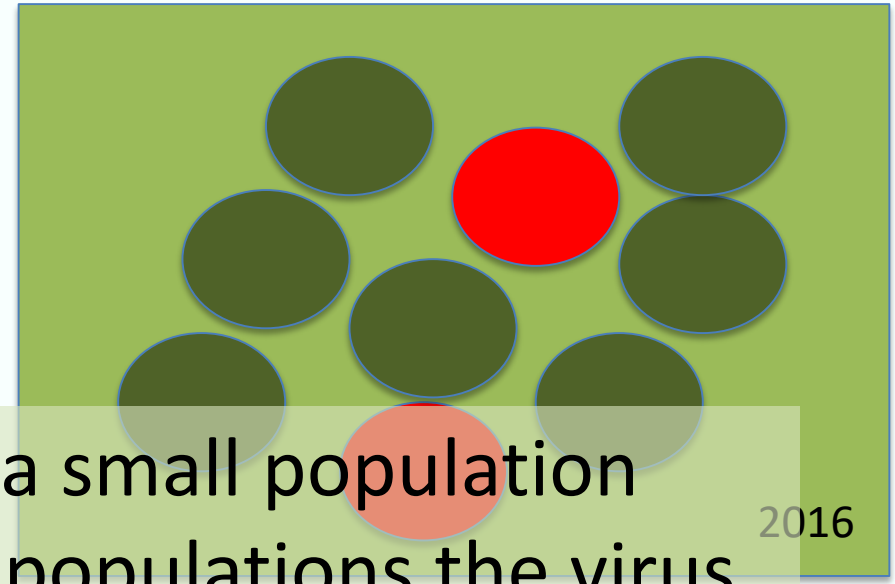
- **Virus** transmissibility, lethality and recovery
- **Host** population density, fertility, turn over, age and gender classes, management (including feeding, hunting quotas and seasons etc. etc.)

Mathematically the CCS is the population size at which the infection has **50% probability** to fade out spontaneously;

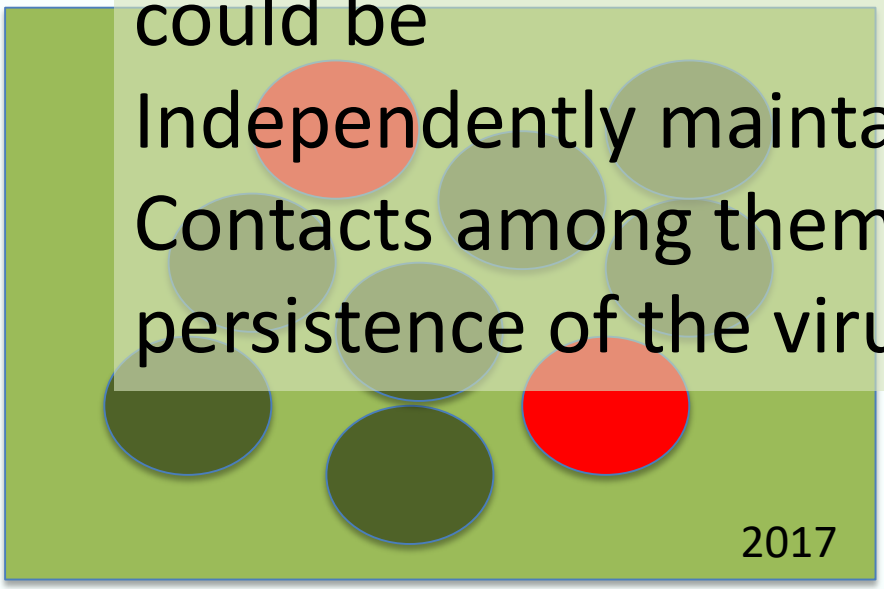
Critical community size

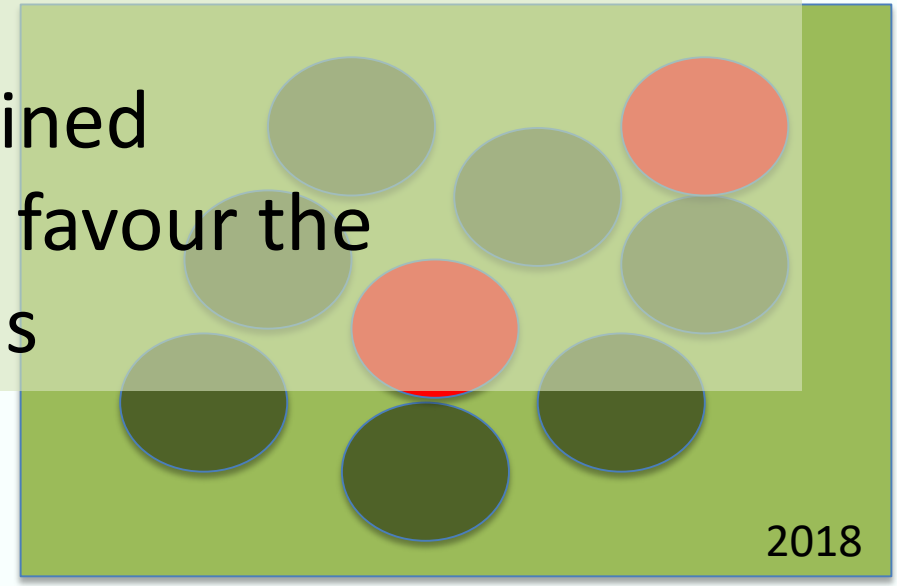
- It cannot be calculated but estimated through simulations that consider all the necessary parameter values (when available);
- It is a probabilistic estimate with some mathematical instability;
- Can work in one area and not in the neighbouring one;
- 100% eradication probabilities coincides with host eradication;



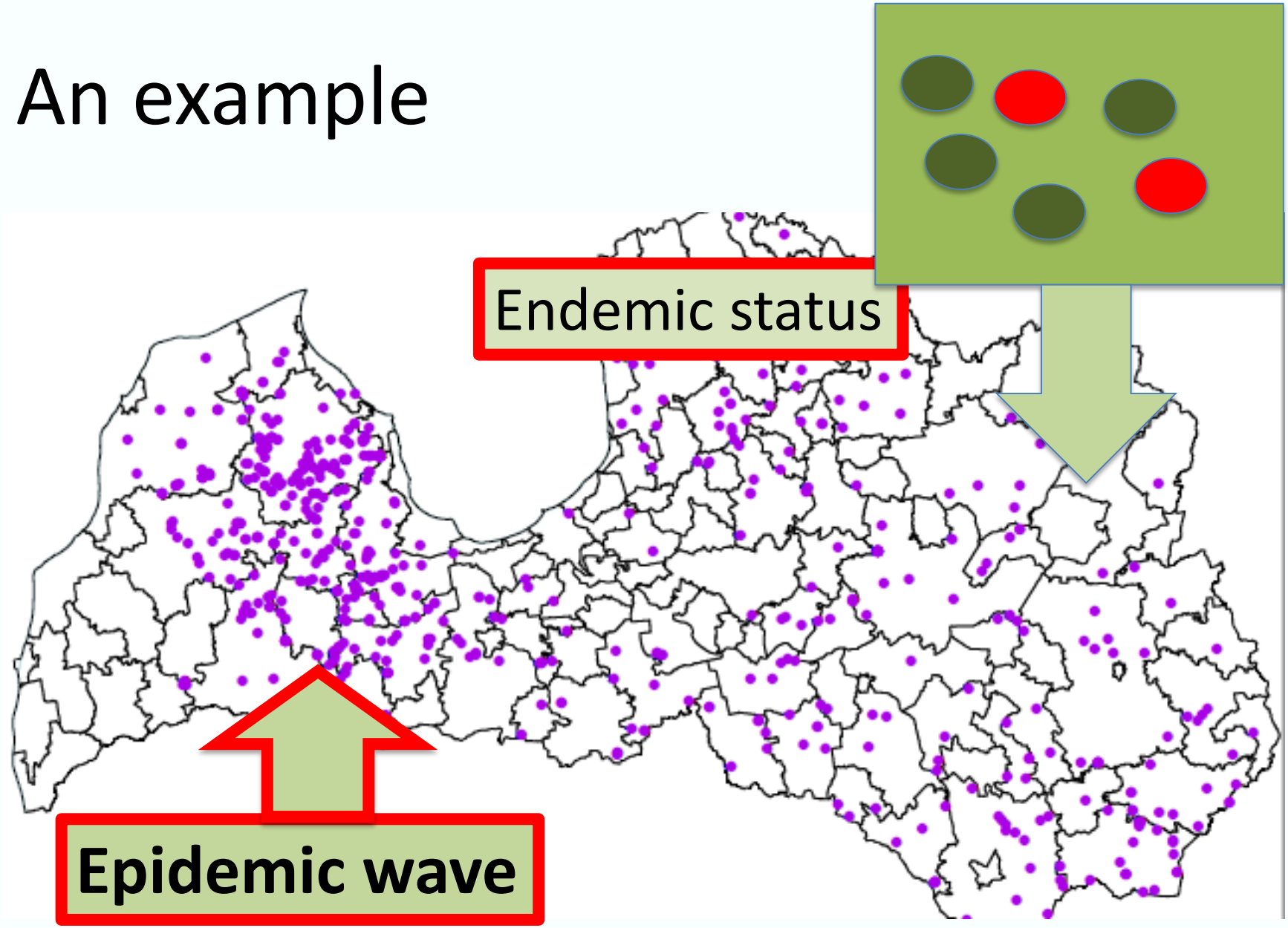


Each one of the dot is a small population
In each of these small populations the virus could be
Independently maintained
Contacts among them favour the persistence of the virus





An example

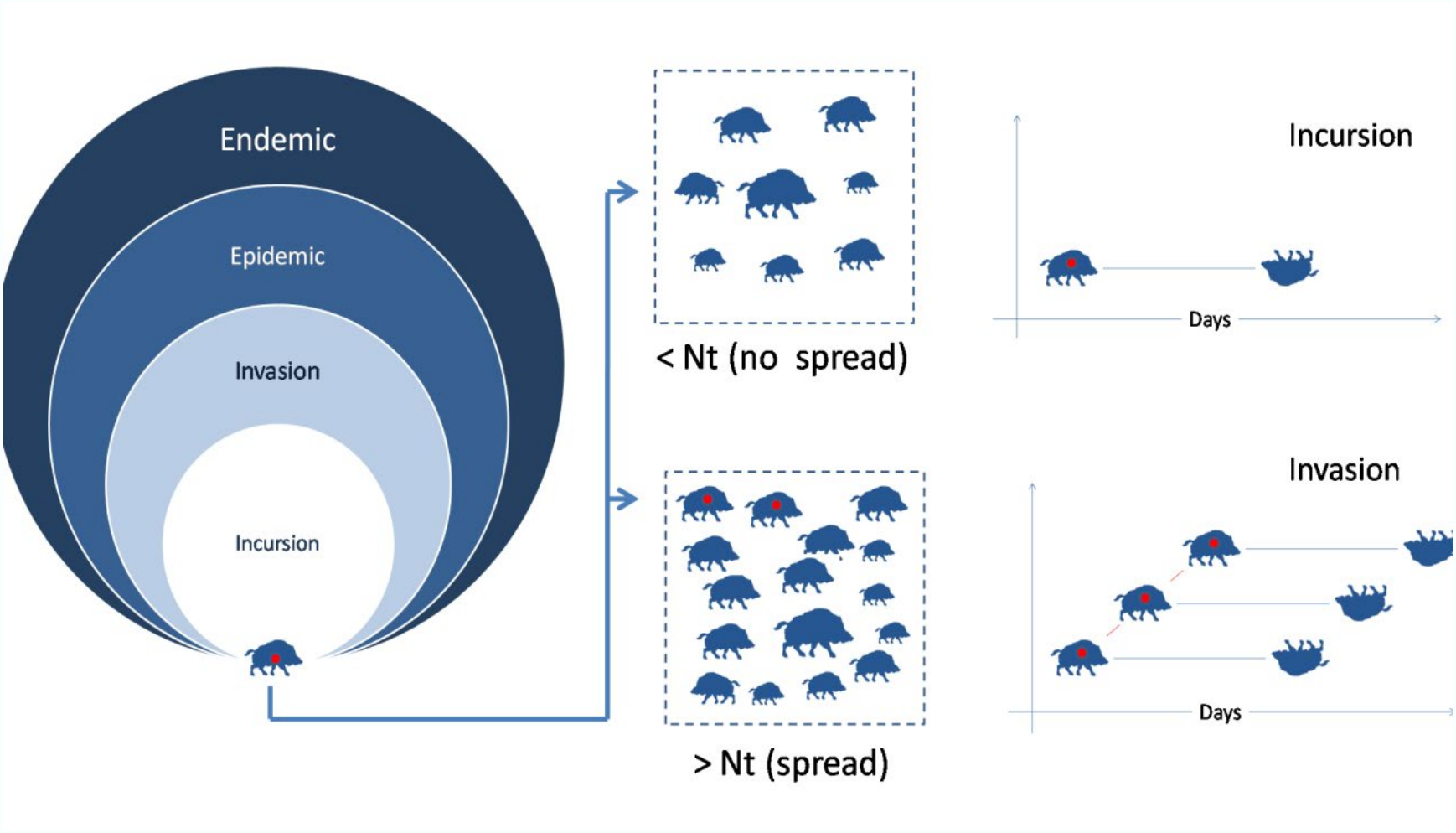


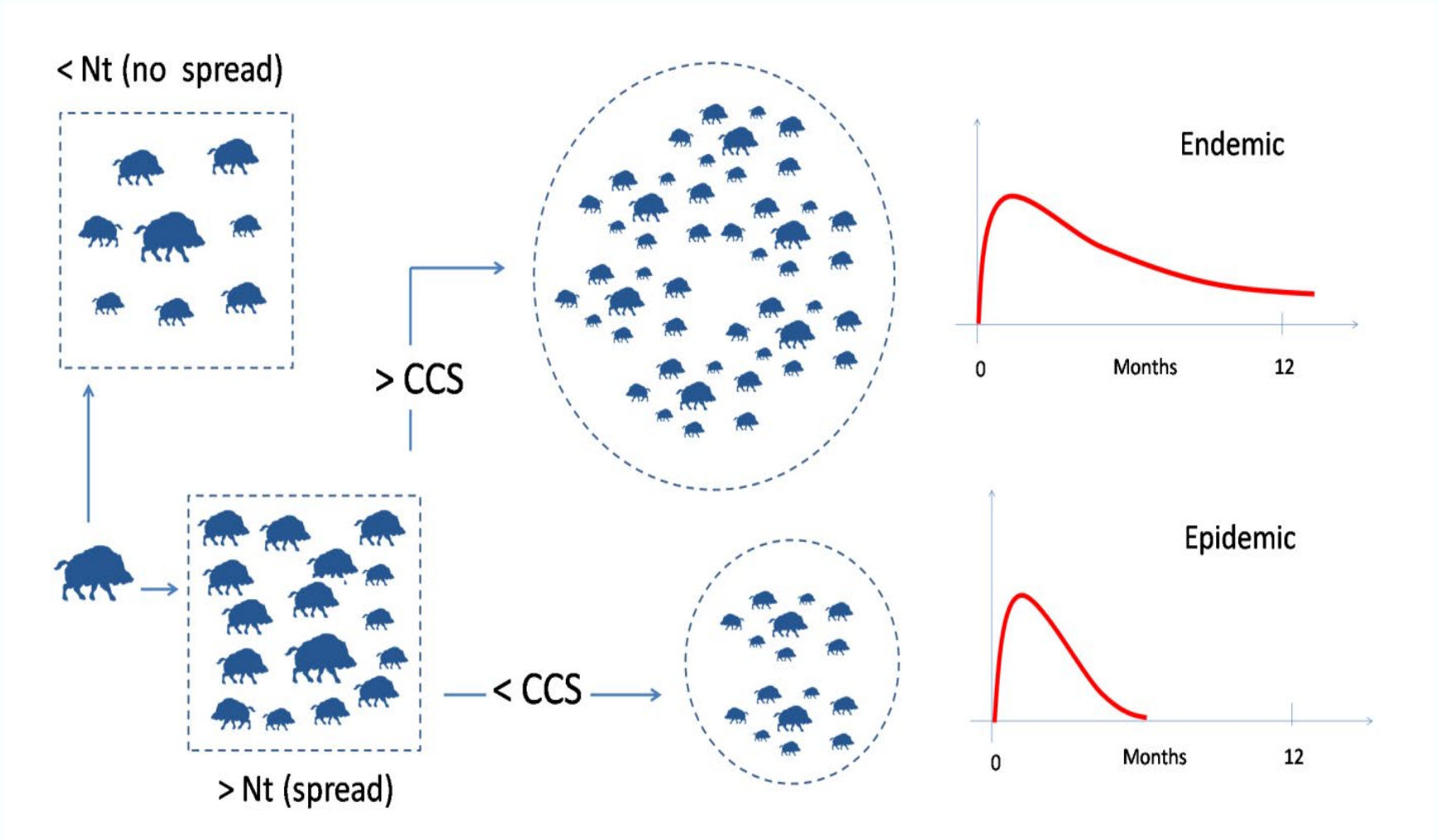
CCS size

ASF survives in small population when :

- Population fertility rate is high;
- Carcasses left in the forest;
- Population turn-over is high

Summarizing (OIE handbook)

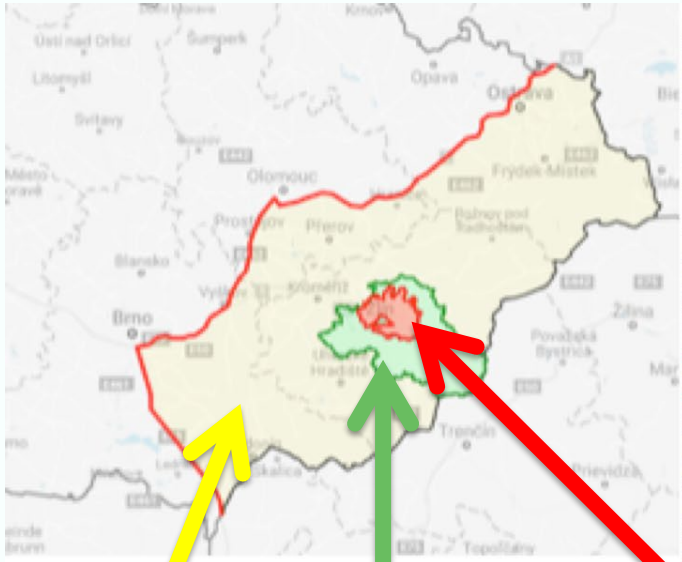


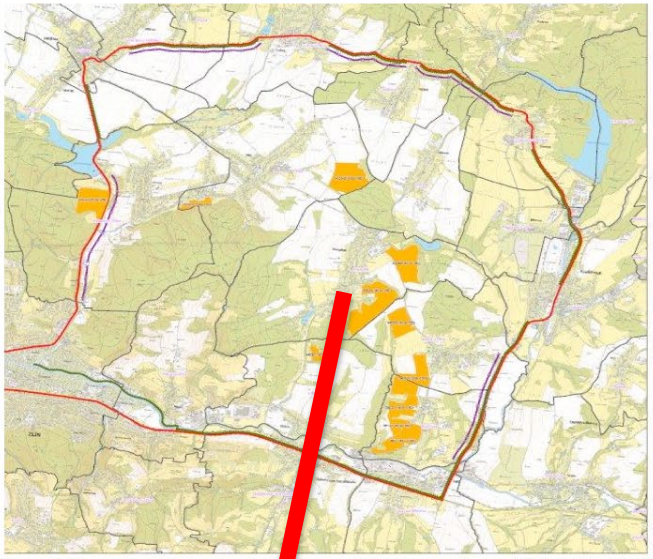

< Nt (no spread)
> CCS
< CCS
> Nt (spread)
Endemic
0
Months
12
Epidemic
0
Months
12

ASF: why time has been needed

- Unexpected African disease in North of Europe;
- Spontaneous fade out in wild boar was expected
- Technical difficulties
- New infections = (direct contact) + (contact with carcasses)
- No available scientific literature covers such complex disease….it is new transmission model!!!!

Until now the only area where ASF has been (apparently) eradicated in wild boar in the EU

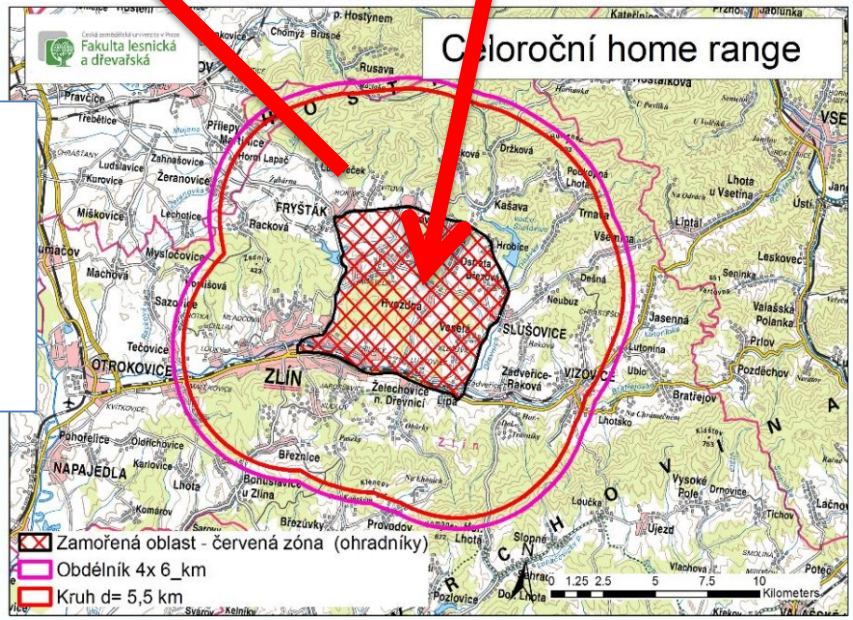




Higest risk
fenced area

Low risk area

Intensive hunting area
5305 hunted wild boars
at 13 October 2017



High risk area
(fenced plus buffer
Designed according
wild boar home range

ZAMOŘENÁ OBLAST

AFRICKÝ MOR PRASAT

NAŘÍZENÍ č. j. SVS/2017/108438 ze dne 11. 9. 2017

ZÁKAZ VSTUPU

PROBÍHÁ LOV

NAKAŽENÝCH

DIVOKÝCH PRASAT

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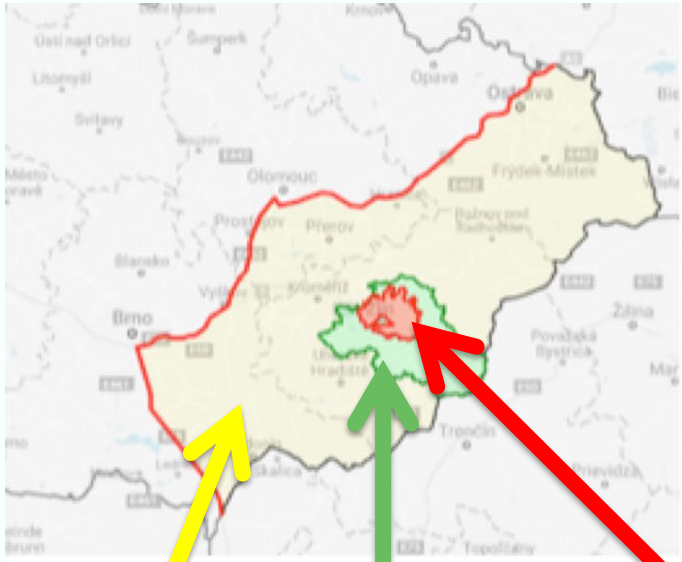

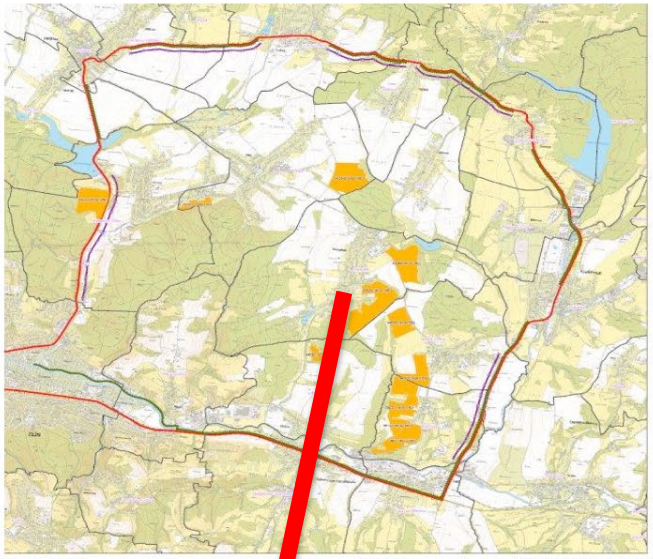

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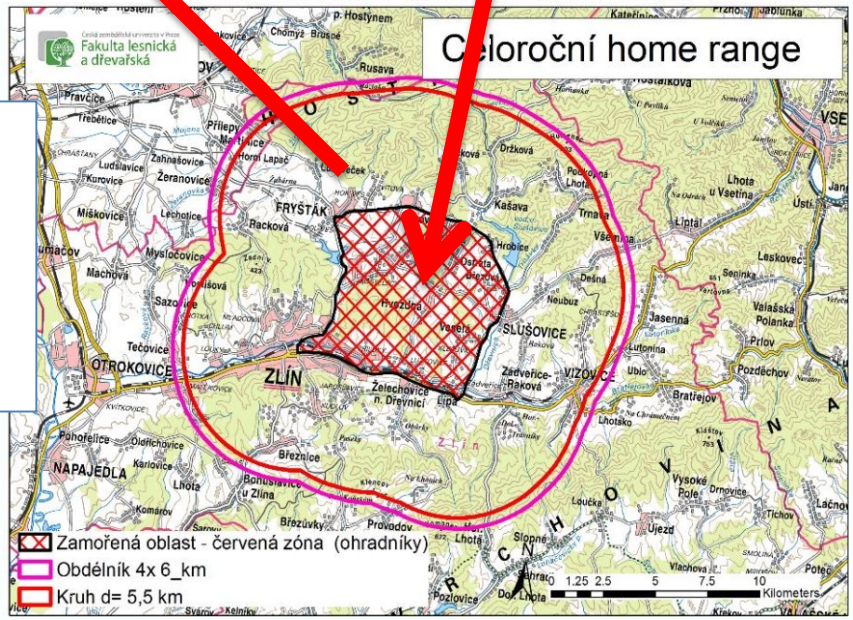

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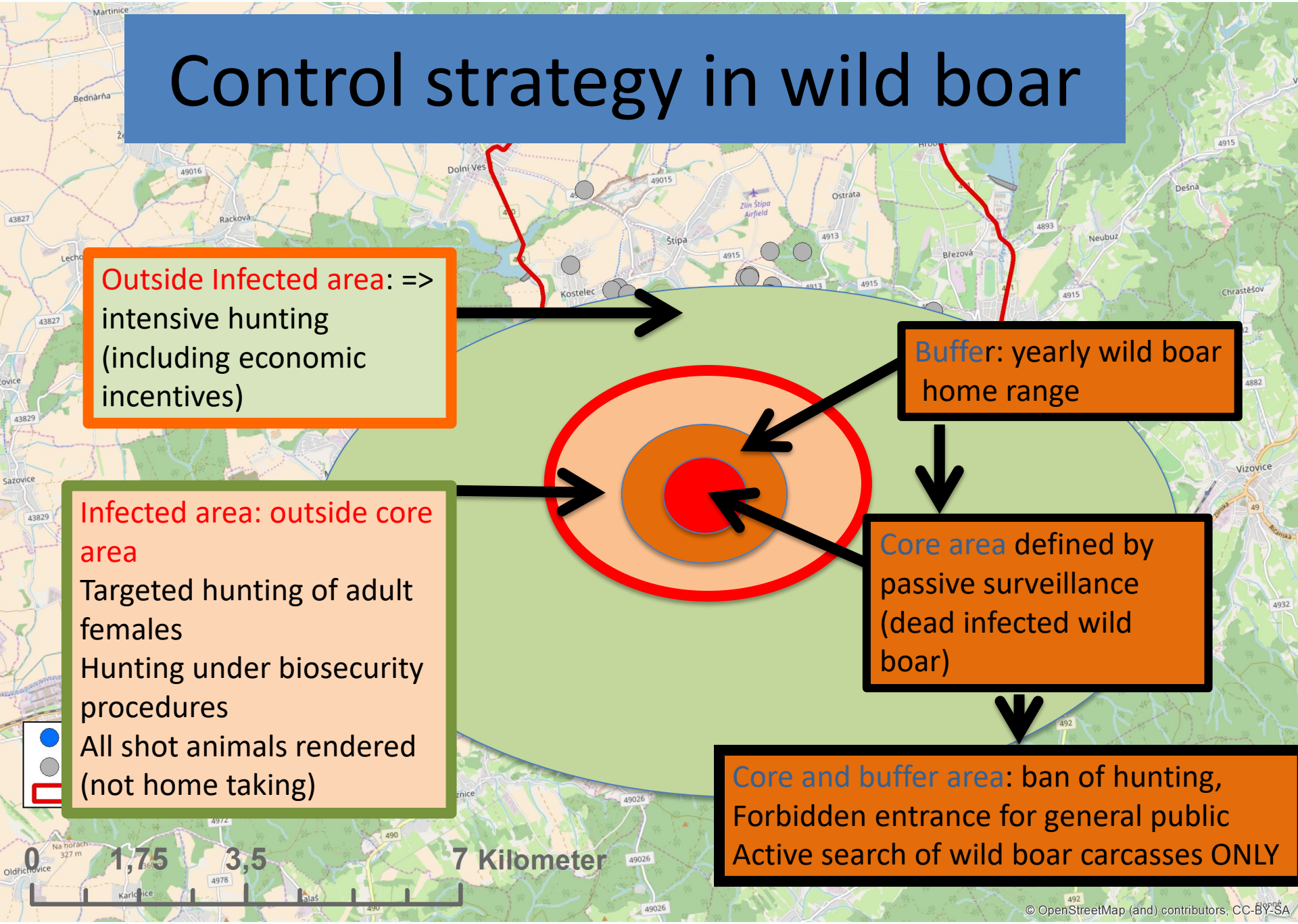
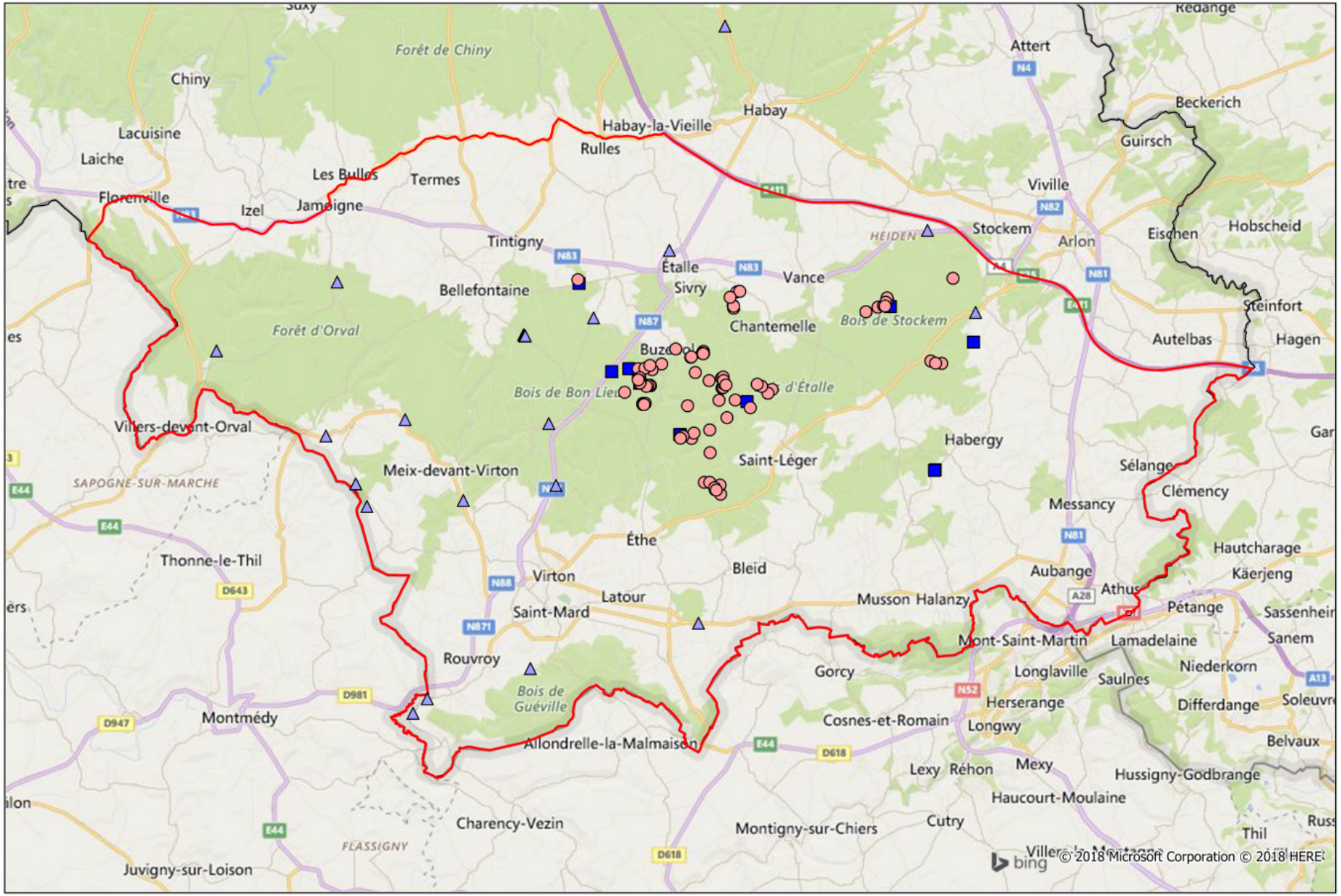
PROBÍHÁ LOV

NAKAŽENÝCH

DIVOKÝCH PRASAT

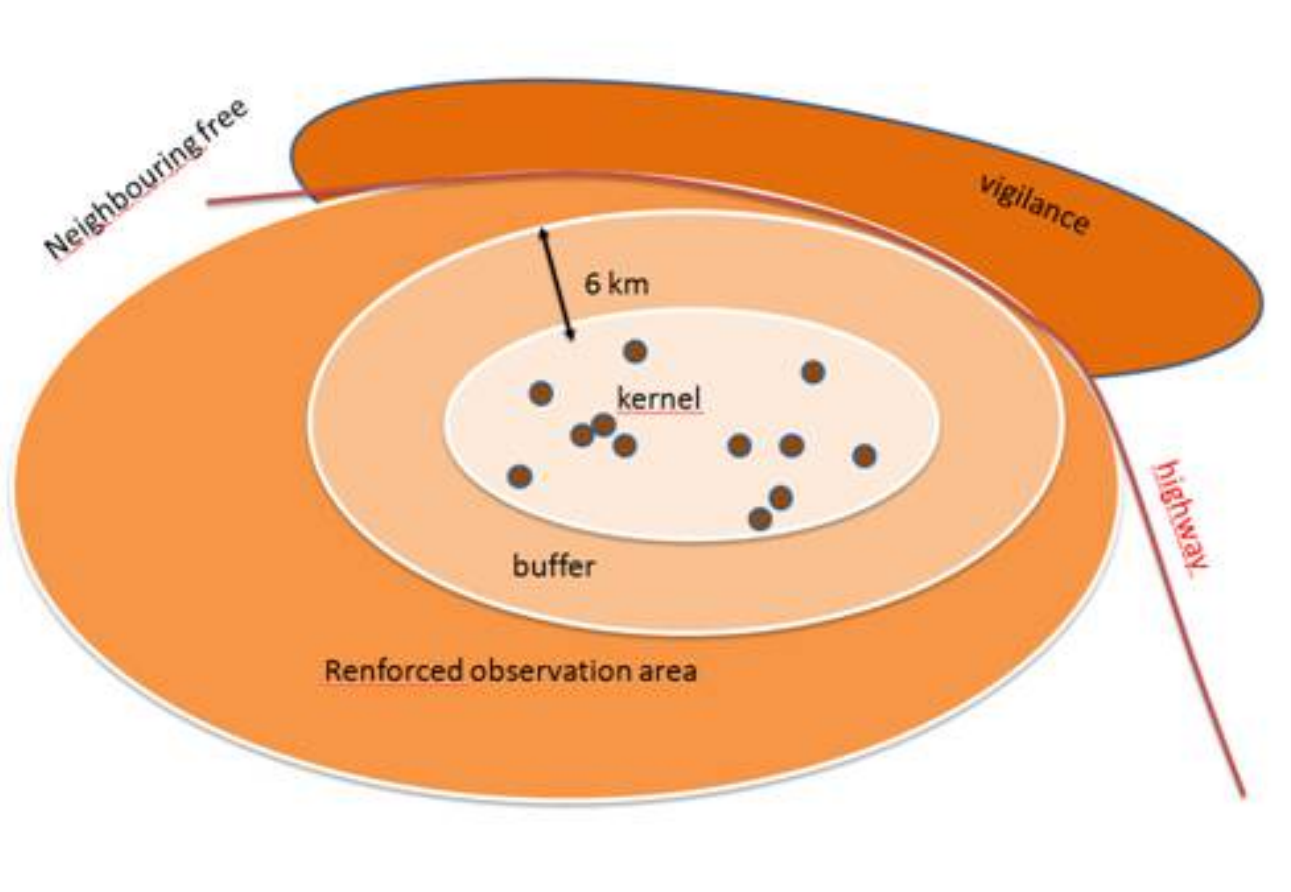
Control strategy in wild boar

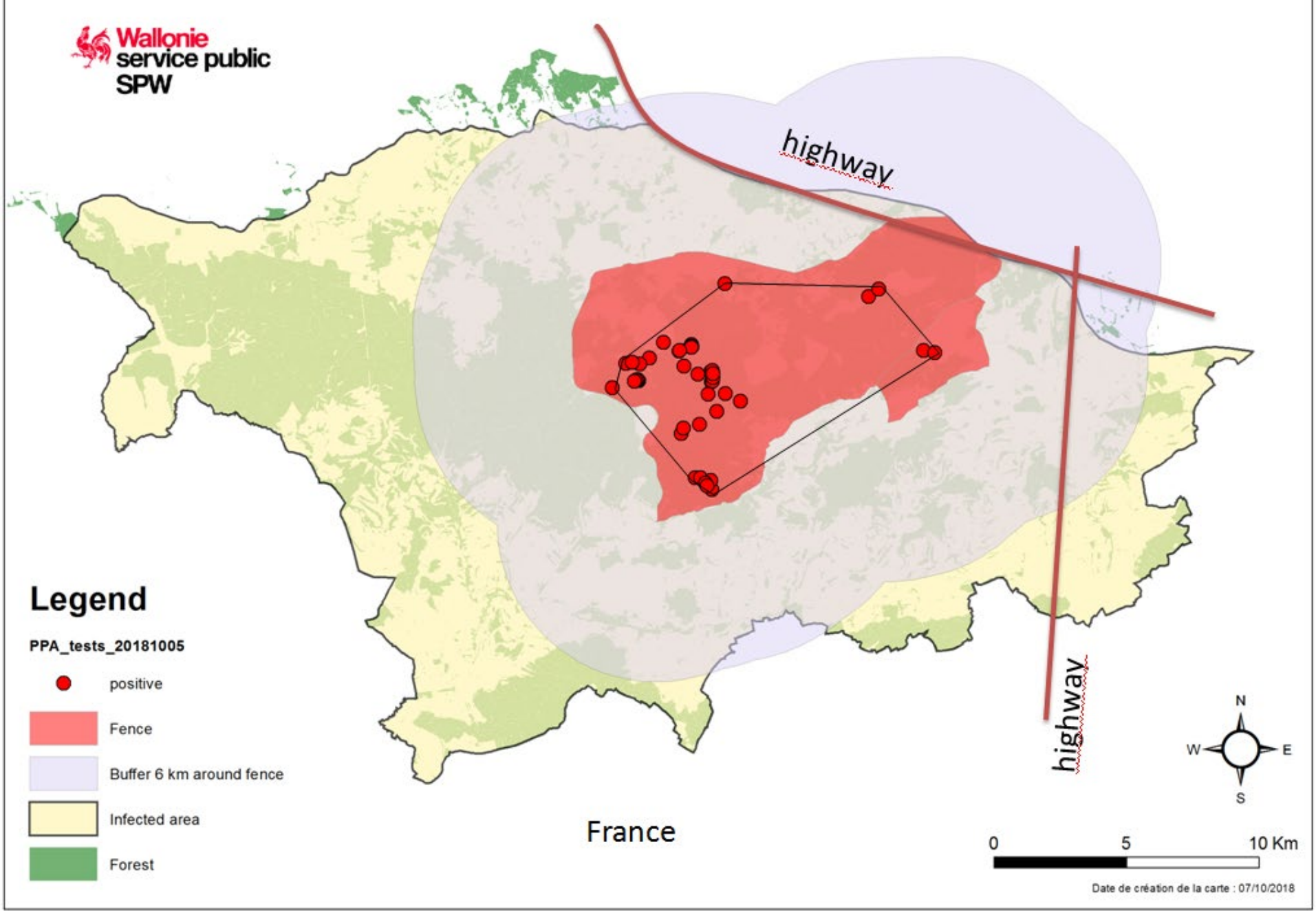


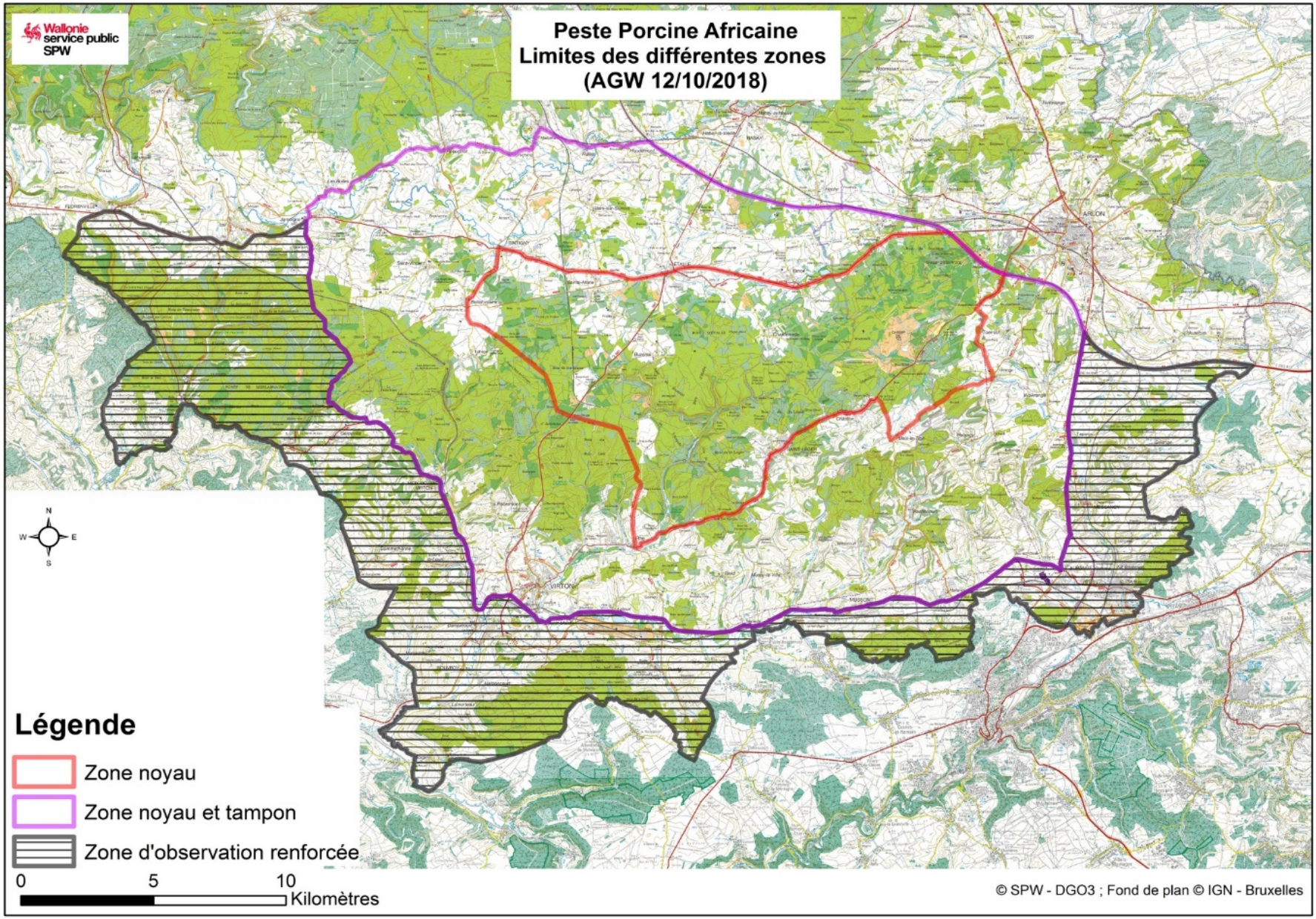


17-10-2018

positive (new) | positive | negative (new) | negative | in progress | infected zone


Neighbouring free
vigilance
6 km
kernel
highway
buffer
Renforced observation area


Wallonie
service public
SPW
highway
highway
Legend
PPA_tests_20181005
positive
Fence
Buffer 6 km around fence
Infected area
Forest
France
N
W
E
S
0
5
10 Km
Date de création de la carte : 07/10/2018


Wallonie
service public
SPW
Peste Porcine Africaine
Limites des différentes zones
(AGW 12/10/2018)
N
W
E
S
Légende
Zone noyau
Zone noyau et tampon
Zone d'observation renforcée
0
5
10
Kilomètres
© SPW - DGO3 ; Fond de plan © IGN - Bruxelles

Take at home message

- Threshold is **a preventive** measure
- During the Epidemic/endemic eradication is aimed in removing the **last infectious** animal
- The probability to remove the last infectious animal is LOW during the **epidemic** (when the virus is detected)
- During the endemic phase, the probability to eliminate the last infectious animal is higher but has to be achieved in each maintenance Critical Community
- The virus **naturally reaches its minimum prevalence** but carcasses make specific the epidemiological landscape of ASF
- During the endemic phase, the **removal of carcasses** is probably more important than any WB density reduction

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http://opera-italy.eu/

Better Training for Safer Food

BTSF

- *European Commission*

Consumers, Health and Food Executive Agency
DRB A3/042
L-2920 Luxembourg

Food safety