Role of wild boar in ASF epidemiology
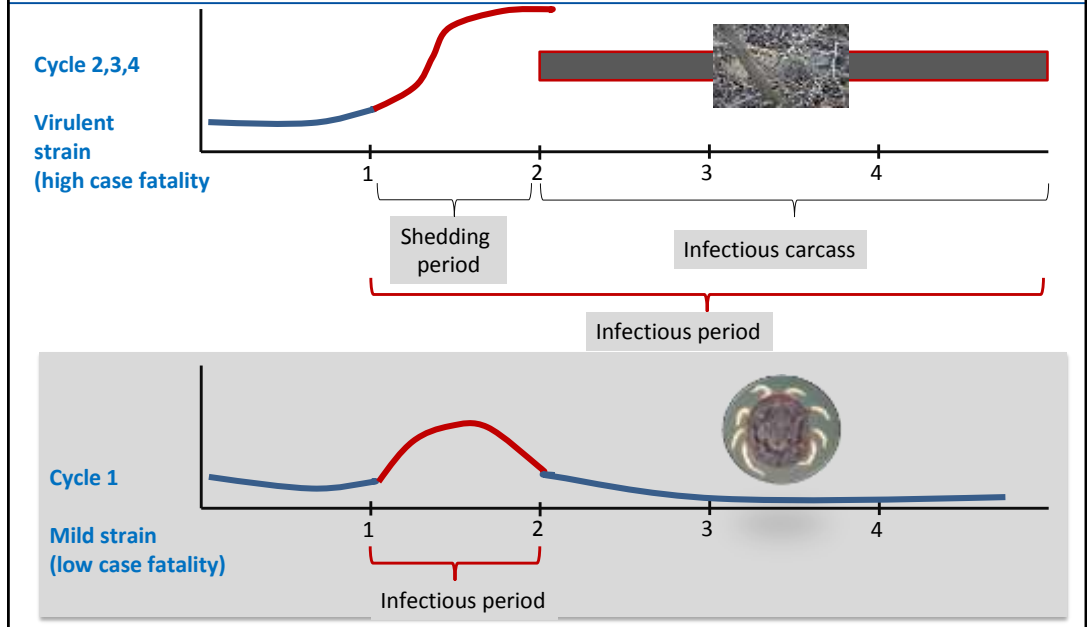
K Depner
18 February 2019
Belgrade

Wild boar-habitat cycle

Chenais et al., 2018

1) Sylvatic cycle: the common warthogs; bushpigs and soft ticks.
2) Tick-pig cycle: soft ticks; domestic pigs.
3) Domestic cycle: domestic pigs and pig products.
4) Wild boar-habitat cycle: wild boar; pig- and wild boar products and carcasses; the habitat.

Cycle 2,3,4

Virulent strain (high case fatality

1   2   3   4

Shedding period

Infectious carcass

Infectious period

Cycle 1

Mild strain (low case fatality)

1   2   3   4

Infectious period

Characteristics of epidemics in wildlife populations

Complex situation: interaction of many factors
(infected animals, animal density, hunting activities, agriculture, etc.)

Obscure situation: not all important parameters are known *(e.g. animal density, animal movements, etc…)*

Dynamic situation: *permanent change of parameters* *(e.g. seasonal influences, fluctuation in animal number)*

Influencing one factor can cause unpredicted side-effects

Jan. 2014: LT
Feb. 2014: PL
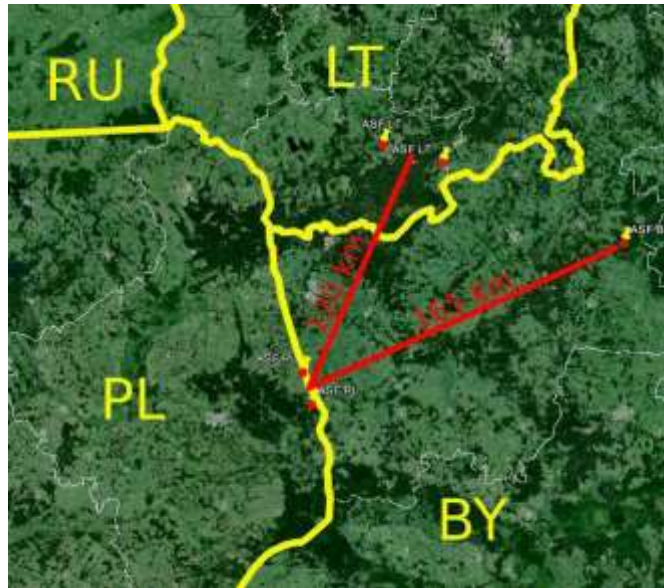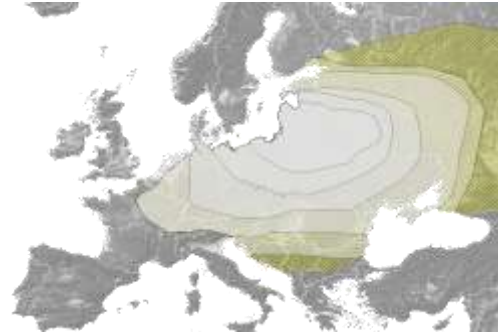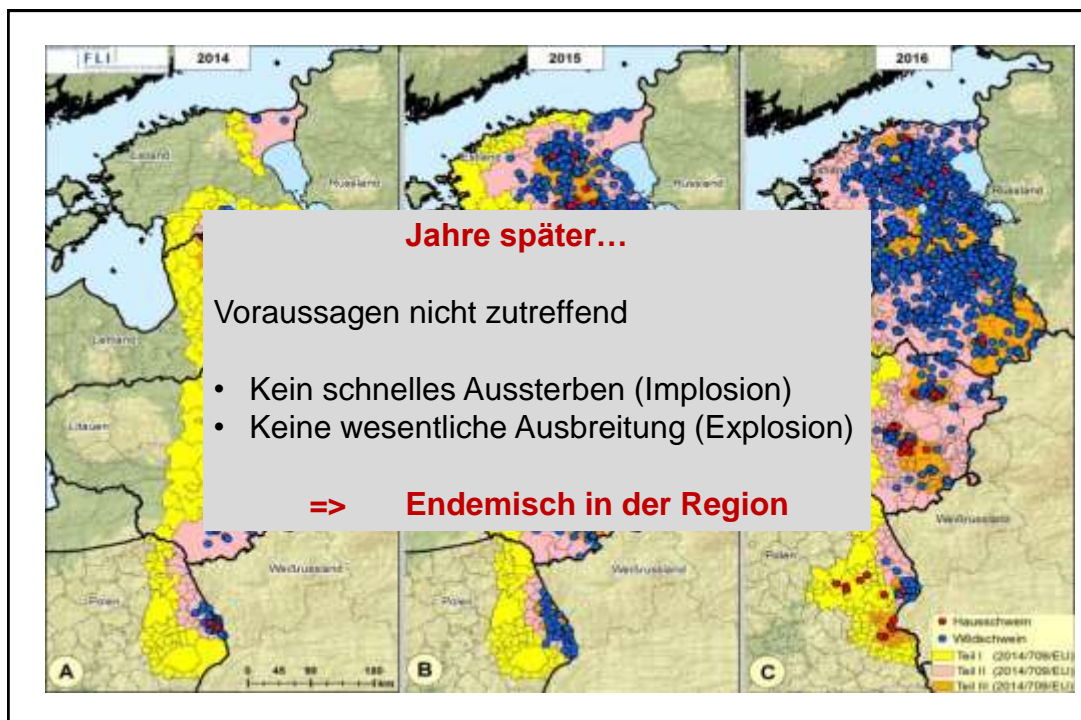Juni 2014: LV
Sep. 2014: EE

Juni 2017: CZ
Aug. 2017: RO
…?

Photo: K. Depner

Arbeitshypothesen Wildschwein

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- **Schnelle Ausbreitung** Richtung Westeuropa, ähnlich wie bei der Fuchstollwut *(Explosion)*

- Wegen der sehr hohen Letalität wird die Seuche von selbst **zum Stillstand kommen** *(Implosion)*

Tollwut

Jahre später…

Voraussagen nicht zutreffend

- Kein schnelles Aussterben (Implosion)
- Keine wesentliche Ausbreitung (Explosion)

=>   Endemisch in der Region

K. Lamberga

Persistency triangle (ASF)

High tenacity ensures long term virus persistence in the environment

High case fatality rate makes the virus largely available in the form of many carcasses.,

The relatively **low contagiousity** prevents the complete depletion of the host population and may hamper early detection.

The interaction of these three parameters maximize local persistence and limits fast geographical spread of the virus within an affected population. ASF is maintained locally, with a low but steady presence, making its eradication a challenge.

Chenais et al. 2019
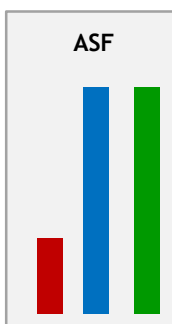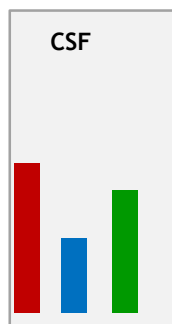
Low contagiousity

The qualities of three epidemiological traits make ASFV efficient in persistence and transmission

High case fatality

High tenacity & long exposer

Summary

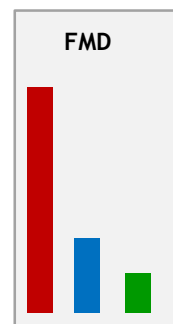| ASF	CSF	FMD	Conatgiousity

Conatgiousity
Tenacity
Case fatality

Endemic situation, slow spread, does not fade out
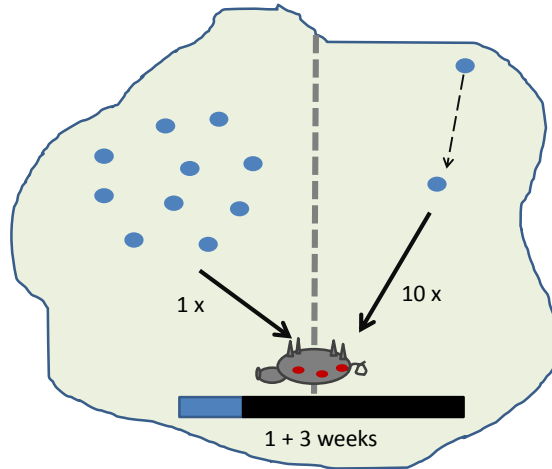
Fades out after reducing susceptibles by Vaccination (EU)

Fades out Spontaneously (BG)

Two of three parameters should be low/medium for the epidemic to fade out

Exposure opportunity

1 x

10 x

1 + 3 weeks

?
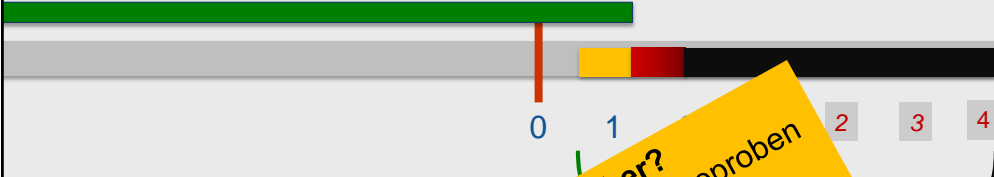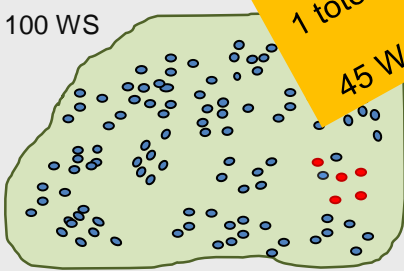
Carcass removal

- If carcasses will be removed, exposure opportunity will decrease -> less contacts
- If carcasses will NOT be removed, exposure opportunity will increase -> more contacts

---

(Lebens-)Zeit, in der ein WS erlegt werden kann

0   1   2   3   4

diagnostisch...
bei ...

...stisches Fenster
bei WS-Kadaver
3 - 4 Wochen (PCR +)

Was ist einfacher?
1 totes WS zu finden und zu beproben
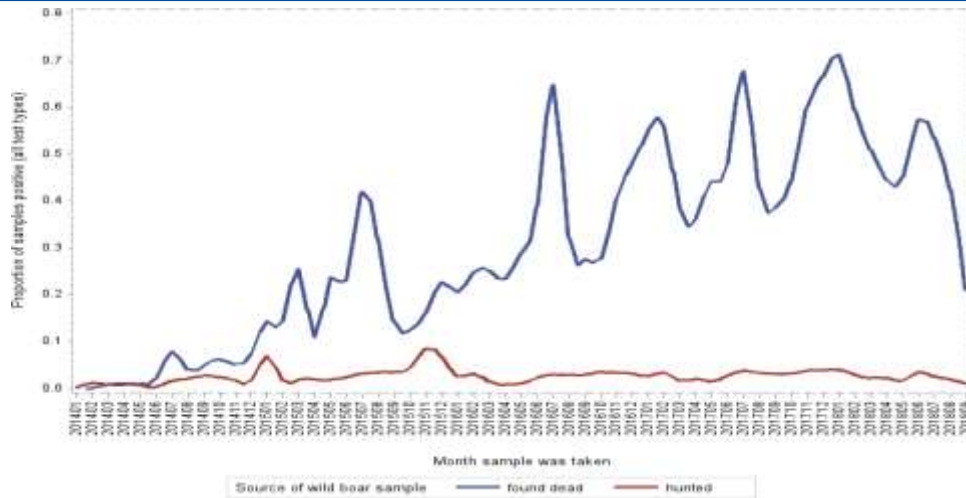oder,
45 WS zu erlegen und zu beproben?

100 WS

5 von 100 infiziert (5%)

5/95-Konzept

Am Jagdtag sind 5 von100 WS infiziert (5%). Um mindestens **1** positives Tier zu finden, müssten **45** WS erlegt werden (95% Konfidenz)

(Bei einer Prävalenz von 2% müssten 78 Tiere erlegt werden, bei 1% müssten es 96 sein…)

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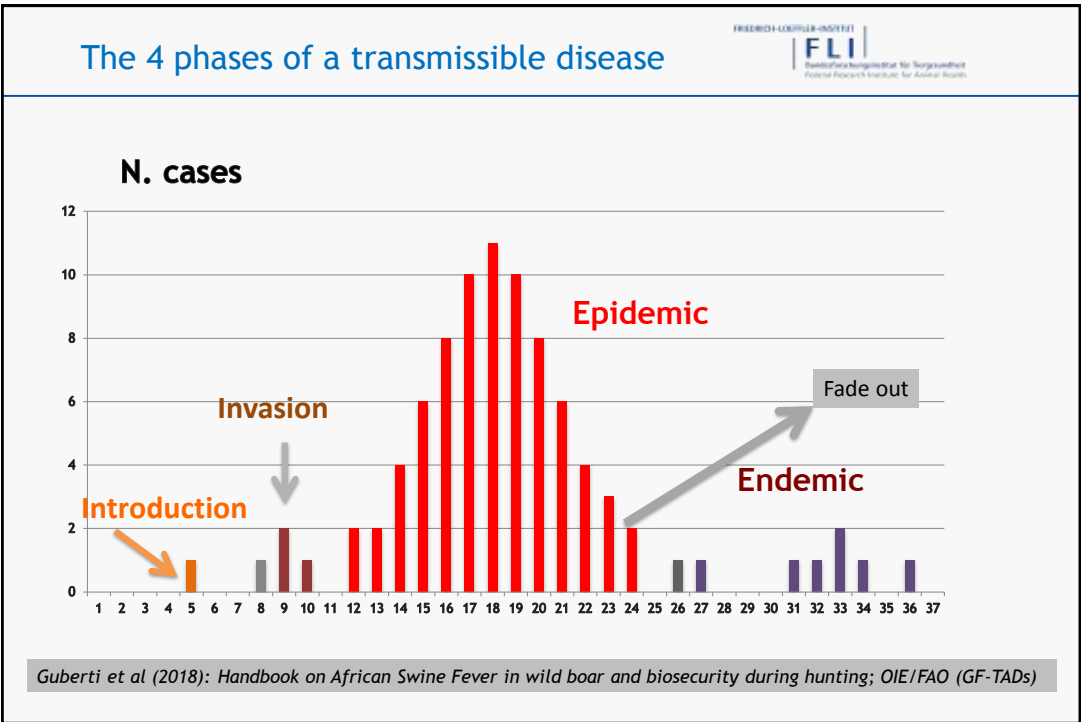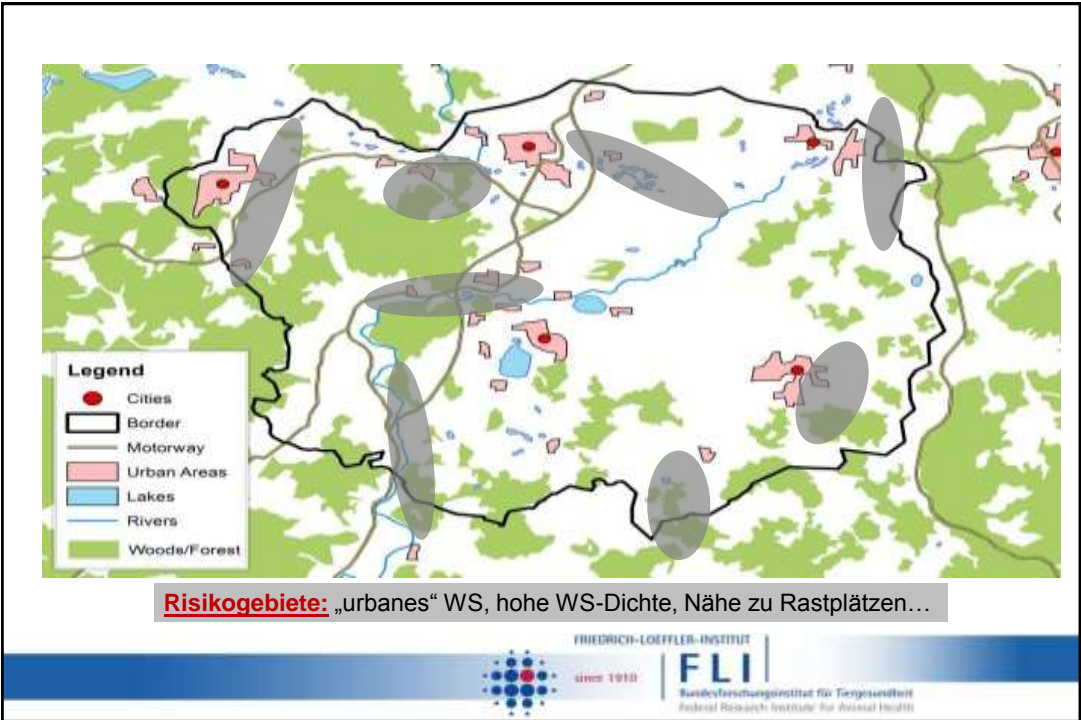Federal Research Institute for Animal Health

Proportion of positive sample over tested samples (PCR and AB-ELISA) in hunted wild boar and wild boar found dead in the Baltic Countries and Poland since the first introduction Epidemiology of ASF in the EU.

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Risk Assessment Germany

- Assessment for import risk through
  – Legal import of pigs and products
  – Contaminated vehicles and clothes
  – Wild boar

- Qualitative not quantitative
  – Negligible / low / medium / likely / high

- With confidence level
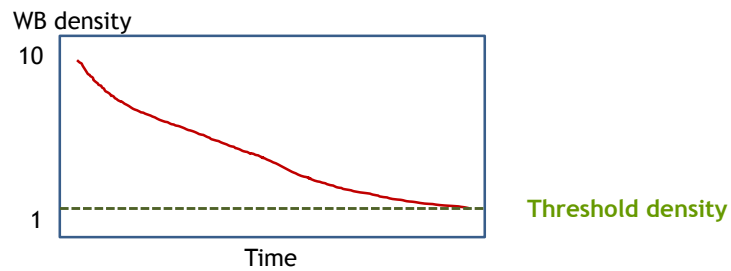 – Low, medium, high

Carola Sauter-Louis

Risikogebiete: „urbanes" WS, hohe WS-Dichte, Nähe zu Rastplätzen…

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F L I

since 1910

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The 4 phases of a transmissible disease

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N. cases

Epidemic

Invasion

Fade out

Endemic

Introduction

Guberti et al (2018): Handbook on African Swine Fever in wild boar and biosecurity during hunting; OIE/FAO (GF-TADs)

Can we define the threshold density?

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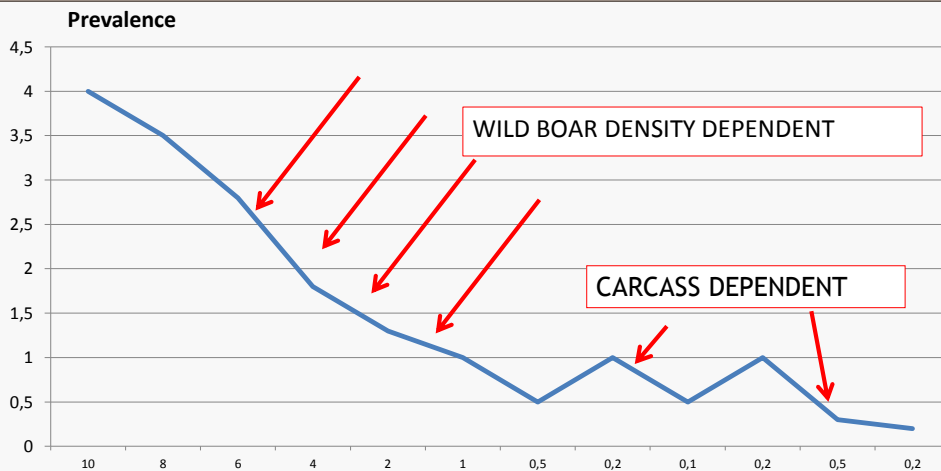Federal Research Institute for Animal Health

The critical density at which an infection stops (an infectious wild boar does not encounter any susceptible wild boar in due time to spread the infection)

If the number of <u>susceptible individuals </u>is decreased till a certain density, the infection fades out through a density dependent mechanism
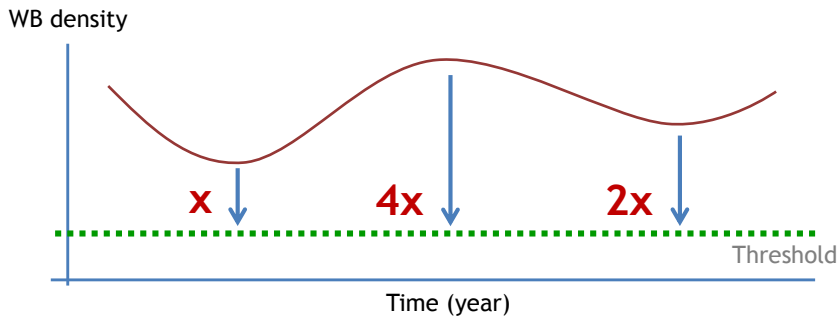
NO WILD BOAR = NO DISEASE

WB density

10

1

Time

Threshold density

V. Guberti

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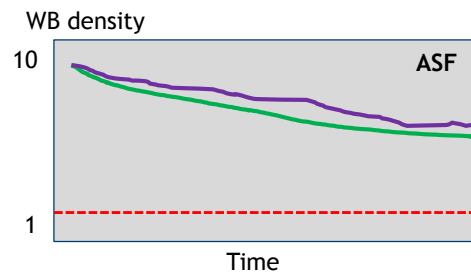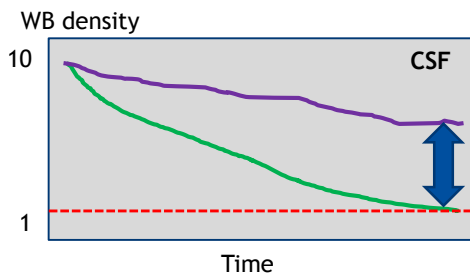The virus itself kills most of the animals

Prevalence

| 4,5 |
| 4 |
| 3,5 |
| 3 |
| 2,5 |
| 2 |
| 1,5 |
| 1 |
| 0,5 |
| 0 |

WILD BOAR DENSITY DEPENDENT

CARCASS DEPENDENT

10   8   6   4   2   1   0,5   0,2   0,1   0,2   0,5   0,2

V. Guberti

10

Threshold elasticity

WB density

x   4x   2x

Threshold

Time (year)

> **Estimating the threshold:** *easy to come up with a theoretical figure*

> **Reaching the desired threshold:** *difficult (impossible???)*

- *The total number of wild boar is unknown and all estimates are wrong*

- *Best is, do not disturb the animals and remove carcasses as effectively as possible...*

Susceptible population & threshold

WB density

10   CSF

1

Time

WB density

10   ASF

1

Time

Total population
Susceptible population
Extinction

Oral vaccination

No vaccination
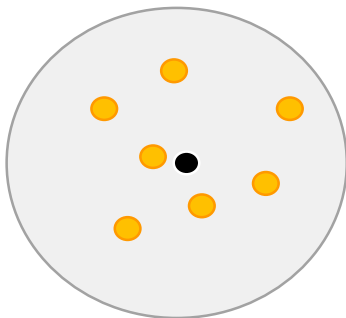*(high case fatality, few survivors)*

V. Guberti

Red: core zone;
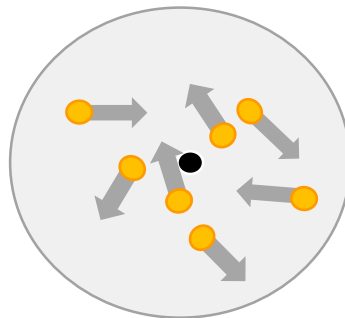Yellow: buffer zone;
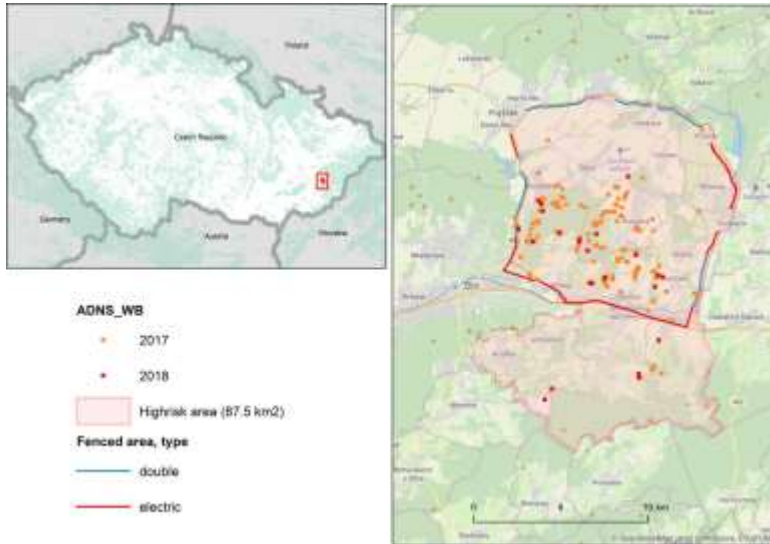Blue: intensive hunting zone.

EFSA Journal 2018;16(11):5494

Exposure opportunity
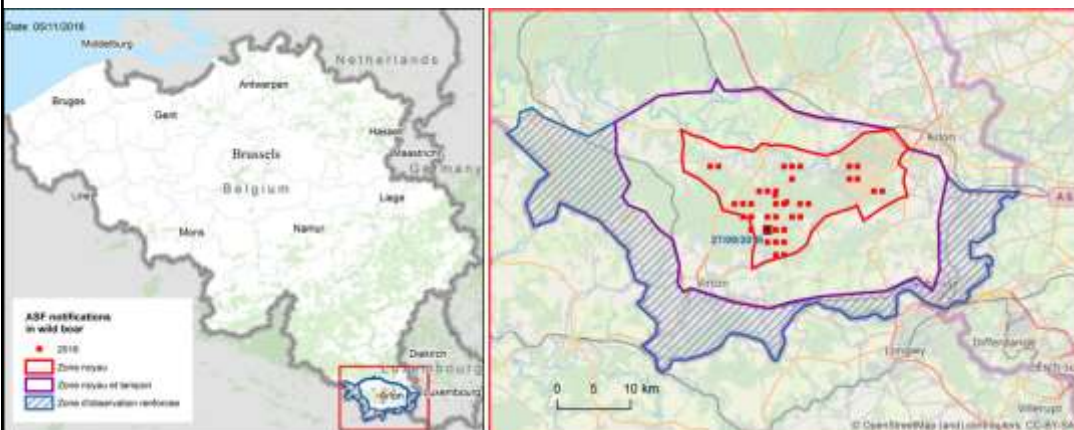

Marbles in motion

Contact rate **+**

Contact rate **+++**

ADNS_WB
- 2017
- 2018
- Highrisk area (87.5 km2)

Fenced area, type
- double
- electric

EFSA Journal 2018;16(11):5494

Belgien

Date: 05/11/2018

ASF notifications
in wild boar
- 2018
- Zone noyau
- Zone noyau et tampon
- Zone d'observation renforcée

0   5   10 km

© OpenStreetMap (and) contributors, CC-BY-SA

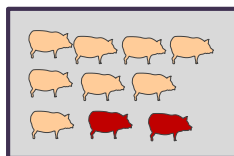EFSA Journal 2018;16(11):5494

08/01/2019

ASF control and eradication

Key characteristics of ASF:
- low contagiousity, slow spread, few secondary infections
- no transmission by wind or insects,
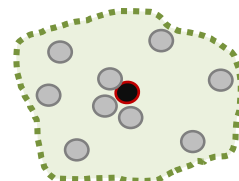- **site fidelity** (stable disease / habitat disease),

DP: stable disease	WB: habitat disease
Measures: 1. Standstill 2. Culling 3. C&D	**Measures:** 1. Standstill (no disturbance of WB, no hunting, electrical fence, (feeding) 2. (Trapping) 3. Disposal of carcasses
Successful approach!!	*"Virtual stable" in forest*

Freedom of disease

Wild boar management measures

e.g. population reduction to avoid agricultural damage

e.g. Intensive hunting

Presence of disease

Disease control measures

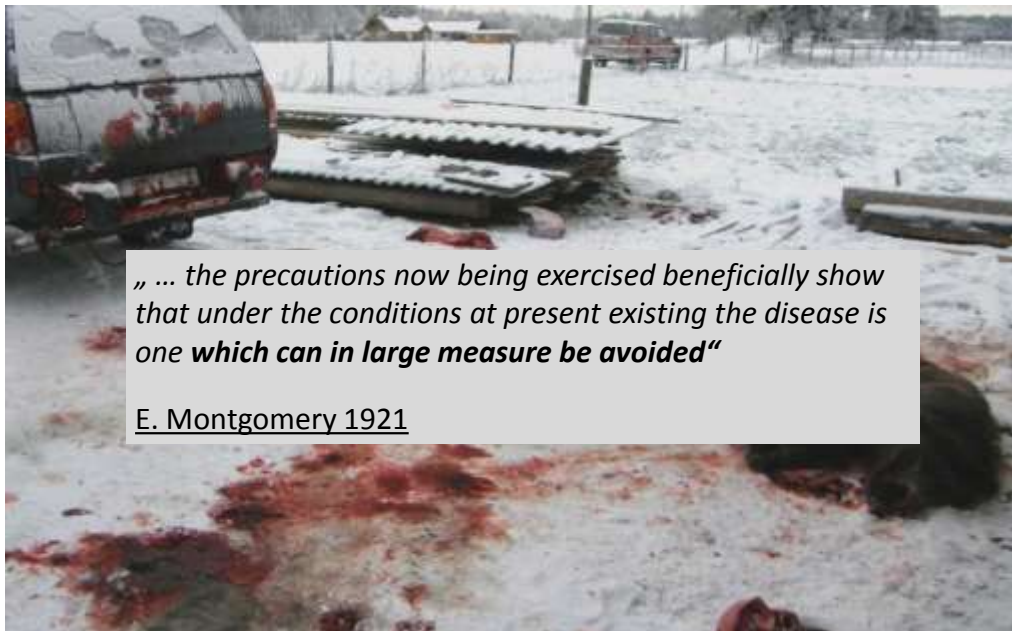*not wild boar management measures!!!*

Movement restriction
Ban of feeding
Prohibition of hunting
Intensive hunting

Hunting/Slaughtering ⟷ **Culling**

„ … the precautions now being exercised beneficially show that under the conditions at present existing the disease is one **which can in large measure be avoided"**

E. Montgomery 1921

Biosecurity during hunting!!!

Biosicherheit im Wald

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Das Wurst-Case-Szenario

Lab results can be used for indicating the duration of infection

PCR	Ab-Test	duration of infection (estimates)
pos	neg	<12d (or the animal died/sampled before 12d)
pos	pos	>12d (or the animal died/sampled after 12d)
neg	pos	>24d (or the animals was sampled after 24d