African Swine Fever

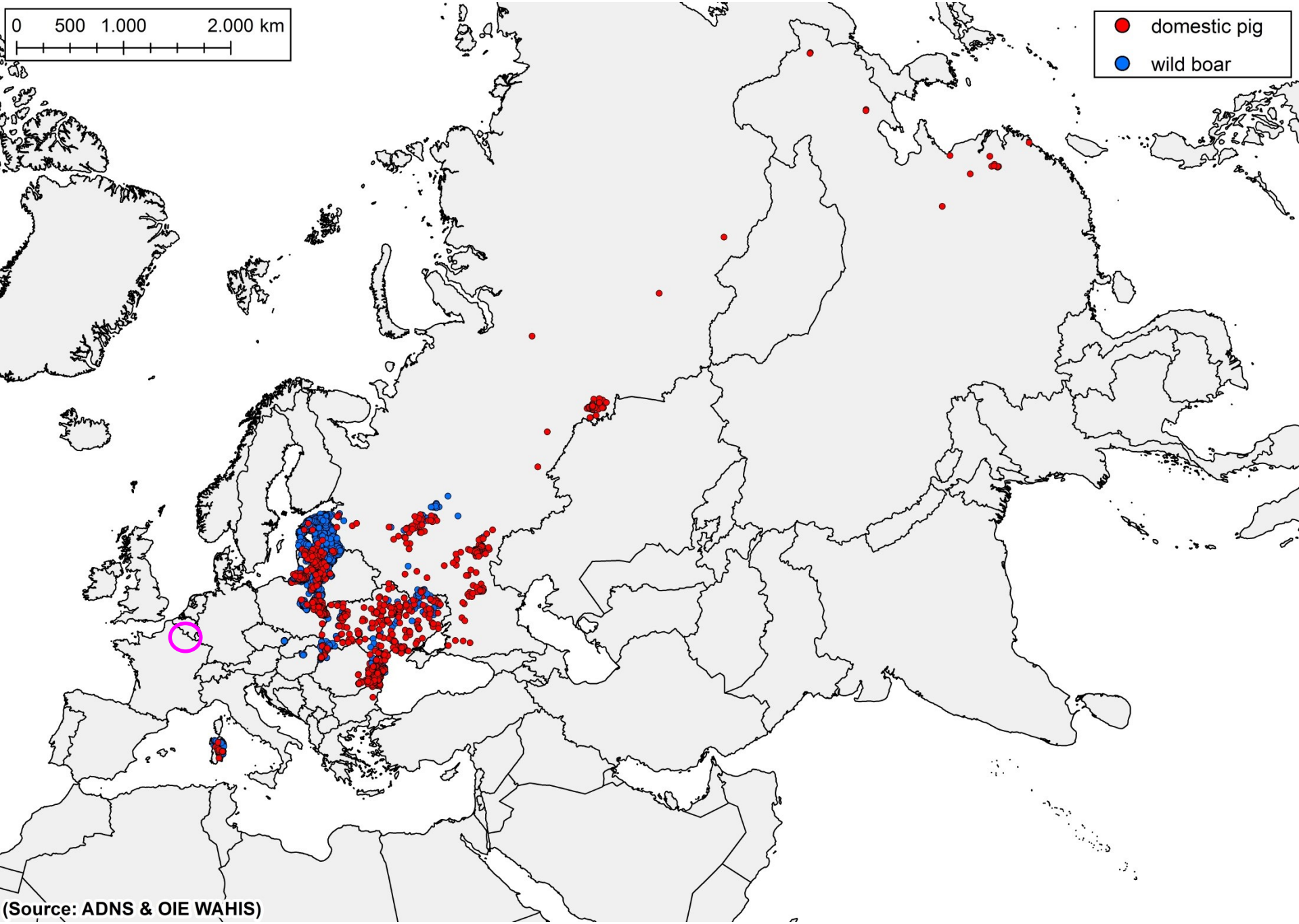
Lessons learned

K Depner

September 2018

Bern


Leningradskaya
Oblast
Russian Federation
Orenburgskaya
Oblast
Ukraine
Kazakhstan
Turkey
Iran

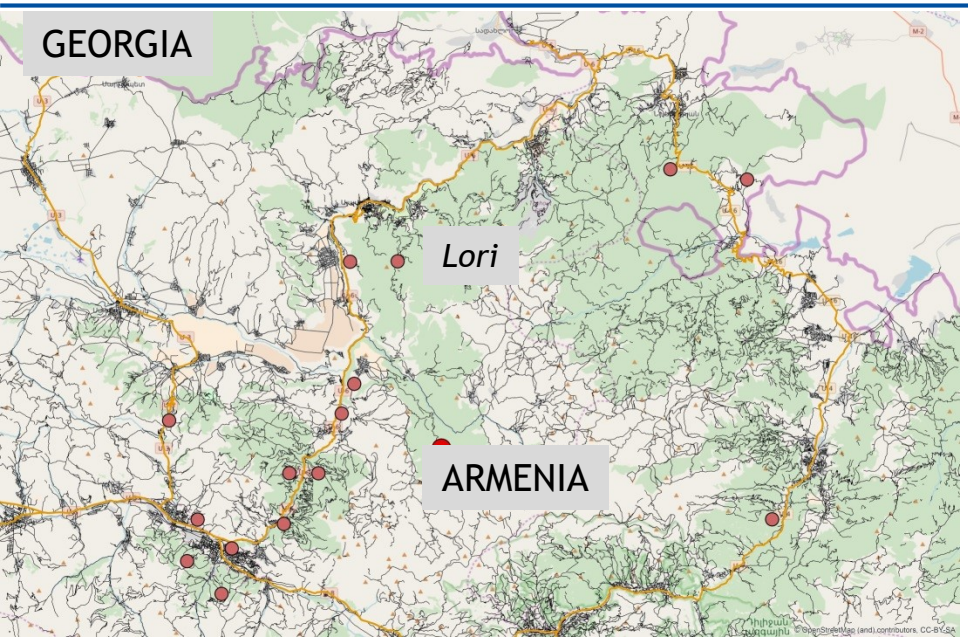

0 500 1.000 2.000 km
domestic pig
wild boar
(Source: ADNS & OIE WAHIS)

ASF is a human driven disease

(“anthropogenic factors”)

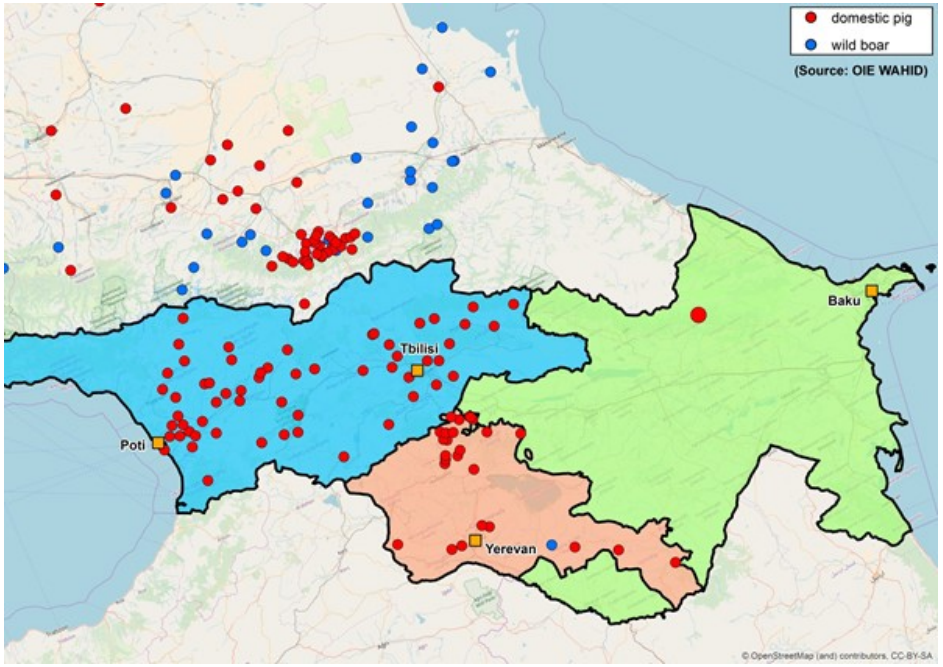
ASF is a human driven disease
("anthropogenic factors")

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



Along the road

Tradition

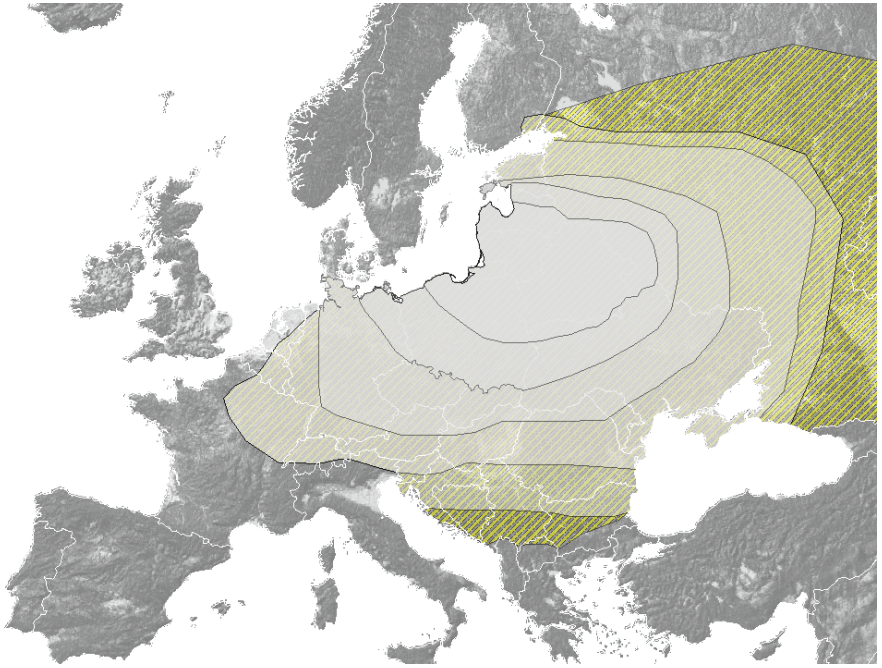


ASF: Working hypotheses for wild boar

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

1) ASF will fade out rapidly from the affected wild boar population due to the high mortality rate induced by the ASFV *(IMPLOSION)*

2) ASF will spread rapidly westwards (Rabies like) since an infected local wild boar population would infect the naïve neighboring populations within a short period of time initiating an epidemic wave… *(EXPLOSION)*



ASF: Working hypotheses for wild boar

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

1) ASF will fade out rapidly from the affected wild boar
population
ASFV *(IMP*

2) ASF will
westwards
an infecte
populatior
naïve neig
within a short period of time
initiating an epidemic wave…
(EXPLOSION)

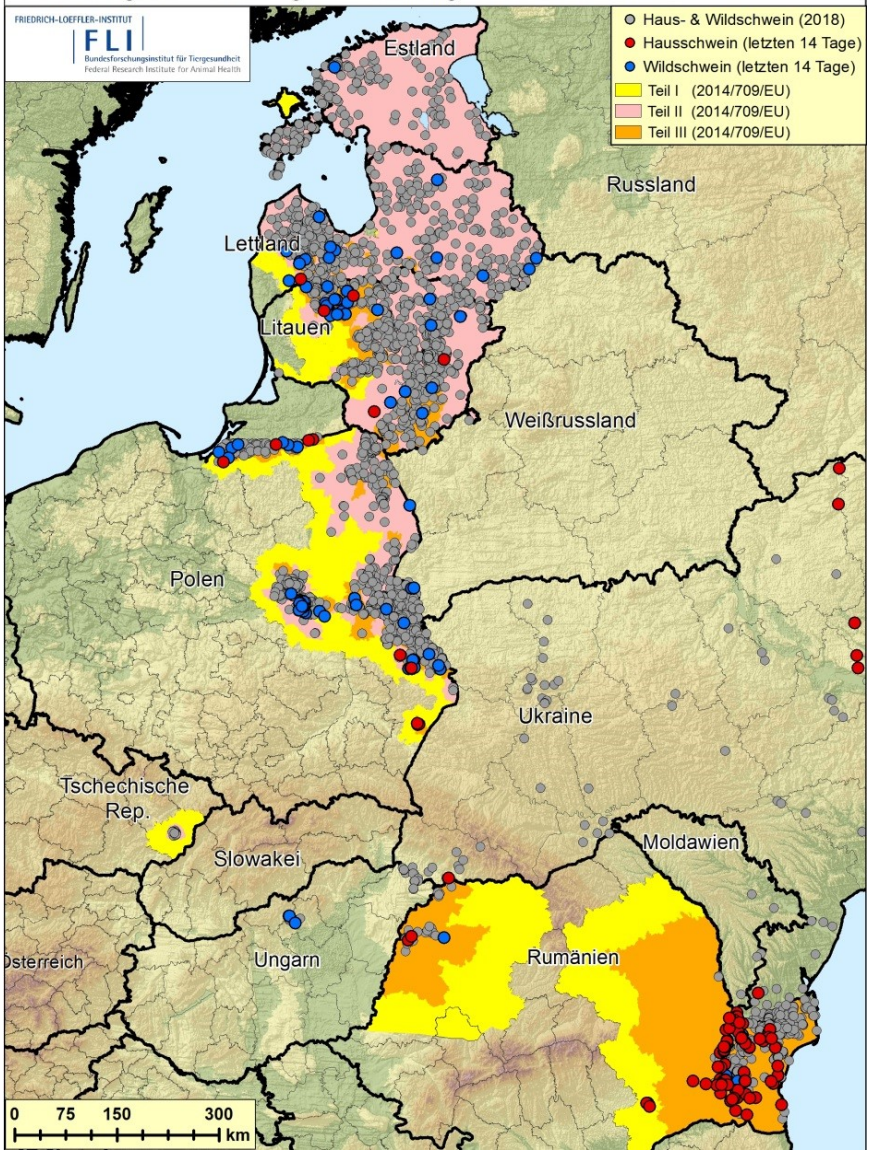
years later…….

both hypotheses proved to be wrong !!!

- NO implosion
- NO explosion

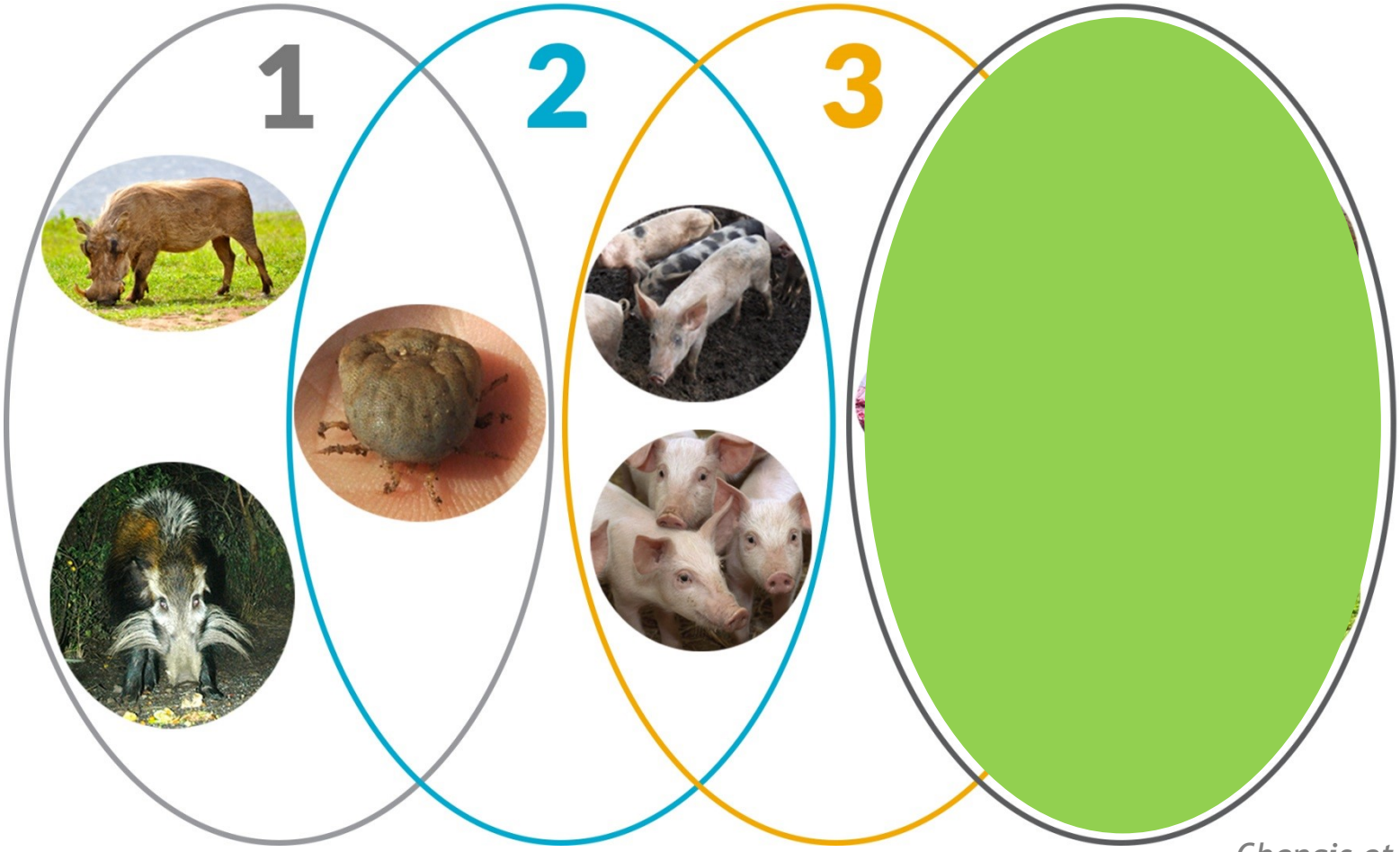
=> Endemic in the region, slow spread

Afrikanische Schweinepest im Baltikum, Moldawien, Polen, Rumänien, Tschechien, Ungarn und Ukraine Datenquelle: ADNS, OIE (Stand: 28.08.2018 - 08:25 Uhr) nach Feststellungsdatum; Restriktionsgebiete nach Anhang des Durchführungsbeschlusses 2014/709/EU



4 epidemiologic cycles of ASF

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



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.

How much do we need to know about ASF to be able to prevent, control and eradicate?

- Something about the virus
- Something about the clinical course
- Something about diagnosis
- Something about contagiosity, infectiosity, transmission…

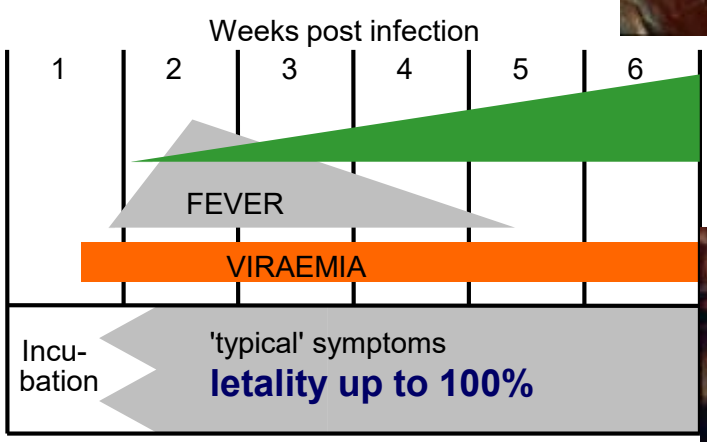
- Much about epidemiology

- **Very much about human - host interactions**
- **Very much about human behaviour**

A bit about ASF

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

- ✓ Scientific information available
- ✓ Knowledge about ways & routes of transmission
- ✓ Diagnostic tools available



If we do not manage ASF, it's not because of lack of knowledge…

ASF virus is relatively stable

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

- frozen meat: indefinitely
- dry meat and fat: almost one year
- blood, salted meat and offal: more than 3 months
- faeces: over one week

Temperature plays an important role in decreasing the survival duration of ASF virus in any matrix.

ASFV survives the process of putrefaction and carcasses may remain infectious for weeks

Textbooks are misleading…

copy/paste …

"ASF is a highly contagious disease… causing high mortality up to 100%…"

Contagiousity/Contagiousness

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

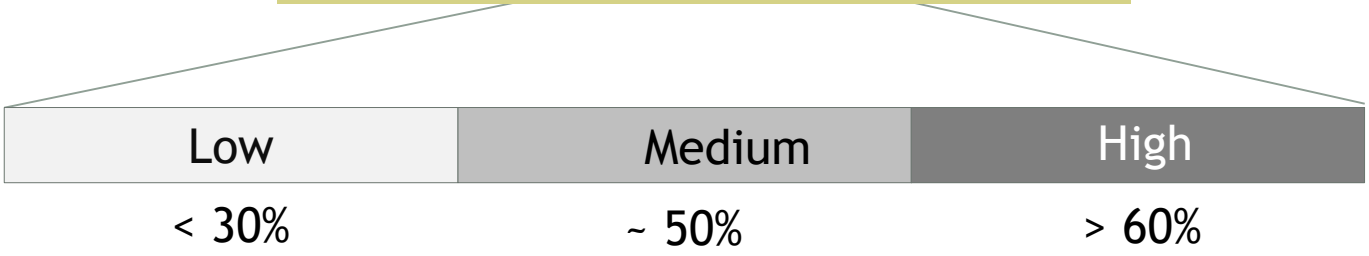
percentage of animals which get infected after contact with an infectious agent.

probability that an animal picks up an infection after contact with a pathogen

It is NOT an indicator for disease severity and impact!!!

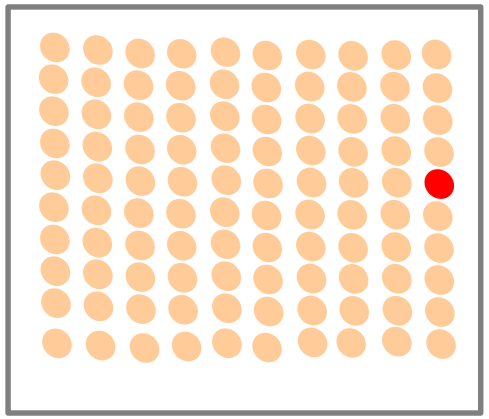
- ***Low contagious diseases with severe course and high impact***
- ***Highly contagious diseases with mild course and low impact***

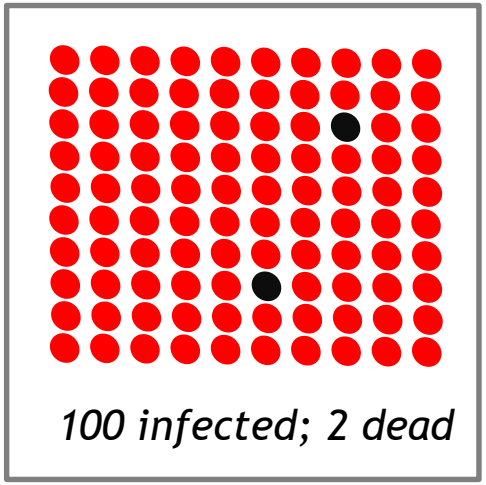
Contagiousness
Probability of infection



ASF - CSF - FMD

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health





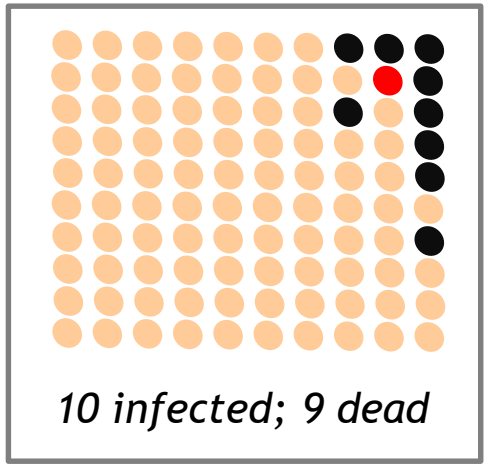
100 infected; 2 dead

FMD

Prevalence: 100%
Mortality: 2%
Lethality: 2%

Contagiousity: +++

● Infected ● dead

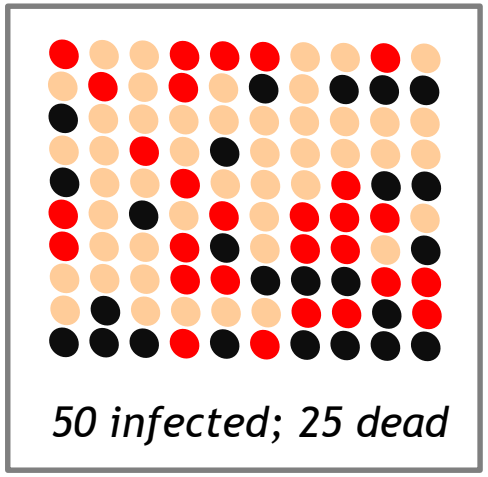


10 infected; 9 dead

ASF

P: 10%
M: 9%
L: 90%

Contagiousity: +



50 infected; 25 dead

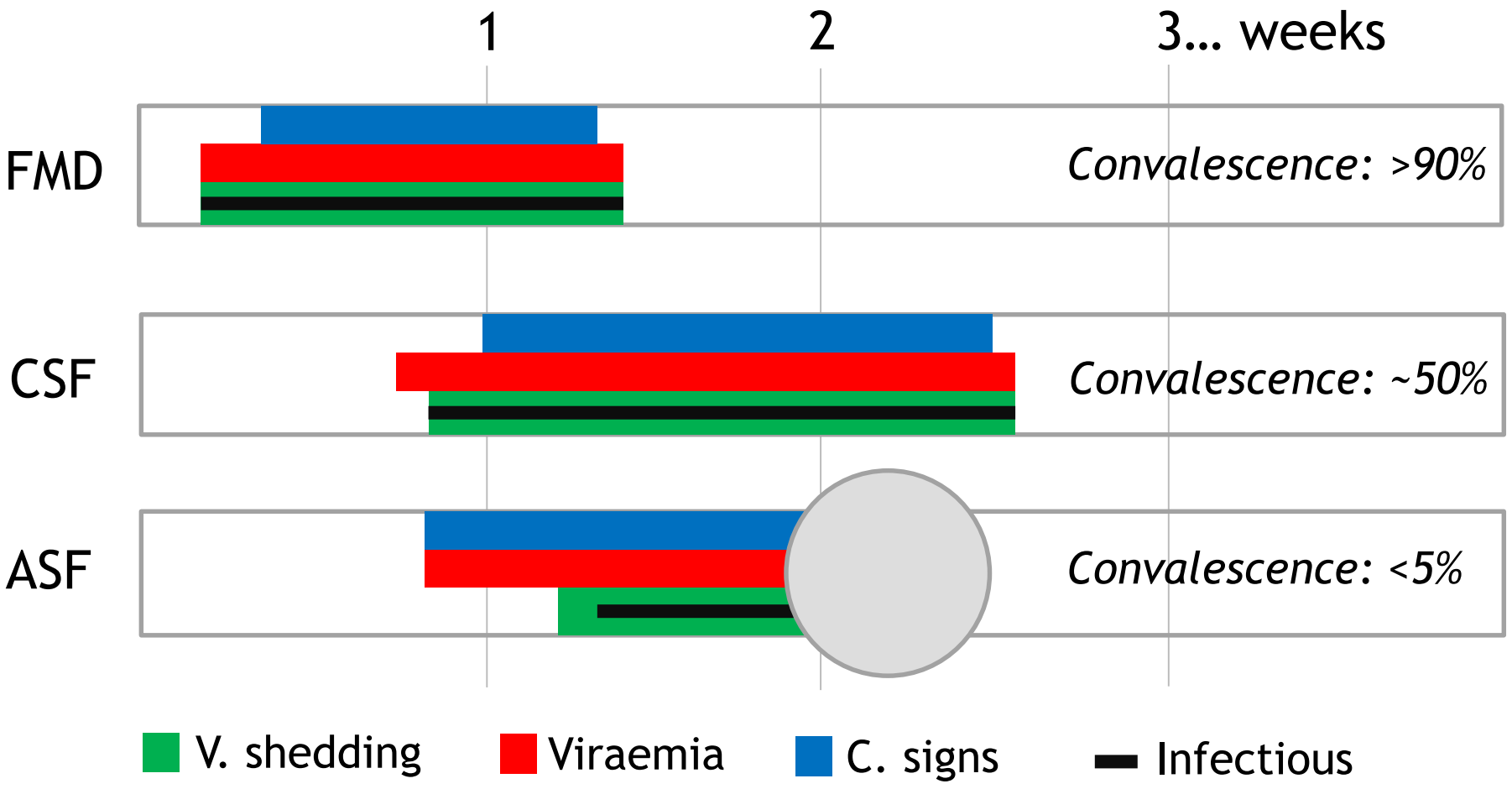
CSF

P: 50%
M: 25%
L: 50%

Contagiousity: ++

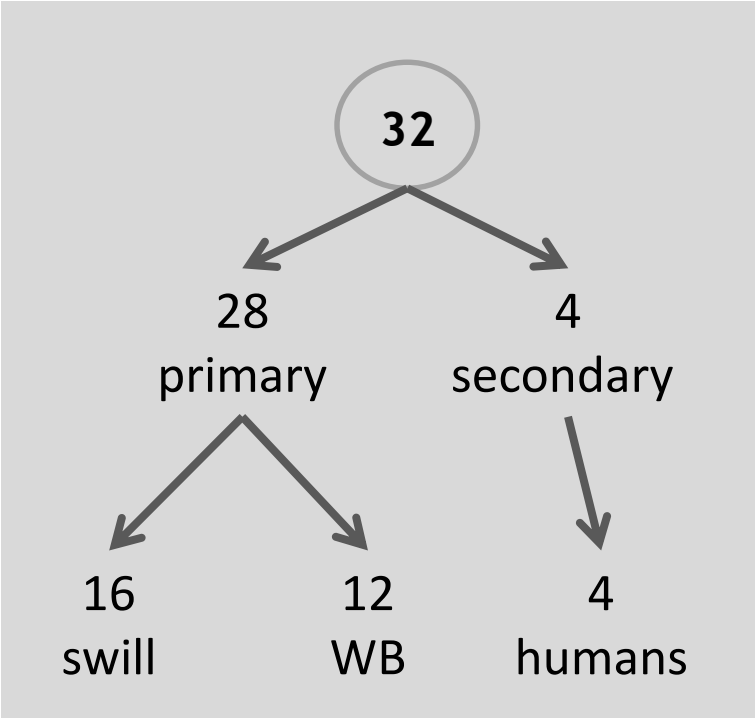
ASF - CSF - FMD

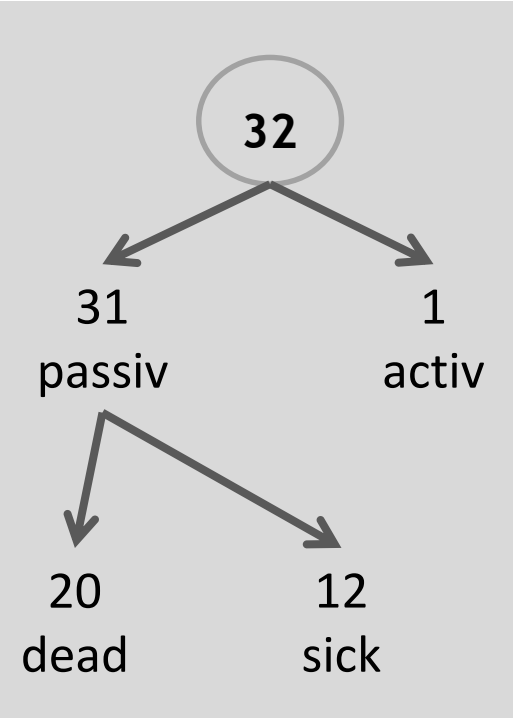
FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



ASF outbreaks in Latvia in 2014

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health





Field observations

(Oļševskis et al., 2015)

12 %

69 / 585 = 0,12 (12%)

Probability of infection

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

within a group (within stable)
high virus dose (>1000 HAU)
parenteral transmission

HIGH

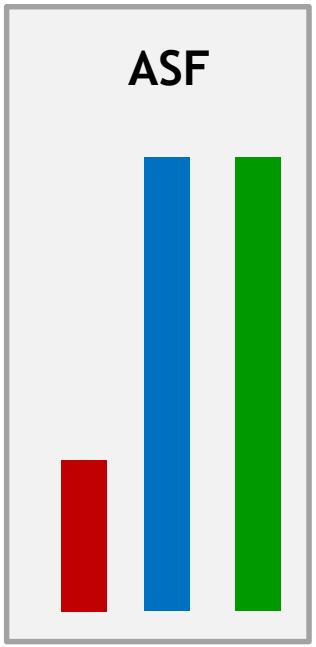
Contagiousity

LOW

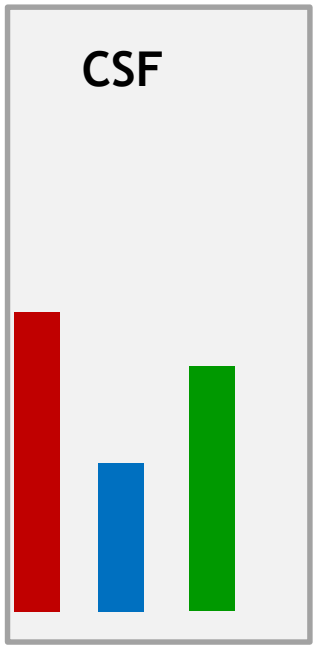
between groups (open system…e.g. forest)
low virus dose (<100 HAU)
oral transmission

Summary

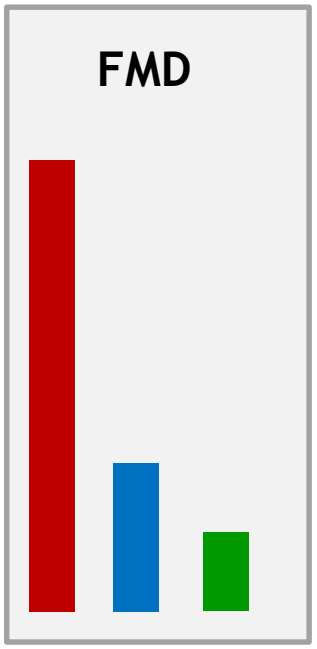
FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



Endemic situation, slow spread, does not fade out



Fades out after reducing susceptibles by vaccination



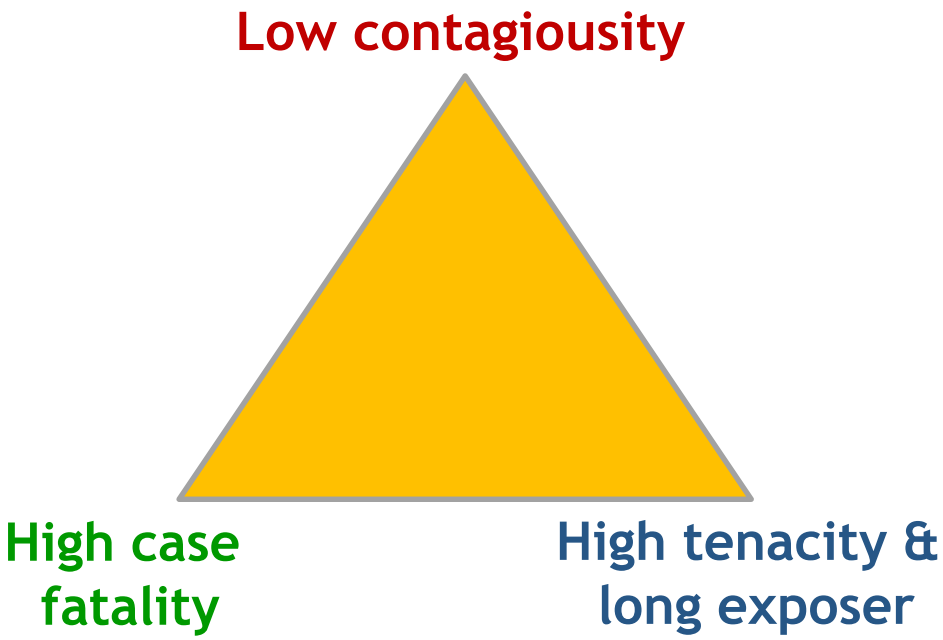
Fades out spontaneously

Conatgiousity
Tenacity
Case fatality

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

Persistency triangle (ASF)

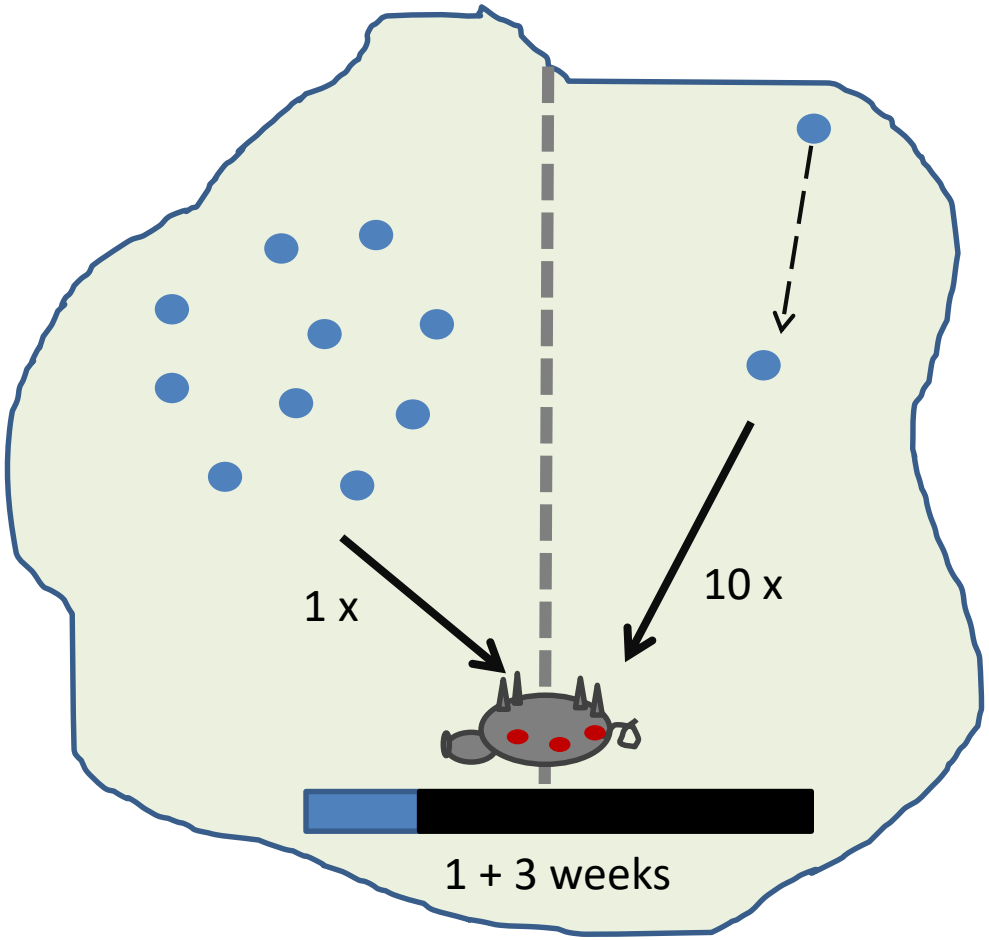
FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



Low conatgiousity: only few animals get infected
High case fatality: very few survivors & insufficient immunological protection
High tenacity: long time survival of virus in the environment, long exposer time

Exposure opportunity

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



?

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

Lessons learned in recent years

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

- **ASF is not a highly contagious disease**
- **ASF in WB is a habitat disease**
- **ASF is a "slow" disease**
  - ASF did not fade out: NO implosion
  - ASF did not spread rapidly (Rabies-like…) NO explosion
  - Lethality high (>90%)
  - Starting mortality low (<5%)
  - Prevalence low (<5%)
  - Not necessarily a density dependent process

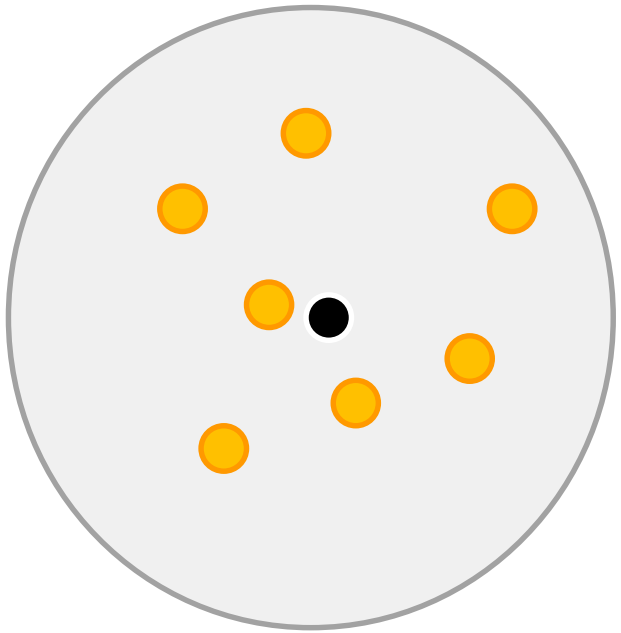
Endemic in the region, slow spread

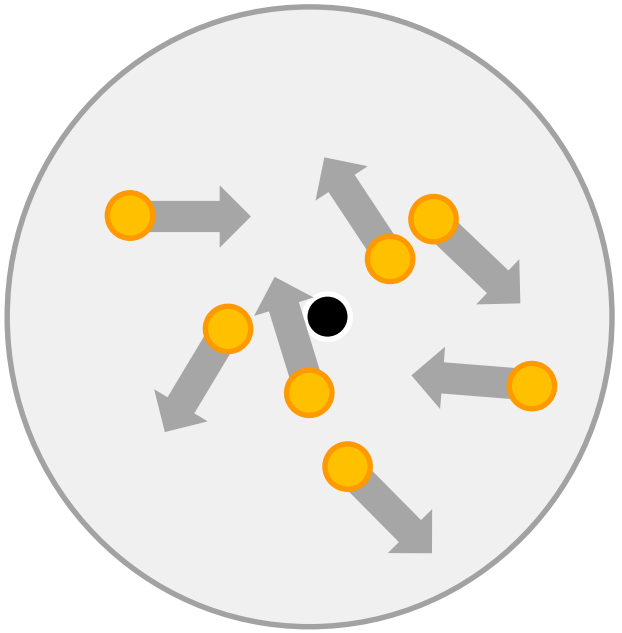
It changed the understanding of ASF

Exposure opportunity

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

Marbles in motion





Contact rate +

Contact rate +++

Passive surveillance for DP and WB

5/95 surveillance concept is not purposeful

Active surveillance gives a false sense of security

Early detection of ASF in wild boar

Passive surveillance vs. active surveillance

	tested	positive	% positive
Passive (found dead)	245	177	***72.24***
Active (hunted)	2765	40	***1.45***
		217	

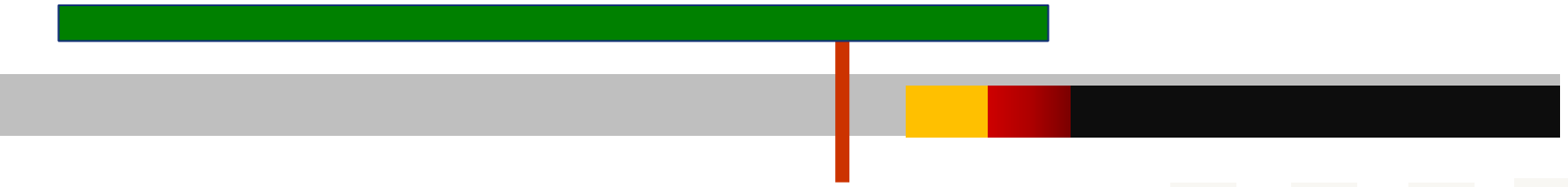
Passive / Active: 72.24 / 1.45 = 49,82

*The probability to detect an ASF positive case is **50** times higher in dead animals than in hunted animals*

***81 out of 100** positive cases are likely to be detected in **dead** wild boar*

(177 / 217 x 100 = 81)

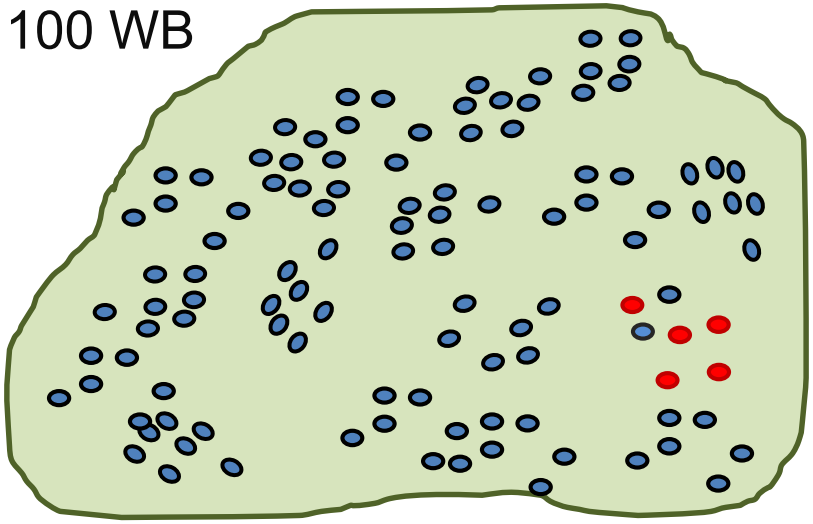
Period during which a WB can be hunted



0 1 2 *1* *2* *3* *4*

<1 week (PCR +)

Targeted diagnosis, > 4 weeks (PCR +)



5 of 100 infected (5%)

5/95-Concept

<u>On the day of sampling</u> 5 out of 100 WB (5%) are incubating ASFV. To find at least 1 positive WB 45 have to be sampled same day (95% confidence)!

(Prevalence of 2% -> 78 WB have to be sampled (1% … 96 WB…)

Epidemiological enquiry

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

1. **The epidemiological enquiry shall aim to:**

   a. identify the likely origin of the disease and the means of its spread;

   b. calculate the likely length of time that the disease has been present **(High Risk Period);**

   c. identify establishments and epidemiological units therein, food and feed businesses or animal by–products establishments, or other locations….;

   d. obtain information on the movements of animals, persons, products, vehicles, etc. which could have spread the disease agent during the relevant period preceding the notification *(High Risk Period);*

   e. obtain information on the likely spread of the disease in the surrounding environment, including the presence and distribution of disease vectors.

Epidemiological farm investigations

A) Postulate different hypothesis
B) Address each hypothesis separately
C) Exclude hypothesis one by one

Hypothesis for:

- **Way of entrance**: How (by which ways) did the pathogen entered the holding
  - ***Biosecurity check***
- **HRP:** When did the pathogen entered the holding (date of entrance)

Epidemiological road map

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

Hypothesis

Likely origin - way of entrance

H1: Trade of pigs
H2: Contact with wild boar environment
H3: Swill, contaminated food
H4: Others (people, vehicles, instruments…)
H5: Vectors (ticks, insects, ???)
H6 …

HRP
Date of entrance

H1: <50: 1w
H2: <150: 2-3w
H3: >150: >4w
H4…

Toolbox

- *Map of farm (village)*
- *Laboratory results*
- *Timeline of clinical events (Vet activities)*
- *Mortality /morbidity data*
- *Record of movements (animal, persons, vehicles, equipment…)*
- *Etc…*

Biosecurity check

- Hardware
  - *Buildings*
  - *Filters*
  - *Fences*
  - *…*
- Software
  - *Management*
  - *Awareness*
  - *…*

Likely escape (secondary infections)

Likely origin - way of entrance

H1: Trade of pigs
H2: Contact with "wild boar"
H3: Swill, contaminated food
H4: others (vehicles, instruments…)
H5 vectors
H6 …

Biosecurity check

- Hardware
  - *Buildings*
  - *Filters*
  - *Fences*
- Software
  - *Management*
  - *Awareness*

Hypothesis	Biosecurity check		Findings	Likelihood
	Hardware	Software		
Wild boar	Building Fence Gates Sanitary filters Disinfectants etc	Personnel Human activities Management Work flow etc	No contacts with wild boar	excluded
Contaminated food			Swill feeding	+++
Trade			No trade	excluded
Fomites			No sanitary filters	++
Vectors (ticks)			No vectors	excluded

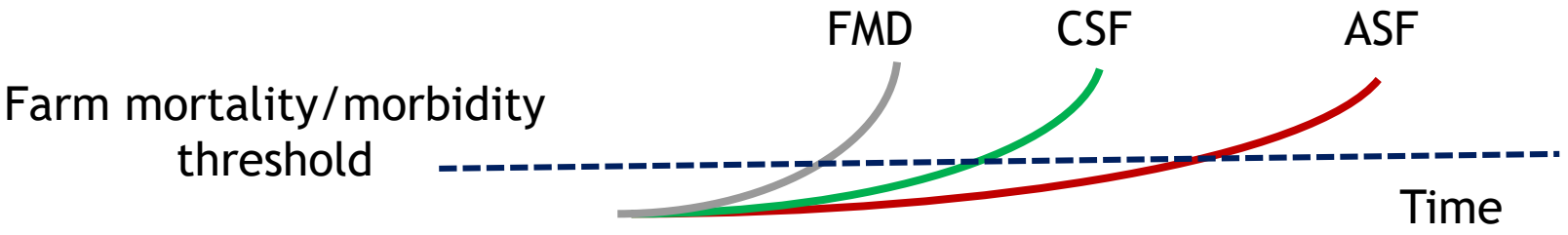
Hypothesis approach: HRP

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

Farm size	HRP
Small/back yard (<50)	1 week
Medium/small commercial (<150)	2-3 weeks
Large /industrial (>150)	> 4 weeks

High Risk Period (HRP)

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health



Low contagiousity => low (initial) mortality

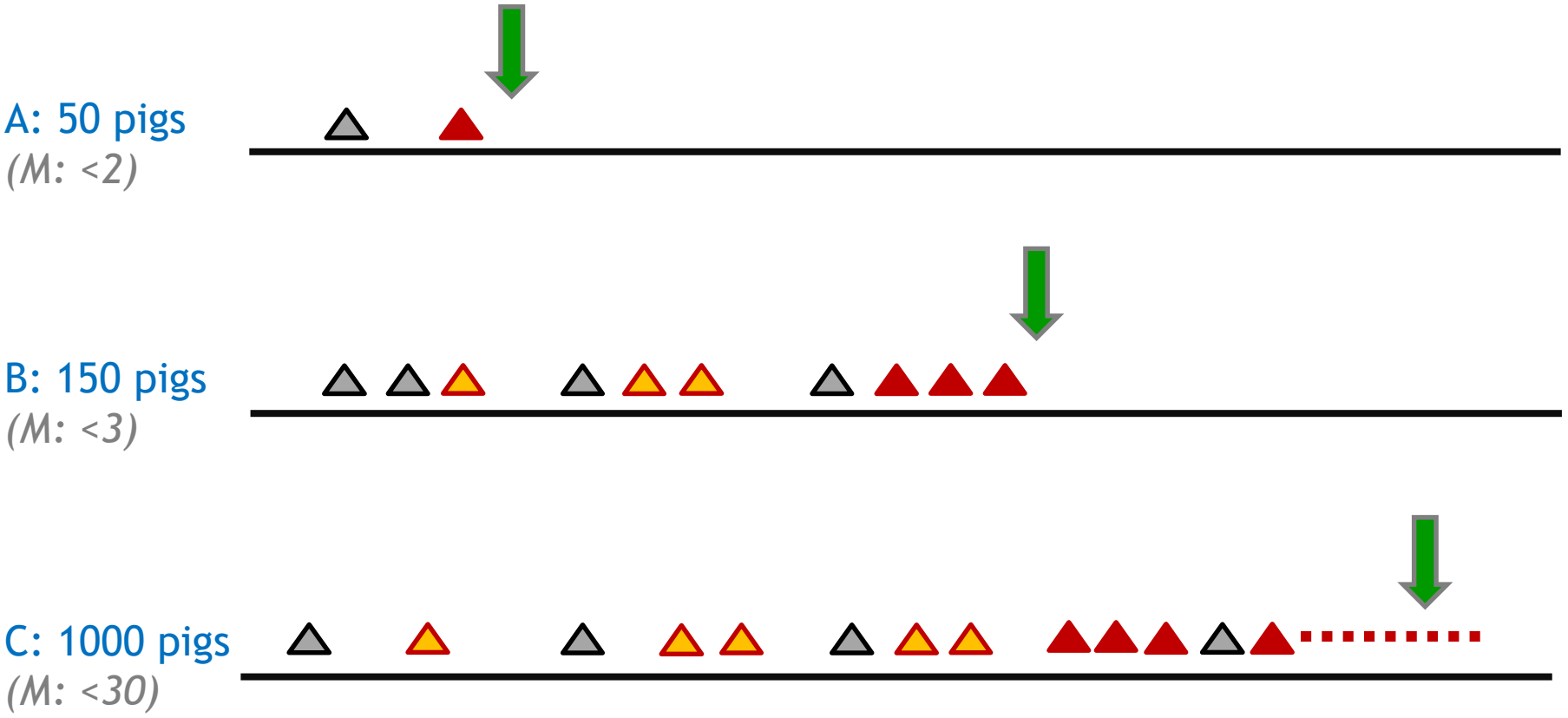
ASF remains undetected in large pig farms (below the normal mortality threshold)

HRP -> farm size

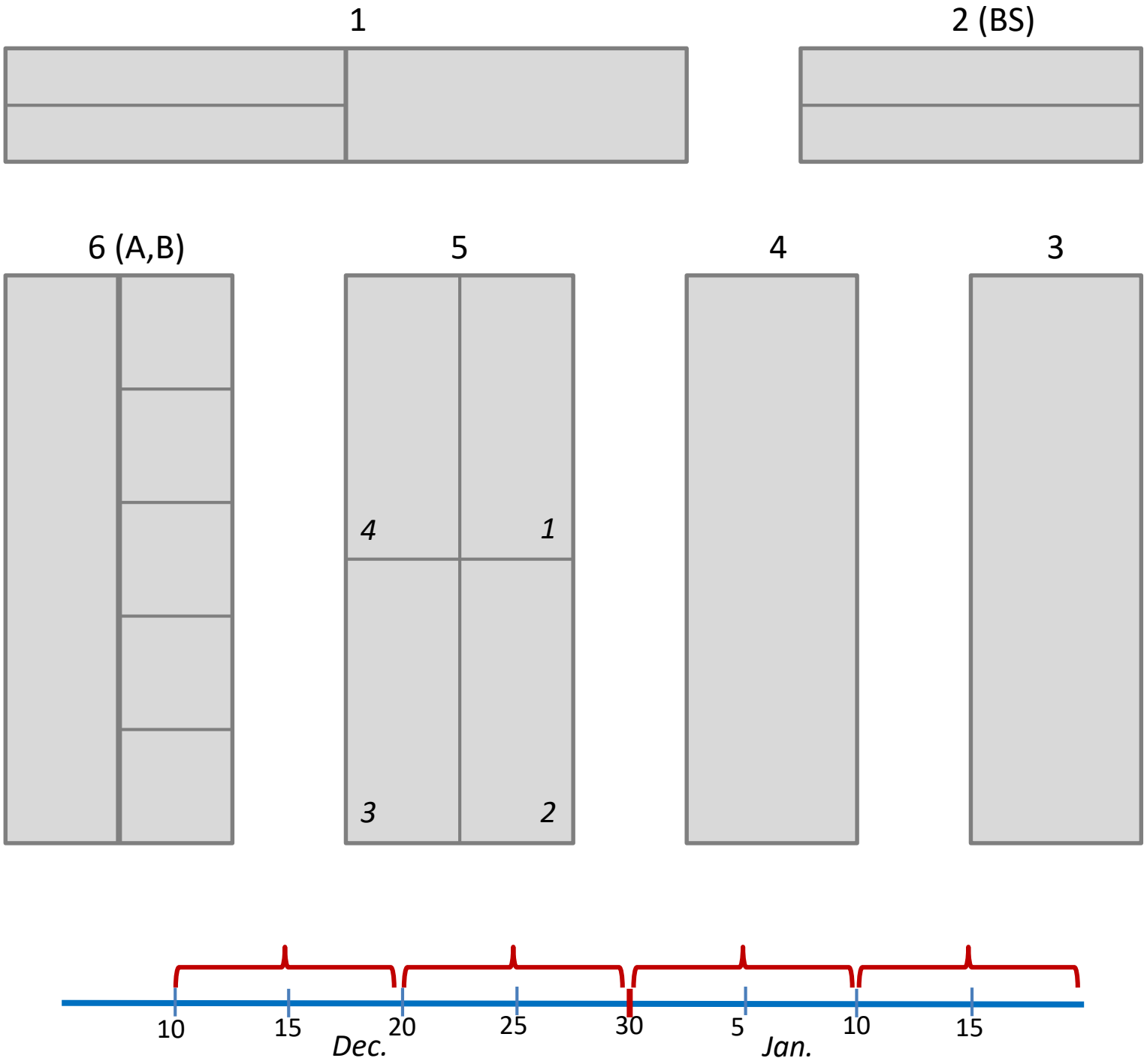
- *back yard: rather short*
- *large farm: rather long*

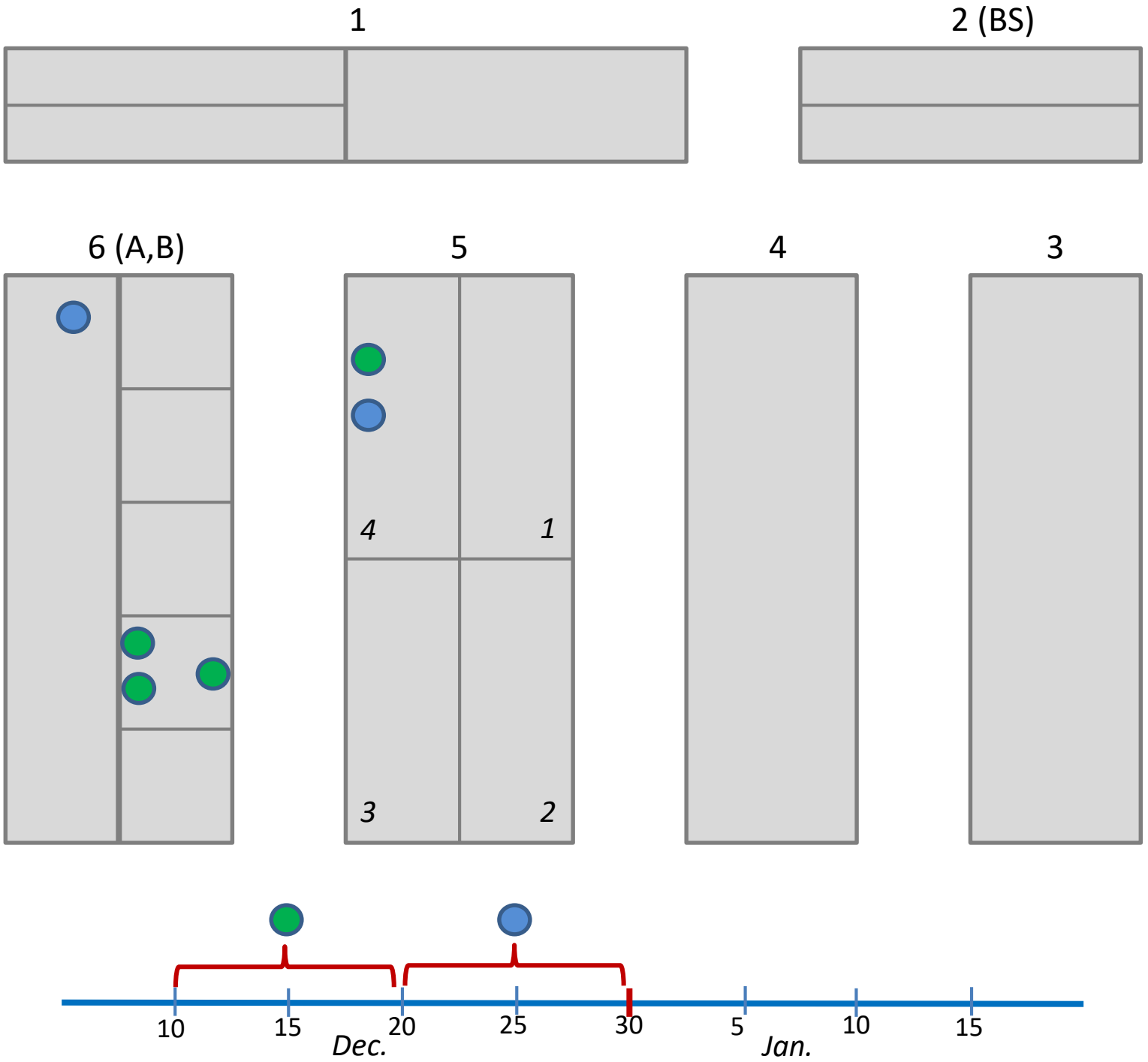
Farm mortality 3%/week

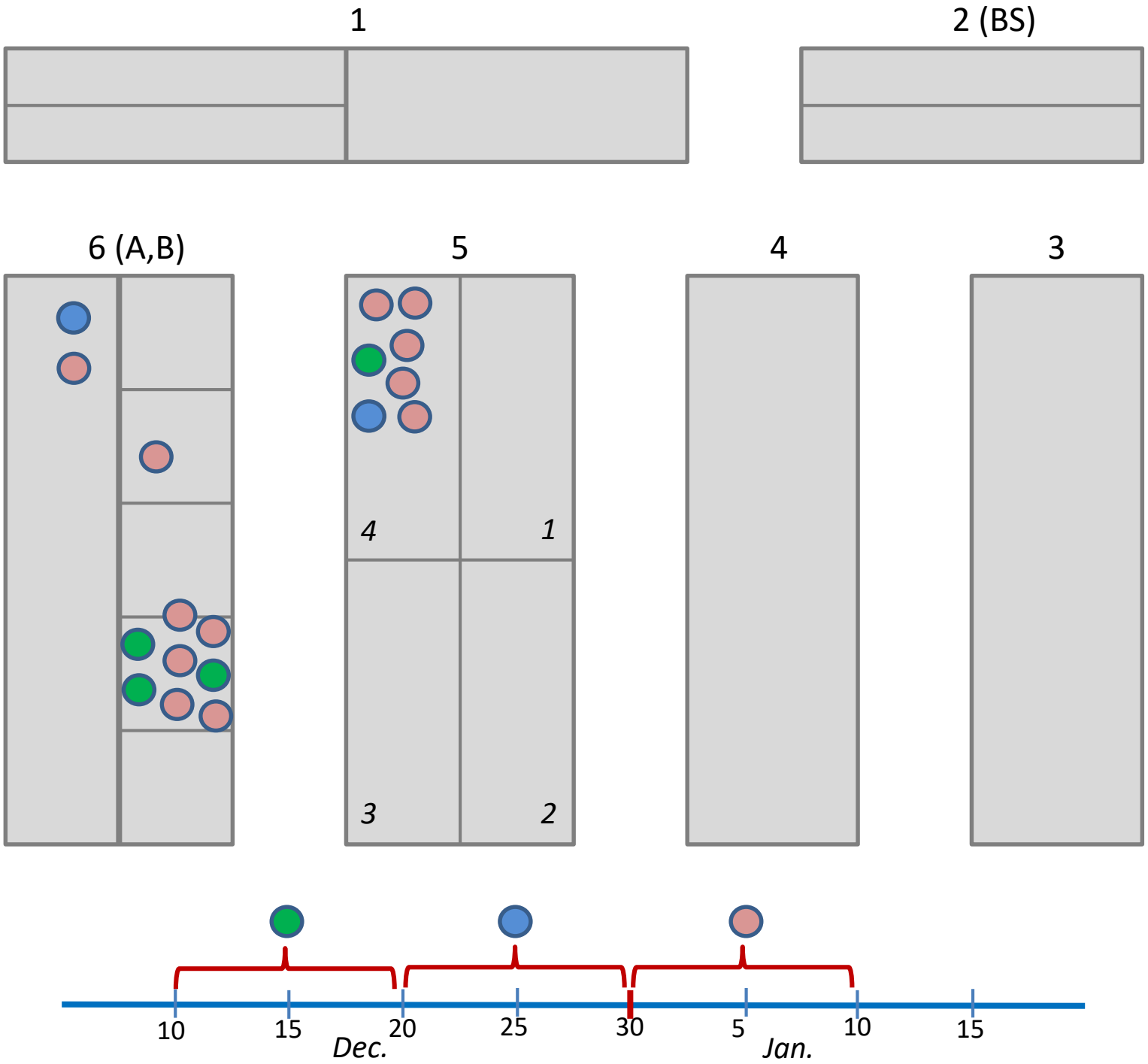
FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

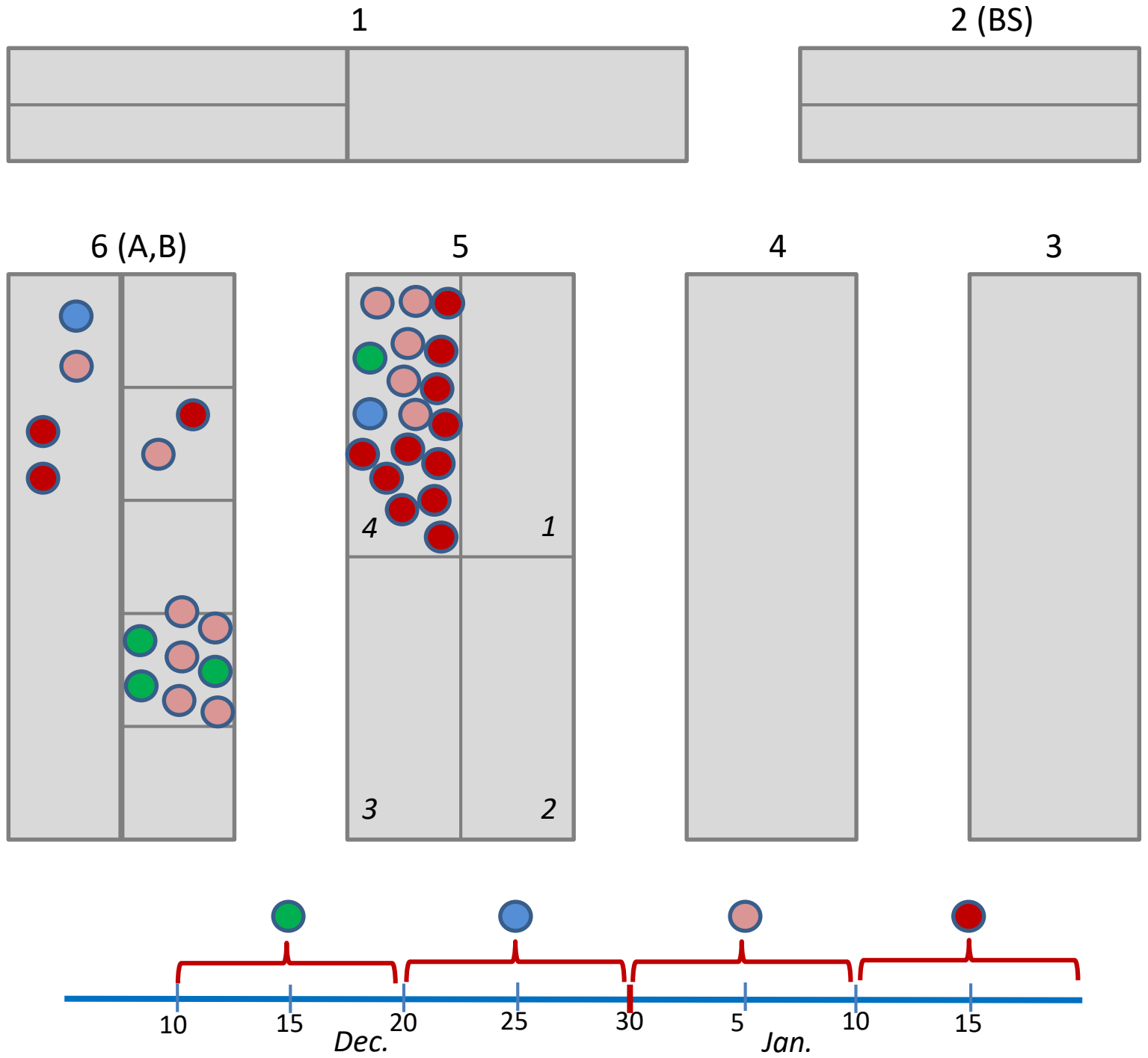


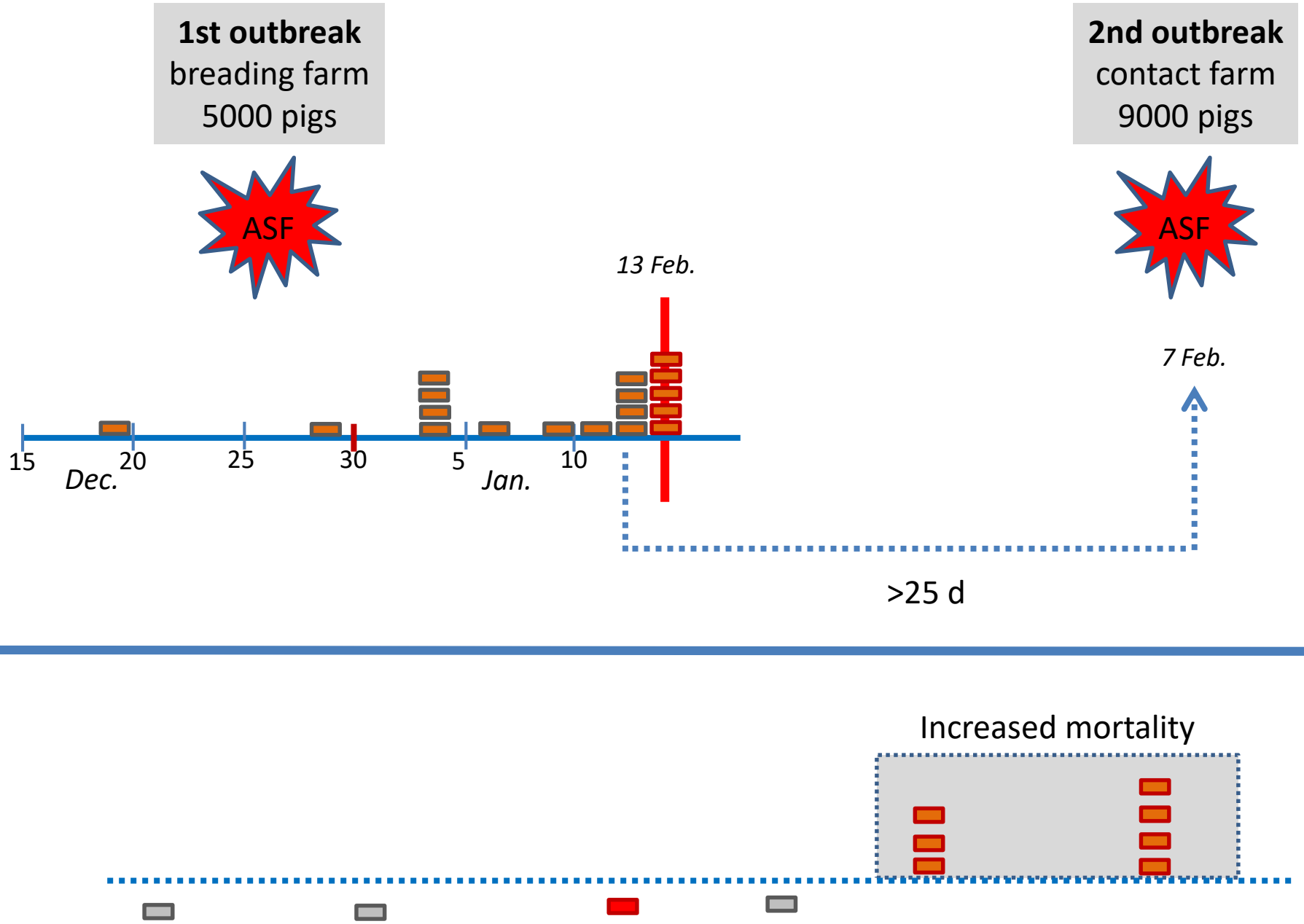
HRP => size of epidemiological unit


1
2 (BS)
6 (A,B)
5
4
3
4
1
3
2
10
15
20
25
30
5
10
15
Dec.
Jan.


1
2 (BS)
6 (A,B)
5
4
3
4
1
3
2
10
15
20
25
30
5
10
15
Dec.
Jan.


1
2 (BS)
6 (A,B)
5
4
3
4
1
3
2
10
15
20
25
30
5
10
15
Dec.
Jan.


1
2 (BS)
6 (A,B)
5
4
3
4
1
3
2
10
15
20
25
30
5
10
15
Dec.
Jan.


1st outbreak
breading farm
5000 pigs
ASF
2nd outbreak
contact farm
9000 pigs
ASF
13 Feb.
7 Feb.
15
20
25
30
5
10
Dec.
Jan.
>25 d
Increased mortality

Biosecurity

the most effective control tool

The only potent tool we have...

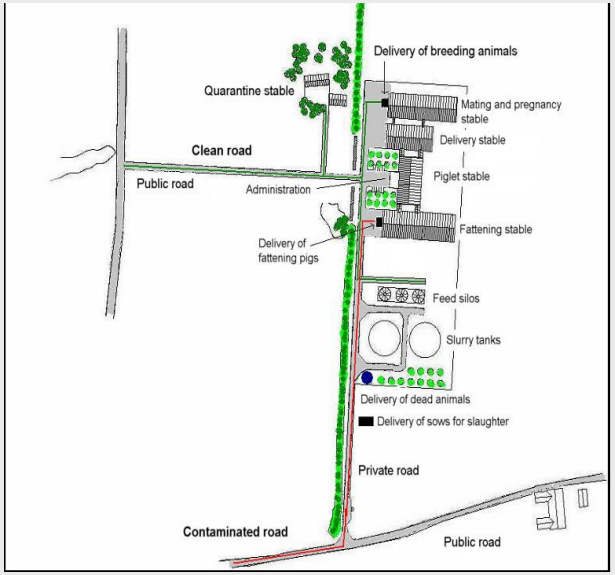
- *Africa - double fencing*
- *Three golden rules of biosecurity*

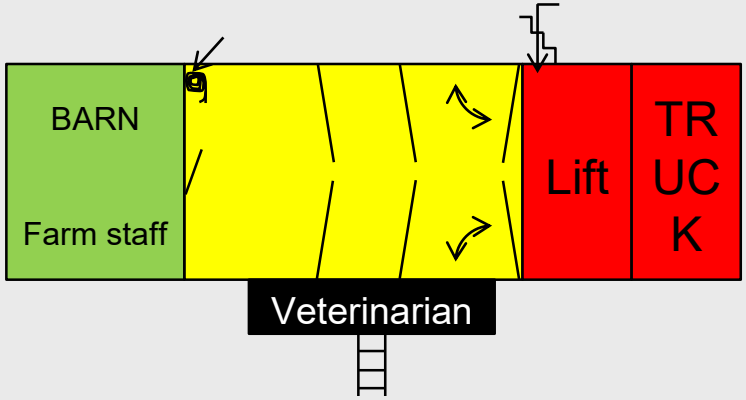
Biosecurity

Hardware

Software

(Mindset/Philosophy)





J. Westergaard

Good news (domestic pigs): no (rapid) spread of the disease

ASF in domestic pigs can be controlled effectively by good biosecurity!!!

Bad news (wild boar): no (rapid) spread of the disease

ASF in wild boar survives locally over months or years in wild boar populations (a habitat disease)

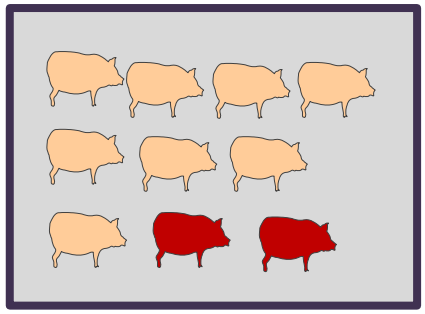
ASF control and eradication

FRIEDRICH-LOEFFLER-INSTITUT
FLI
Bundesforschungsinstitut für Tiergesundheit
Federal Research Institute for Animal Health

Key characteristics of ASF:

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

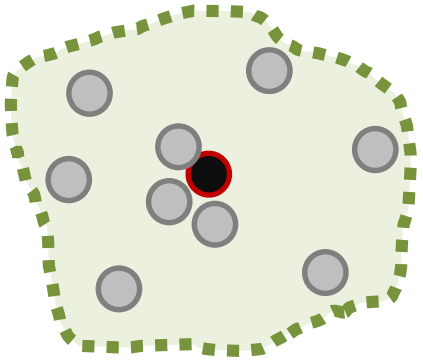
DP: stable disease



Measures:
1. Standstill
2. Culling
3. C&D

Successful approach!!

WB: habitat disease



Measures:
1. Standstill (no disturbance of WB, no hunting, electrical fence, (feeding)
2. (Trapping)
3. Disposal of carcasses

"Virtual stable" in forest

Risk assessment on local level (district)

Introduction/release

↓

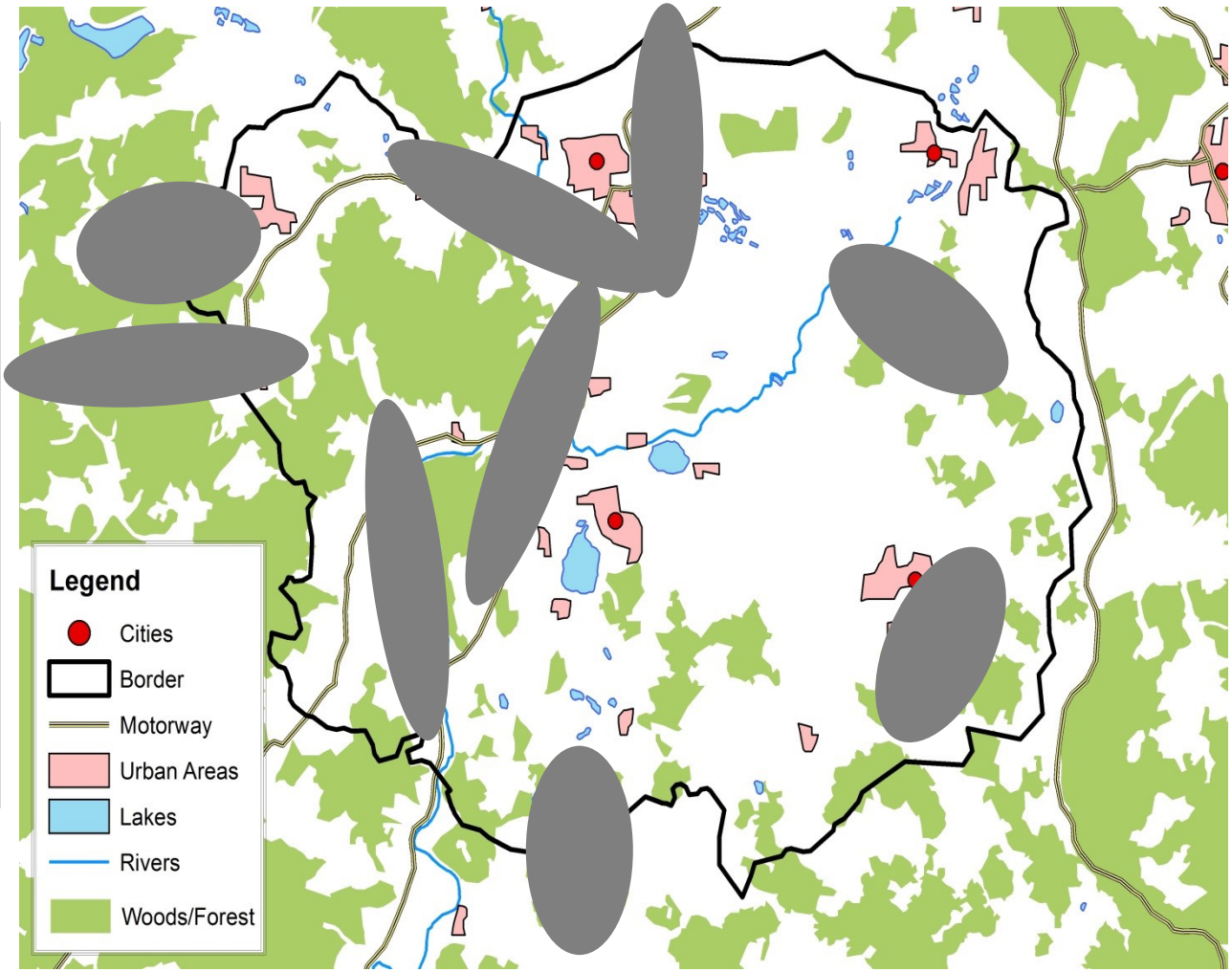
Contact/ primary infection

↓

Secondary infection/perpetuation

↓

Endemicity/spread



Risk areas: „urban “ WB; high WB density; resting areas on highways, etc…

Freedom of disease	Disease is present
Wild boar management measures	**Disease control measures**
e.g. population reduction to avoid agricultural damage	*not wild boar management measures!!!*
e.g. Intensive hunting	Movement restriction Ban of feeding Prohibition of hunting Intensive hunting

Hunting/Slaughtering ⟷ **Culling**