

## Session 2b – Risk Mitigation



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Office National de la Chasse et de la Faune Sauvage  
(National Wildlife & Hunting Agency)  
France

# Acknowledgements

*Thanks to many experts involved*

- EFSA (12<sup>th</sup> December 2008) Annex to The EFSA Journal (2008) 932, 1-18 and 933, 1-16

Control and eradication of Classic Swine Fever in wild boar

[http://www.efsa.europa.eu/en/scdocs/doc/ahaw\\_report\\_csf\\_en.pdf](http://www.efsa.europa.eu/en/scdocs/doc/ahaw_report_csf_en.pdf)



- EFSA (17<sup>th</sup> March 2014) - EFSA Journal 2014;12(3):3616 [23 pp.]

Evaluation of possible mitigation measures to prevent introduction and spread of African swine fever virus through wild boar

<http://www.efsa.europa.eu/en/efsajournal/pub/3616.htm>



- EWDA (European section of the WDA) workshop Uppsala 6-7<sup>th</sup> March 2014

Workshop: African swine fever in wild boar

<https://sites.google.com/site/ewdawebbsite/conferences-meetings>



- OIE and CIC workshop Paris 30<sup>th</sup> June/1<sup>st</sup> July 2014

Early detection and prevention of African Swine Fever

- APHIS, OIE, UC workshop Fort Collins 18-20<sup>th</sup> November 2014

Early detection and prevention of African Swine Fever

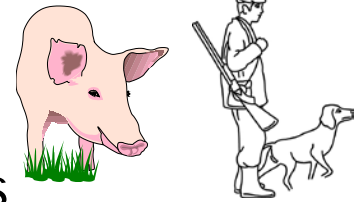


# OUTLINE

## 1. Objectives & options of risk management

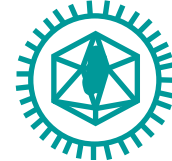
## 2. Managing the interface with target species

→ Farms biosecurity, meat safety, public awareness



## 3. Managing pathogen dynamics

→ Hunting hygiene/viscera, Vaccination



## 4. Managing wildlife populations

→ Reducing Numbers: targeted culling, large scale

→ Limiting the risk of spread: translocation, Feed, fencing



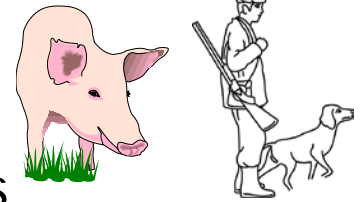
## 5. Conclusions & perspectives

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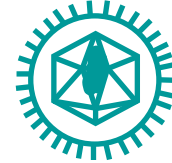
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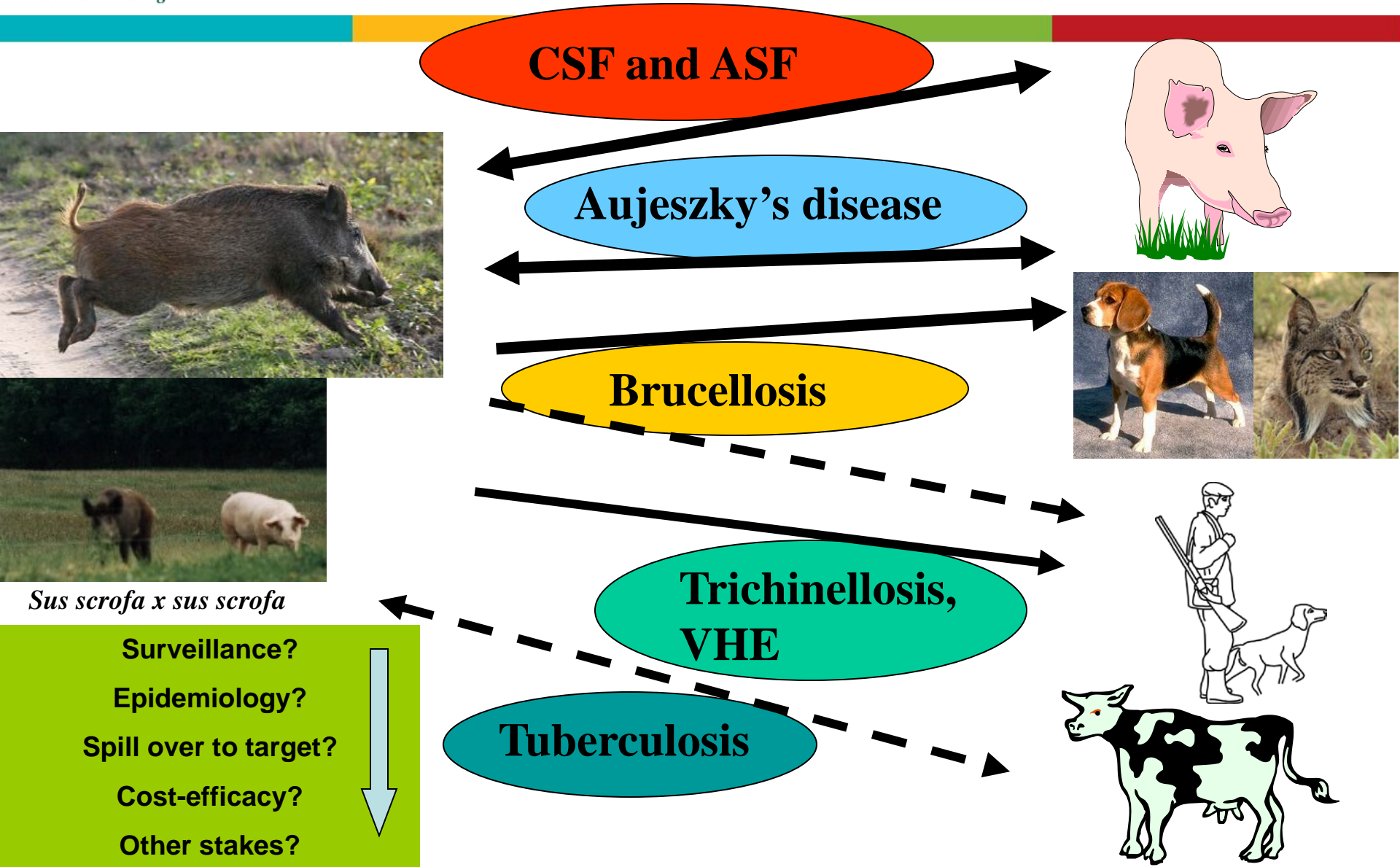
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## 5. Conclusions & perspectives

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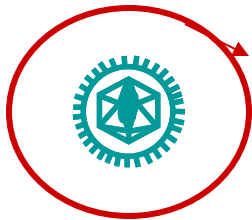
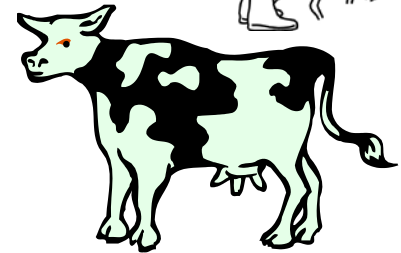
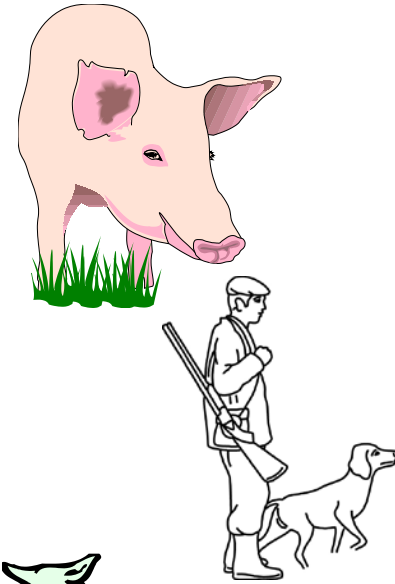


# 1. Objectives & options of risk mitigation



## Interface

Reduce the risk of pathogen transmission to target species...



## Pathogen dynamics

Mitigate spread, prevalence and persistence in wildlife (control/eradiction)

## Population dynamics

Limit disease spread and persistence

Reduce the number of susceptible in order to break the chain of transmission

Population destruction :stamping out

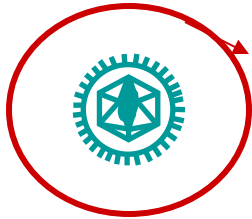
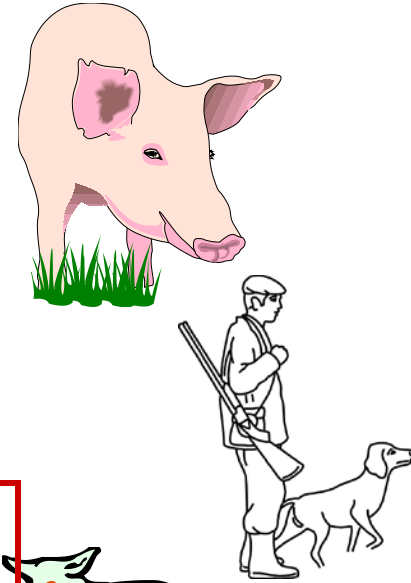


# 1. Objectives & options of risk mitigation



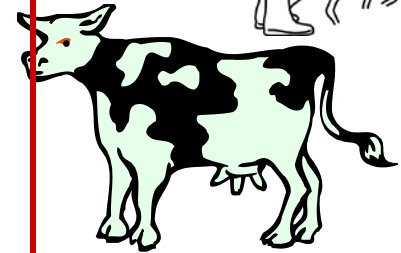
## Interface

- Farms biosecurity
- Hygiene of carcasses
- Public, hunters, farmers awareness



## Pathogen dynamics

- viscera, carcass
- introduction of live animals or trophies
- vaccination



## Population dynamics

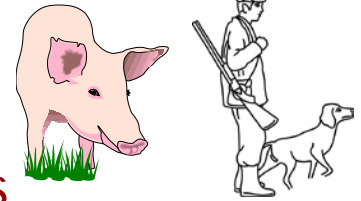
- depopulation
- fencing
- feed ban

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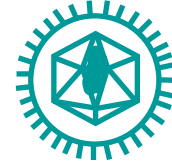
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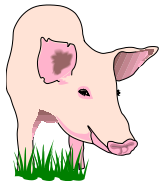
→ Limiting the risk of spread: translocation, Feed, fencing



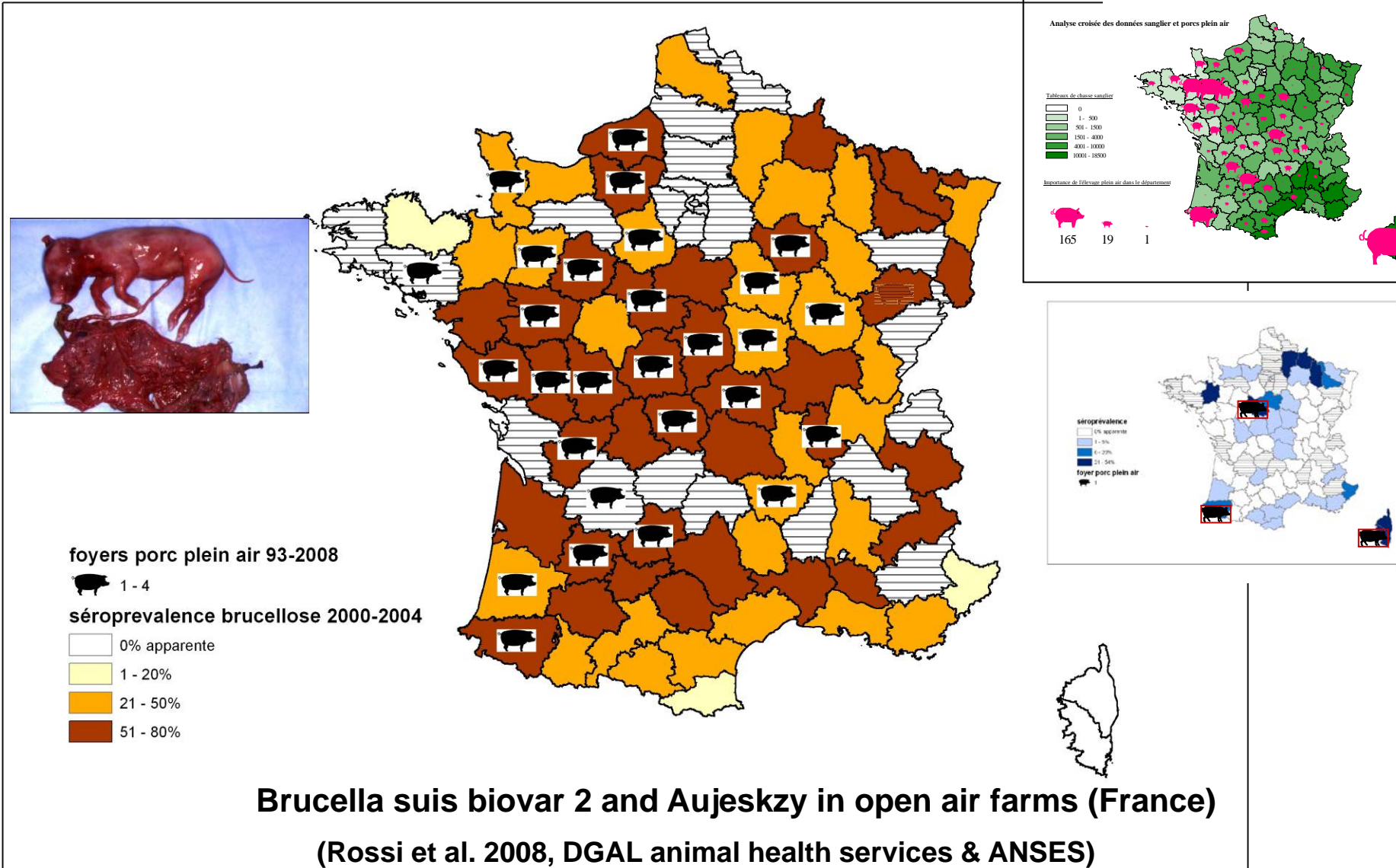
## 5. Conclusions & perspectives



## 2. Managing the interface



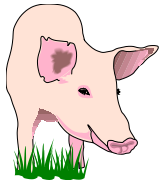
### Agricultural biosecurity



**Brucella suis biovar 2 and Aujesky in open air farms (France)**

**(Rossi et al. 2008, DGAL animal health services & ANSES)**

## 2. Managing the interface

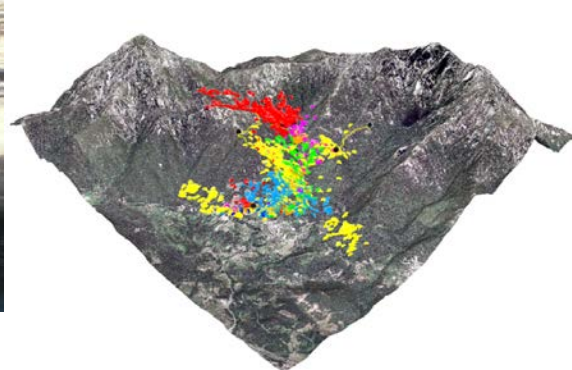


### Agricultural biosecurity



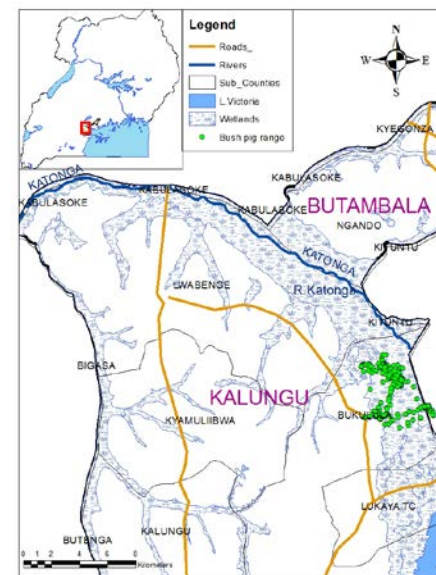
- Compulsory screening of reproducers
- Fences as a condition of compensation in case of outbreaks (from 2005...limited efficacy)
- Questionnaires to farmers (DGAL) → fences of reproductive sows





Ferran Jori, UPR AGIRS, CIRAD  
 GARA Meeting, Pretoria 10-14th, Novembre 2014

## Assessment of wild boar / domestic pig interactions through the use of questionnaires in Corsica



### Role of wildlife in Uganda

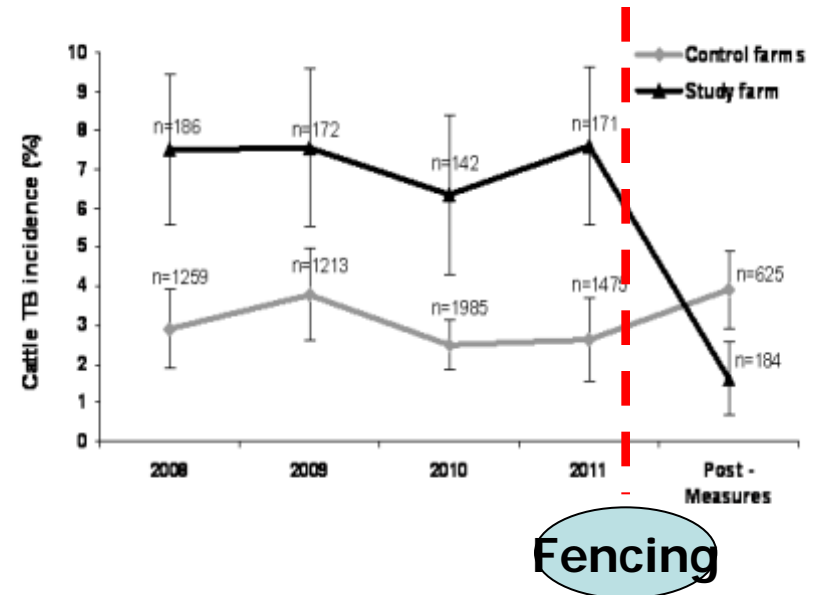
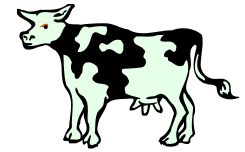
(Suiform newsletter,  
 C. Masembe pers com)

**Understanding the dynamics and spread of African swine fever virus at the wildlife-livestock interface: insights into the potential role of the bushpig, *Potamochoerus larvatus***

K Ståhl<sup>1,2</sup>, P Ogweng<sup>3</sup>, E Okoth<sup>4</sup>, T Aliro<sup>3</sup>, D Muhangi<sup>3</sup>, N LeBlanc<sup>1</sup>, P Atimnedi<sup>5</sup>, M Berg<sup>2</sup>, R.P. Bishop<sup>3</sup>, H.B. Rasmussen<sup>6</sup> and C Masembe<sup>2,5</sup>

# 2. Managing the interface

## Agricultural biosecurity

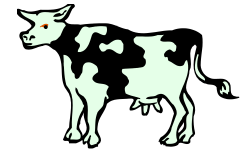


Data shows a decreasing trend in cattle TB incidence, after separating cattle from wildlife at the waterholes

Barasona et al. 2013. Effectiveness of cattle operated bump gates and exclusion fences in preventing ungulate multi-host sanitary interaction. *Prev Vet Med* 111: 42-50

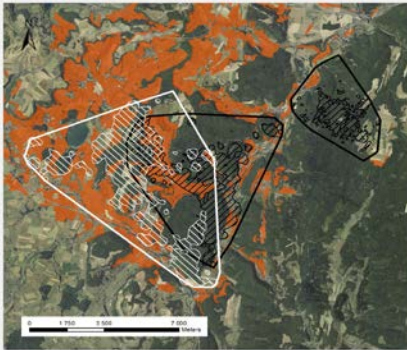


# 2. Managing the interface

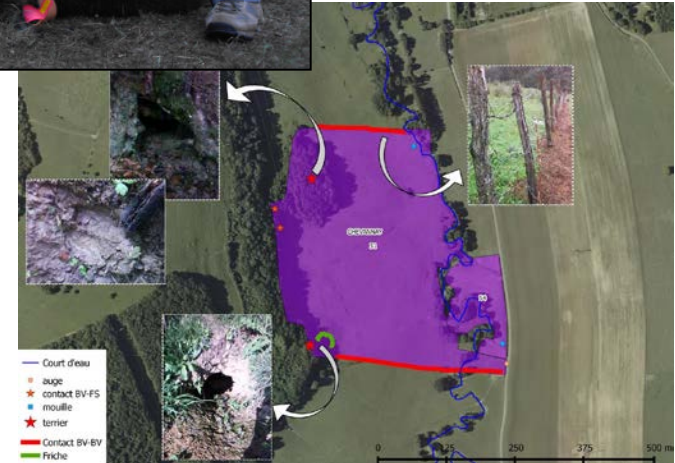


## Agricultural biosecurity

### TB in France



(source: ONCFS)



Source: CIREV



- PHD 2011-2014: identification of key factors of contacts (ONCFS, Payne, 2014)
- Operational program (regional vet services): pasture vulnerability (CIREV)

## 2. Managing the interface

### Meat & Hunting biosecurity



- Carcass inspection by vets (+trichinellosis)
- Hunters training to self protection and detection of anomalies (TB)
- Public awareness (sanitary hazard, cook meat & viscera)
- Dogs / consumption of viscera & meat

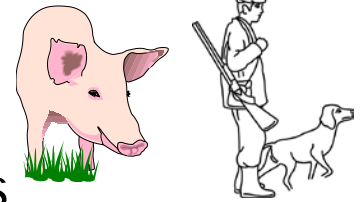


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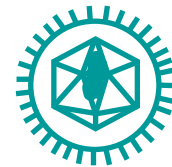
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## 5. Conclusions & perspectives

# 3. Managing pathogen dynamics

## Viscera/carcass collection and destruction



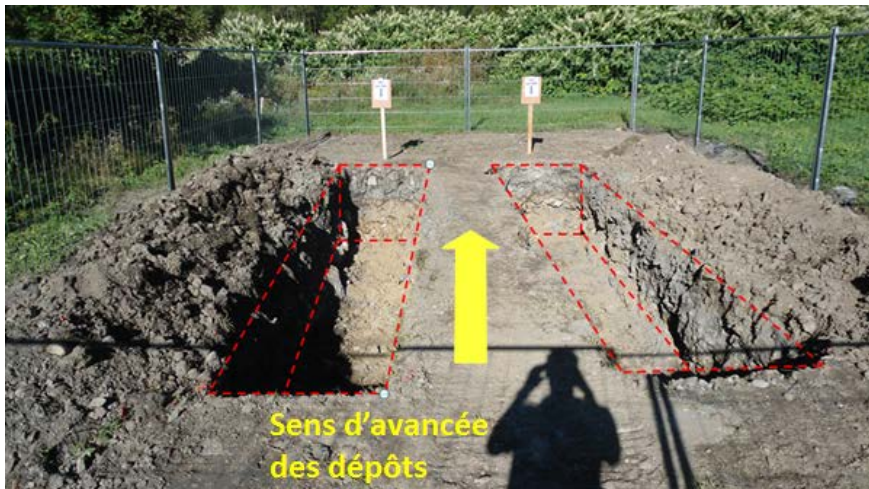
### To collect and destroy in specialized facilities

- Not easy to perform
- Safety of transportation and storage?
- Saturation of the local storage solutions
- Costly (who pays?)



# 3. Managing pathogen dynamics

## Viscera/carcass collection and destruction



### Local destruction/inactivation

- big initial investement (hunters)
- practicaibility studies running
- deployment in several regions

(Eva Faure,  
National French Hunters Federation)

# 3. Managing pathogen diversity

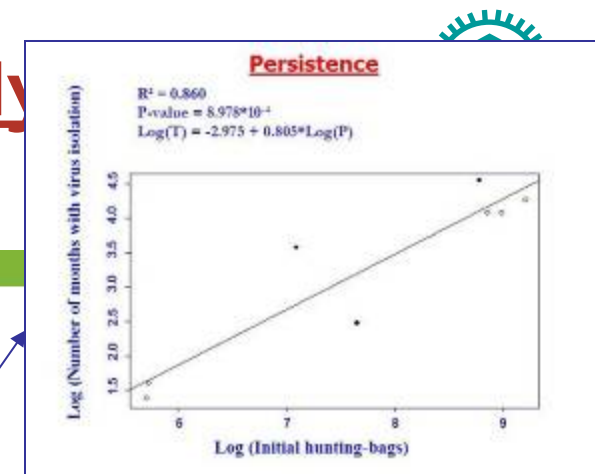
## Vaccination

### CSF In Europe

- Impact on pig farming and trade
- Wild reservoir: low virulent strain and large populations
- Management in pig # wild boar

### Oral mass vaccination (OMV)

- Old but efficient live-vaccine: C strain
- Oral baits and deployment (1-3\*40 baits/km<sup>2</sup>)
- Efficacy in theory and field
- Efficacy of baiting (food availability, age classes)
- Confusing effect on monitoring



Veterinary Microbiology 77 (2006) 250–252



Veterinary Microbiology  
 (journal homepage: www.elsevier.com/locate/vetmic)



Oral immunisation of wild boar against classical swine fever: evaluation of the first field study in Germany

V. Kaden<sup>a</sup>, E. Lange, U. Fischer, G. Strebelow

Preventive vaccination contributes to control classical swine fever in wild boar (*Sus scrofa* sp.)

S. Rossi<sup>a,\*</sup>, F. Pol<sup>a</sup>, B. Forrer<sup>a</sup>, N. Masse-provin<sup>a</sup>, S. Rigaux<sup>a</sup>, A. Bronner<sup>a</sup>, M.-F. Le Portier<sup>b</sup>

Efficiency of spatio-temporal vaccination regimes in wildlife populations under different viral constraints

Veterinary Research 2012, 43:37 doi:10.1186/1297-9716-43-37

Martin Lange (martin.lange@ufz.de)  
 Stephanie Kramer-Schadt (kramer@izv.berlin.de)  
 Hans-Hermann Thulke (hans.thulke@ufz.de)

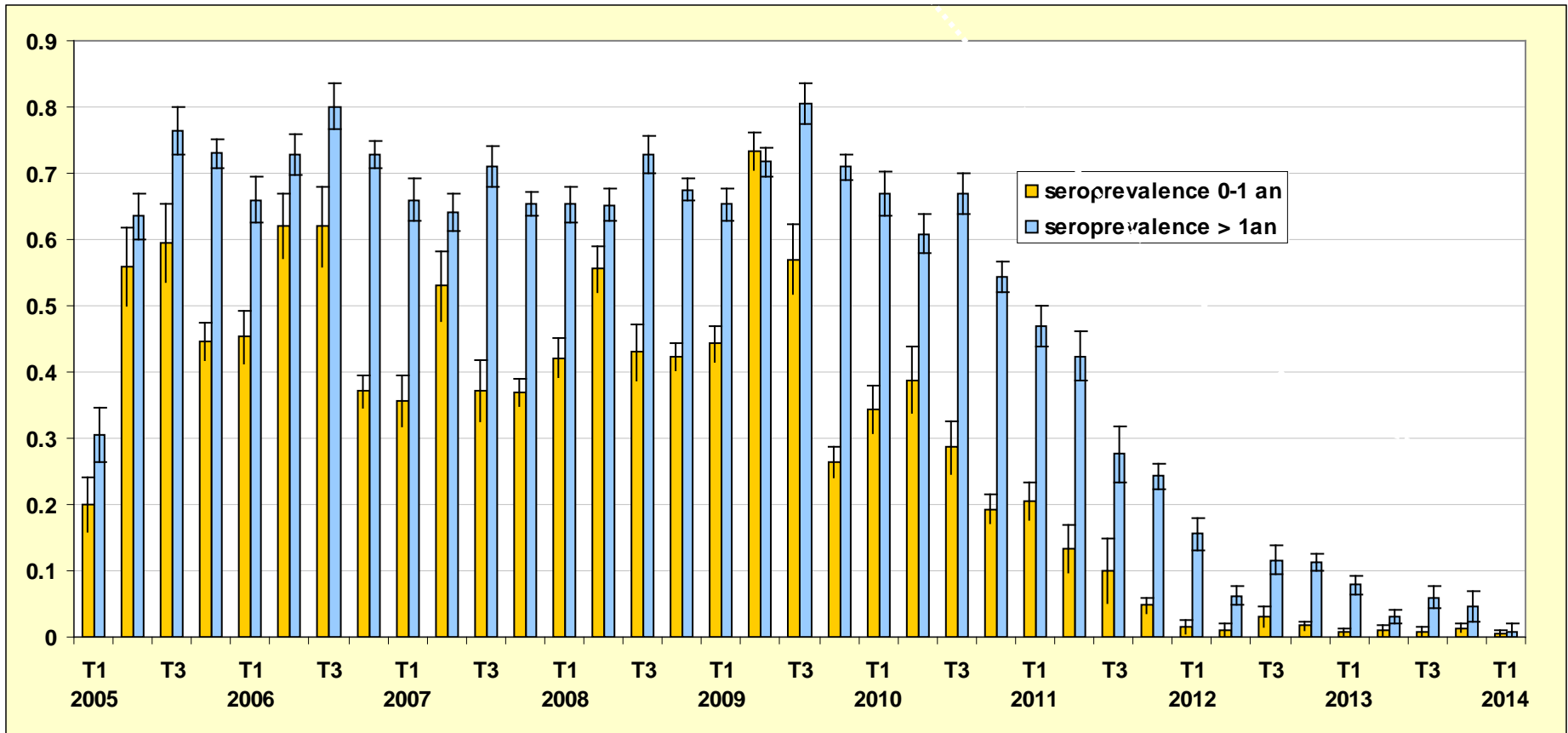




# 3. Managing pathogen dynamics

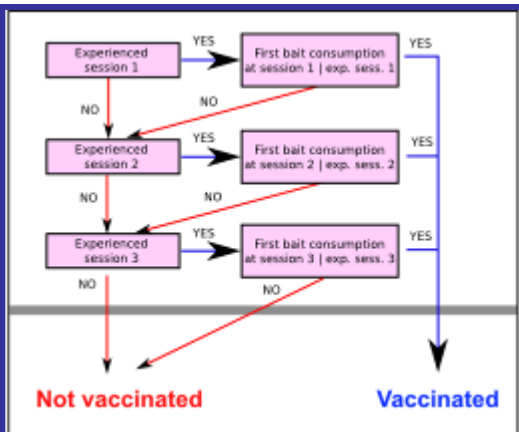
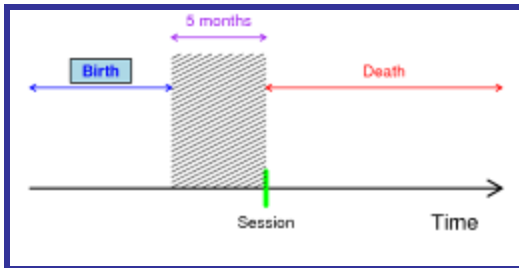
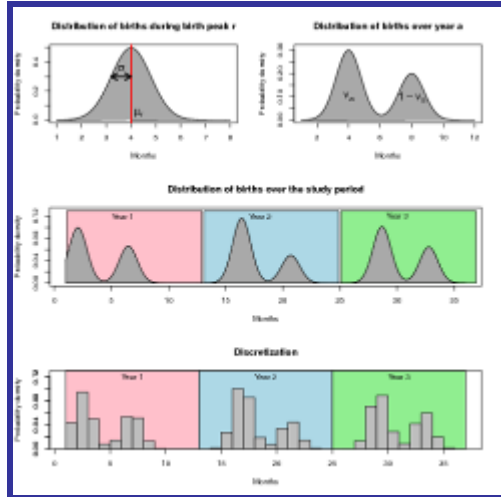


## Vaccination

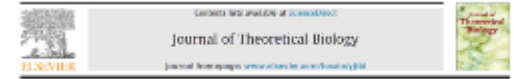
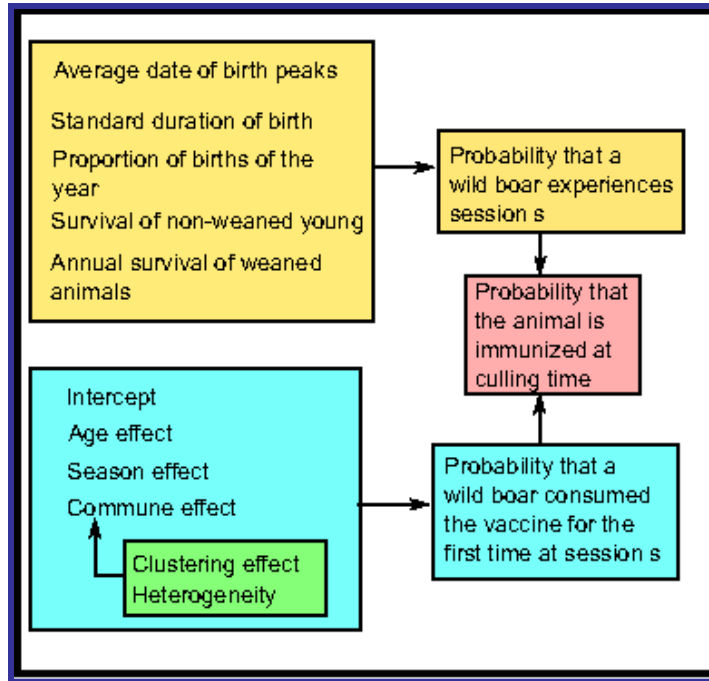


# Modelling during OMV

## Hypotheses a priori



## Bayesian model



Bayesian modelling of hunting data may improve the understanding of host-parasite systems: Wild boar diseases and vaccination as an example

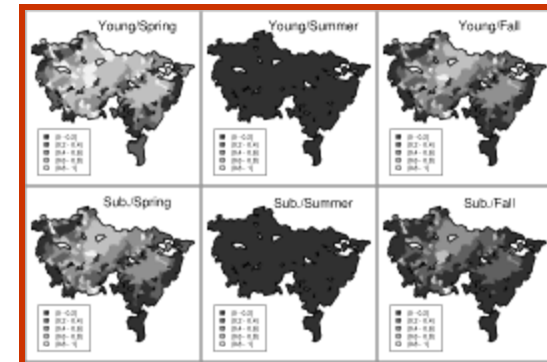
Clément Galergé<sup>1\*</sup>, Sophie Rossi<sup>2</sup>  
<sup>1</sup>UMR 5175 Institut de Biologie et de Santé animale, Université de Bourgogne, BP 20177 21078 Dijon Cedex, France  
<sup>2</sup>UMR 5175 Institut de Biologie et de Santé animale, Université de Bourgogne, BP 20177 21078 Dijon Cedex, France

Observed data :  
 hunted wild boar  
 (2007-2010) ~ 30 000

*Iterative process between observed data and model*

a posteriori distribution of the probability of 1<sup>st</sup> immunisation

seroconversion of piglets out of the vaccination periods

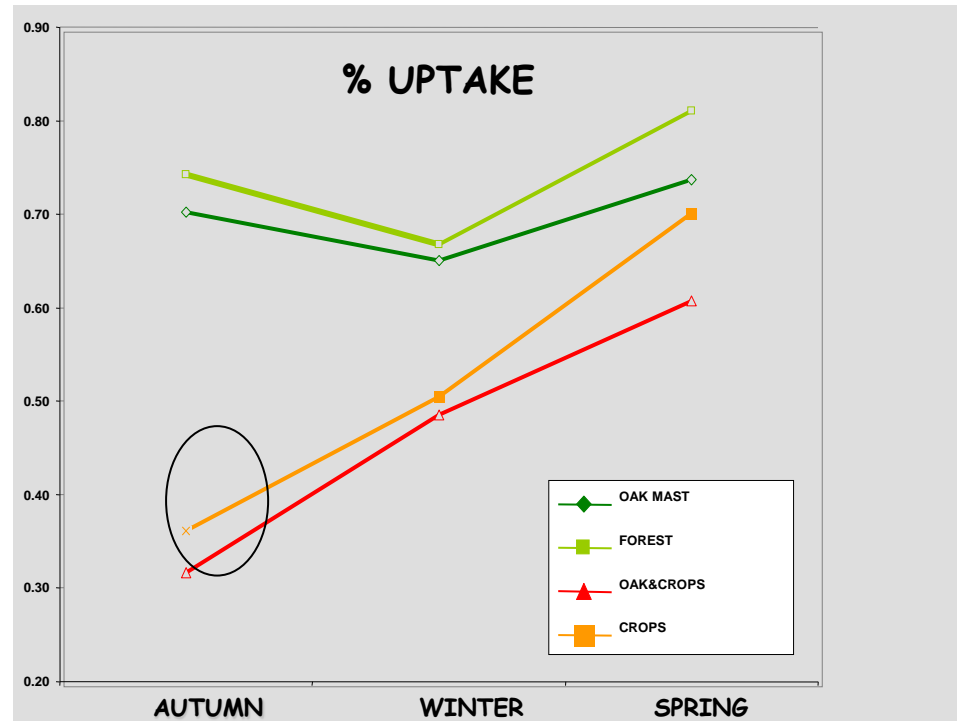
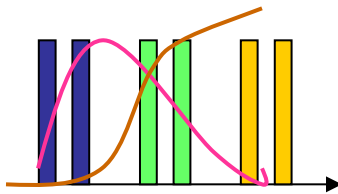


# 3. Managing pathogen dynamics

## Vaccination

- Questionnaire to hunters

- o Number of questionnaires and participation: 8613 (559 hunters)
- o Major problems: cold in wintertime, no wild boar
- o Factors of heterogeneity: **season\*(crops + oak mast)** → « border effect »







# 3. Managing pathogen dynamics



## Vaccination



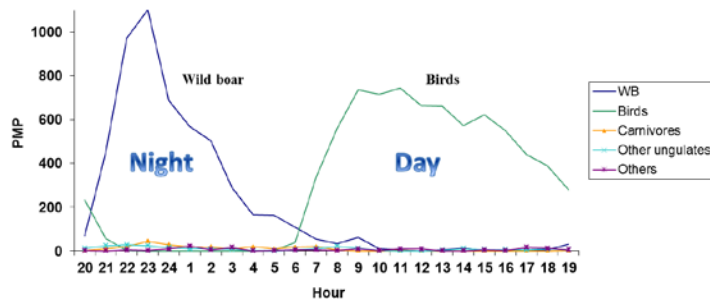
☐ 13504 min of presence at feeders

- 56.37% Birds
- 39.26% Wild boar
- 1.65% Carnivores
- 1.65% Deer
- 1.07% Other



Species presence

N=46 rayoneras  
9 días



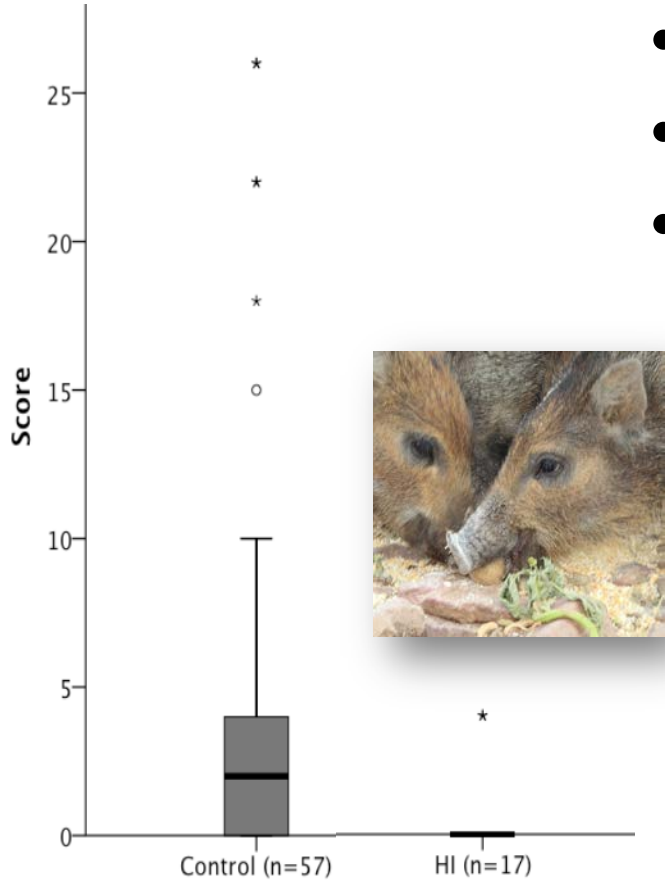
TB in Spain (C. Gortazar)

# 3. Managing pathogen dynamics



## Vaccination

- Heat-inactivated vaccine better than BCG
- 89% reduction in lesion score (\*\*)
- 88% reduction in *M. bovis* growth (\*\*)

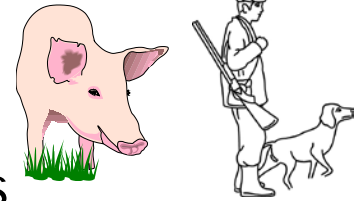


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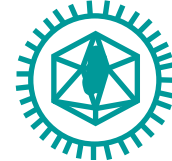
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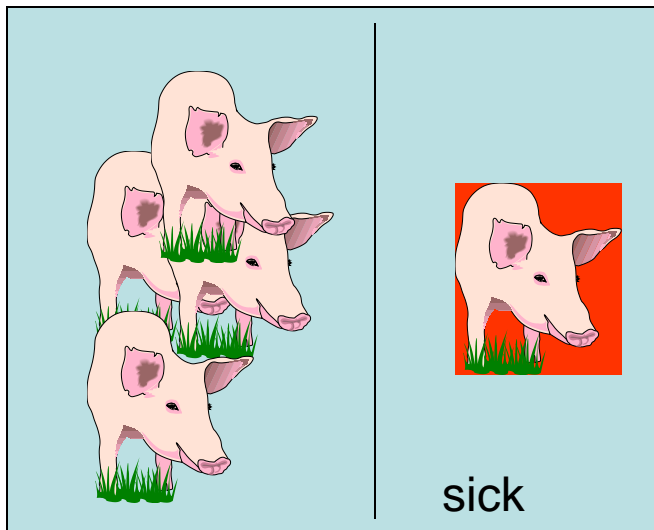
# 4. Managing wildlife population



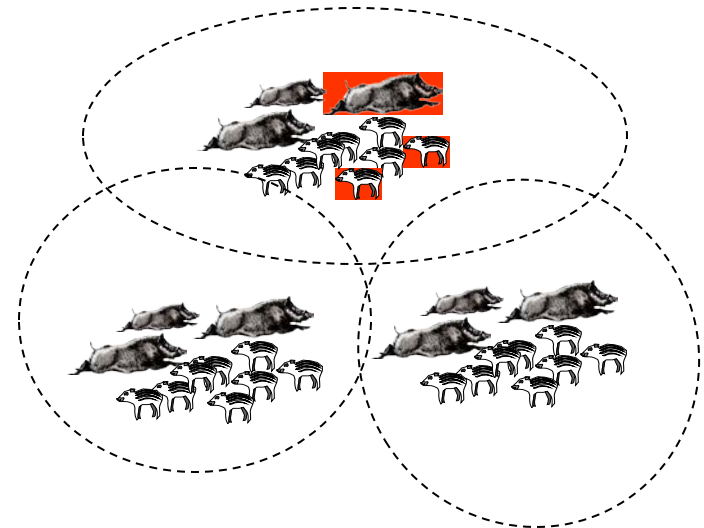
## Reducing numbers

### Wildlife are not Domestic animals

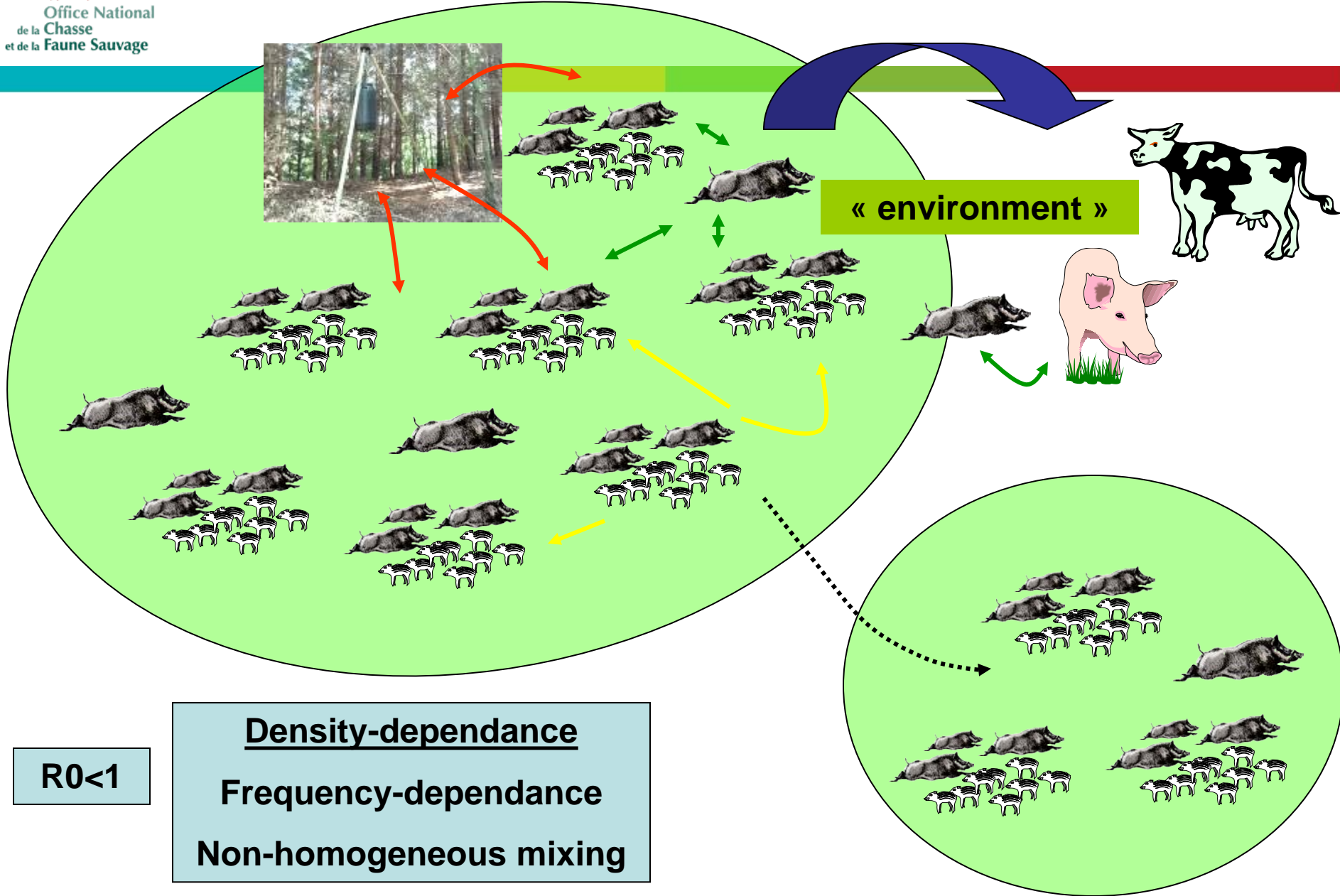
- WB # pig flocks = uncontrolled, unknown numbers
- Movements and dynamics are free and reactive
- Complex heterogeneous mixing (social, landscape)
- Management policy # livestock!!!



#



# 4. Managing wildlife population



# 4. Managing wildlife population



## Reducing numbers

### Reducing number through hunting/destruction

- Targeted culling or stamping out
- Threshold for disease eradication

### Thresholds are not easy to determine

- Most of time threshold is unknown (ASF)
- Not a straightforward relation (CSF)
- Differences between diseases
- Differences between situations for a given disease

#### Should we expect population thresholds for wildlife disease?

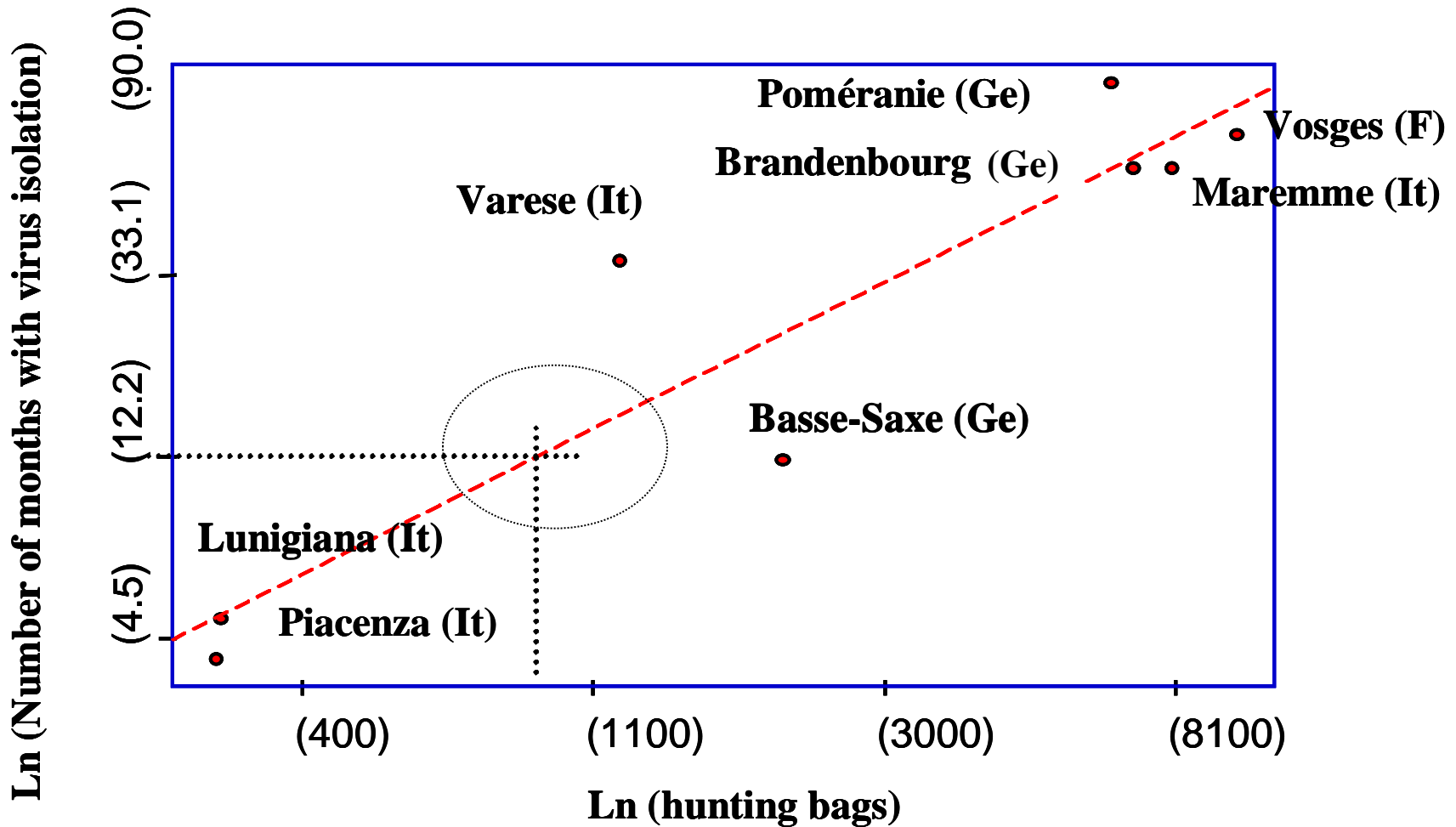
James O. Lloyd-Smith<sup>1,2</sup>, Paul C. Cross<sup>1,3</sup>, Cheryl J. Briggs<sup>4</sup>, Matt Daugherty<sup>4</sup>,  
Wayne M. Getz<sup>1,5</sup>, John Latto<sup>6</sup>, Maria S. Sanchez<sup>1</sup>, Adam B. Smith<sup>6</sup> and Andrea Sweil<sup>4</sup>



# CSF persistence related to population size > density (~landscape dimension)



Rossi *et al.* (2005) Rev. Epidemiol. Infect.



# 4. Managing wildlife population



## Reducing numbers

### Area at risk

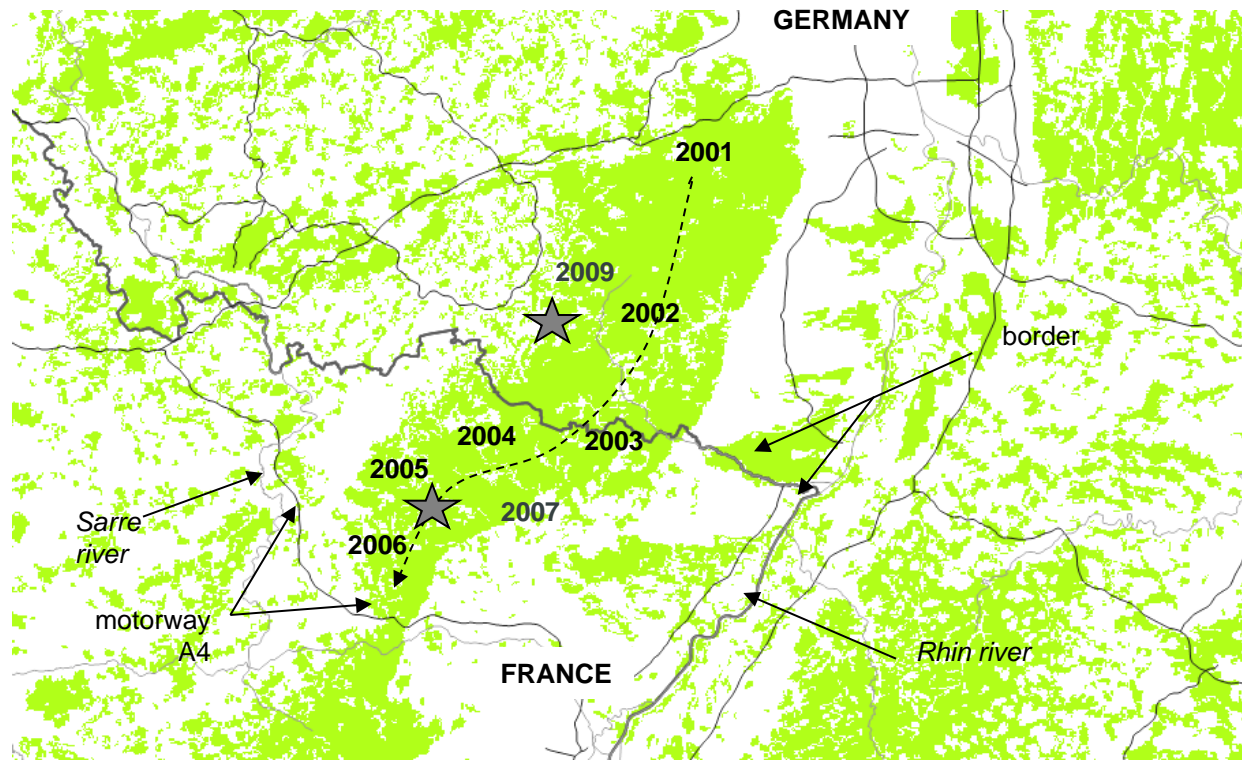
- Old story running from at least 90's
- Large area (>3000 km<sup>2</sup>)
- Landscape based monitoring and management



forest



10 Km





# 4. Managing wildlife population



## Reducing numbers

Density-dependance: differences among diseases  
**Brucellosis << Aujeszky << Tuberculosis (Spain)**

~*Freq. Dep.*

~*Intermed.*

~*Dens. Dep.*



*Epidemiol. Infect.* (2007), 135, 519–527. © 2006 Cambridge University Press  
 doi:10.1017/S0950268806007059 Printed in the United Kingdom

**Estimation of European wild boar relative abundance and aggregation: a novel method in epidemiological risk assessment**

P. ACEVEDO, J. VICENTE, U. HÖFLE, J. CASSINELLO, F. RUIZ-FONS AND C. GORTÁZAR\*

Preventive Veterinary Medicine xxx (2012) xxx–xxx

Contents lists available at SciVerse ScienceDirect



Preventive Veterinary Medicine

journal homepage: [www.elsevier.com/locate/prevetmed](http://www.elsevier.com/locate/prevetmed)

Effects of culling Eurasian wild boar on the prevalence of *Mycobacterium bovis* and Aujeszky's disease virus

M. Boadella<sup>a,\*</sup>, J. Vicente<sup>a</sup>, F. Ruiz-Fons<sup>a</sup>, J. de la Fuente<sup>a,b</sup>, C. Gortázar<sup>a</sup>

<sup>a</sup> Instituto de Investigación en Recursos Cinegéticos, IREC (CSIC-UCLM-JCCM), Ronda de Toledo s/n, 13005 Ciudad Real, Spain

<sup>b</sup> Department of Veterinary Pathobiology, Center for Veterinary Health Sciences, Oklahoma State University, Stillwater, OK 74078, USA



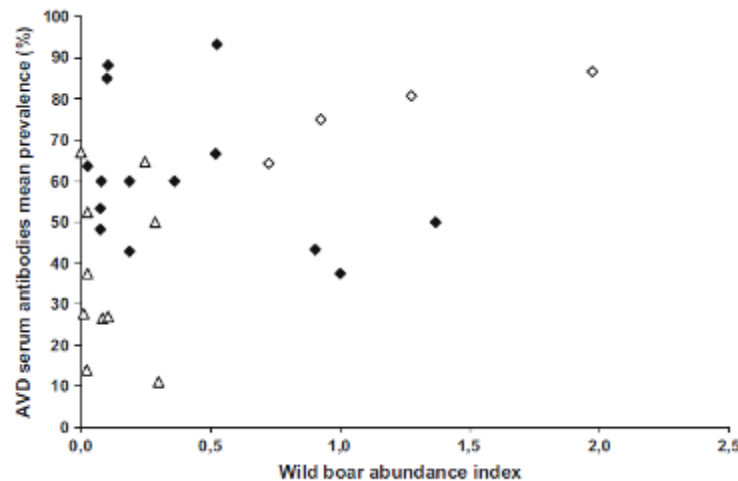
**Threshold for diseases control depends on the disease**  
**T<sub>Aujeszky</sub> << T<sub>Tuberculosis</sub> (Spain)**

# 4. Managing wildlife population

## Reducing numbers

### Density-dependance: differences among areas and management: Aujeszky

Fig. 1 Mean seroprevalence of antibodies against Aujeszky's disease virus, plotted against abundance indexes (mean number of droppings every 100 m in 4-km transects) in 28 wild boar populations from south-central Spain (Vicente et al. 2005).  $\Delta$ , open;  $\blacklozenge$ , fenced;  $\diamond$ , intensively managed



Eur J Wildl Res (2006) 52: 81–87  
DOI 10.1007/s10344-005-0022-2

REVIEW

Christian Gortázar · Pelayo Acevedo ·  
Francisco Ruiz-Fons · Joaquín Vicente

**Disease risks and overabundance of game species**

**ANSES 2011 scientific opinion proposed :  
threshold of wild boar density for TB  
maintenance**

« 10 wild boar/km<sup>2</sup> before hunt »



# 4. Managing wildlife dynamics

## Reducing numbers

### Poor reliability of abundance in

- **Large scale**

- Hunting statistics: available, large scale, biased
- Damages (crops, car): available, large scale, biased
- Landscape modelling: available, large scale (validation)

- **Local (studies scale)**

- Capture-mark-recapture: available, local scale \*
- Distance-sampling: available, local scale \*
- Scat counts: available, local scale \*
- Census: available, local scale \*
- Camera-trapping: available, local scale \*
- Indirect/relative abundance: available, local scale \*

➔ **NO VALIDATED TOOL FOR ESTIMATING ABUNDANCE AND COMPARING AREAS OR TREATMENTS!!!**

# 4. Managing wildlife population



## Reducing numbers

### Limited tools for population control

- **Wild boar ecology**

- Hunting disturbance & disease spread!
- Immediate demographic response
- Selection of most productive sows?



Environ Biol Res  
DOI 10.1007/s13344-011-0548-4

ORIGINAL PAPER

Sex effect on habitat selection in response to hunting disturbance: the study of wild boar

Sonia Soñil · Vincent Taton · Serge Braudt · Eric Baubet

### HIGH HUNTING PRESSURE SELECTS FOR EARLIER BIRTH DATE: WILD BOAR AS A CASE STUDY

Marlene Garralon,<sup>1,2,3</sup> Aurélien Beaud,<sup>1,4</sup> Jean-Michel Gallard,<sup>2,4</sup> Sabrina Servanty,<sup>2,4,5</sup> Eric Baubet,<sup>10,11</sup> Serge Braudt,<sup>2,12</sup> and Olivier Gimenez<sup>1,13</sup>



- **Hunting is not culling**

- Limited hunting pressure (30-50%)
- Hunters' acceptance



## 4. Managing wildlife dynamics



### Reducing numbers

#### Aerial shooting (B. Cowled)

- Effective in suitable habitat (semi-arid) and away from urban areas
- Relatively expensive
- Good for disease surveillance/sampling as well
- Very humane if well regulated and training



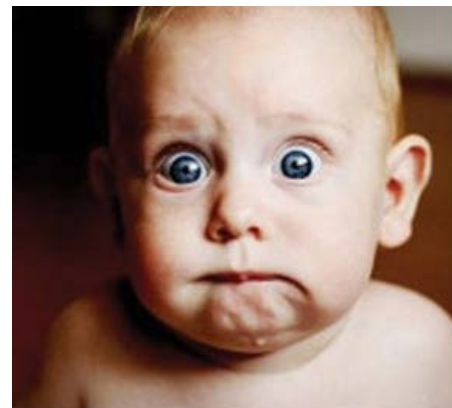
# 4. Managing wildlife population



## Reducing numbers

### Poison baiting efficient (B. Cowled)

- Effective and inexpensive
- Manufactured baits or field prepared
- Meat or grain based
- Aerial or ground deployment
- Welfare a concern
- 1080 most common, sodium nitrite in development



### Poison questionable in native ranges

Safety for non target species  
Ethics and acceptance (native species, hunting economy)



# 4. Managing wildlife dynamics



## Reducing numbers

### Contraceptive

- Research programs (no deployment)
- Modelling
- Important effort and cost
- Safety to non target species
- Ethics and acceptance (hunting & public)



### Trapping efficacy is limited

- Limited spatially and lower efficacy
- Trap-shyness & food availability
- Important effort and cost



# 4. Managing wildlife population



## Feed ban

### Feeding wild boar?

#### Baiting is helpful...

Protection of crops  
Increasing Hunting efficacy  
Deliver vaccines



#### ...but feeding is a risk factor

Source of contamination  
Aggregation increasing contacts  
Intensive management/dynamics



#### Feeding ban?

Proposed inside infected areas  
Not always satisfactory







## Fencing

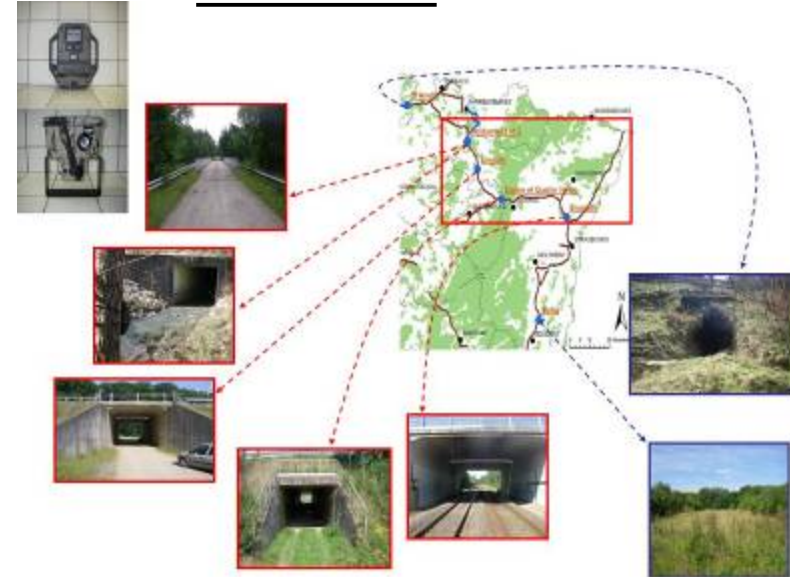
### Fencing wild boar

- **Fences may limit spread**
  - What is a fence for wild boar?
  - Fencing existing barriers

- **Fencing wildlife is questionable**

- Never 100% efficient
- Practicability of large scale fences?
- Green corridors

Siat & al 2010



Klar et al. 2006





# 4. Managing wildlife population



## Fencing

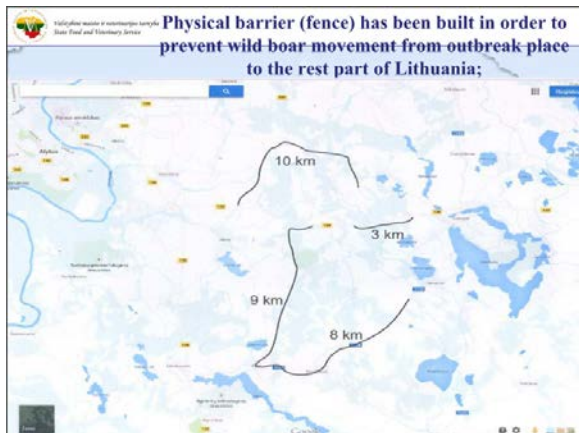
### SCIENTIFIC REPORT OF EFSA

Evaluation of possible mitigation measures to prevent introduction and spread of African swine fever virus through wild boar<sup>1</sup>

## Recent use of repellent, feeding, hunting ban, fences for preventing ASF spread

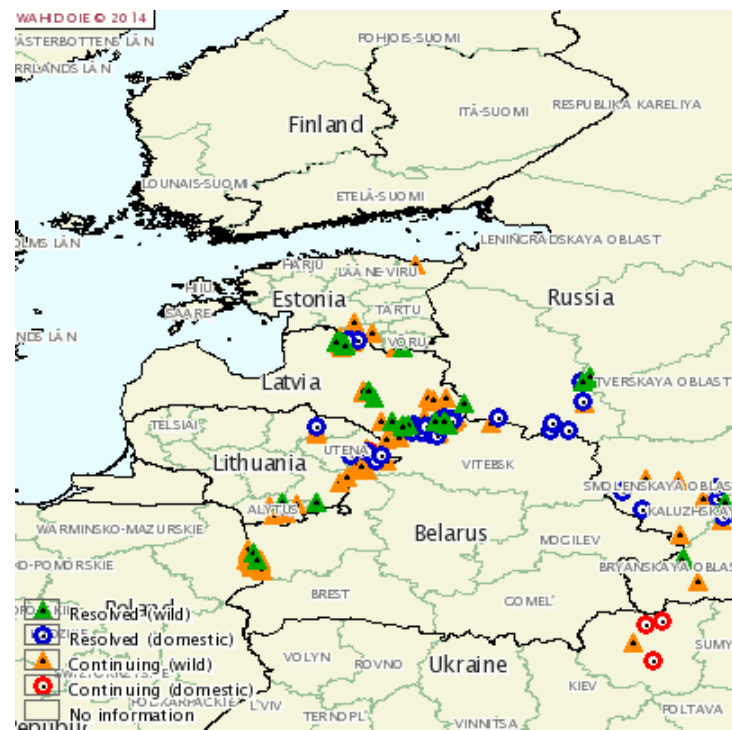
(Dr Masiulis, OIE, Paris, July 2014)

(Wahis, OIE, November 2014)



Vilniaus miesto ir apylinkių karnybių Štato Žuod ir Veterinaris tarnyba  
State Food and Veterinary Service

### Preventive measures - repellents



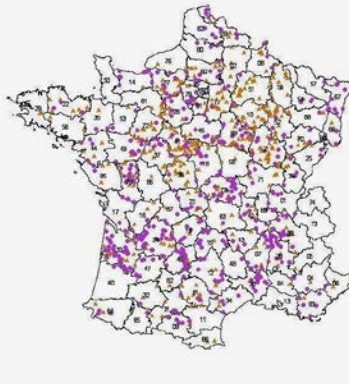
# 4. Managing wildlife population



## Hunting enclosure, translocations, swill feeding

### Increased risk in hunting enclosures (#farms)

- Number of enclosure is increasing
- Recent outbreak of TB in WB and RD
- Risk analysis ANSES SA-2014-0049 (in prep.)



(Saint-andrieux & al. 2012)

(Hars & al 2014)

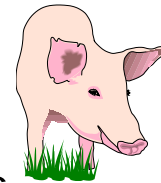
(European Communities)

# OUTLINE

## 1. Objectives & options of risk management

## 2. Managing the interface with target species

→ Farms biosecurity, meat safety, public awareness



## 3. Managing pathogen dynamics

→ Hunting hygiene/viscera, Vaccination

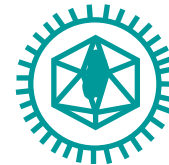


Image  
CSF  
& TB

## 4. Managing wildlife populations

→ Reducing Numbers: targeted culling, large scale

→ Limiting the risk of spread: translocation, Feed, fencing



## 5. Conclusions & perspectives

# 5. Conclusions & perspectives

## Wild swine management

- Good management of population?
  - NOT ALL DISEASES are DENSITY DEPENDENT
  - THRESHOLD MOSTLY UNKNOWN
  - Intensive culling through aerial shooting & poison (pest vertebrate)
  - Targeted culling possible in closed/small areas (Boadella et al. 2013)
  - Hunting disturbance aggravating SPREAD during outbreaks
  - To limit feeding and intensification → “extensive” feeding
  - Stabilizing populations → through qualitative hunting (Gamelon&al2012)

### SOCIAL DIMENSION !!!!



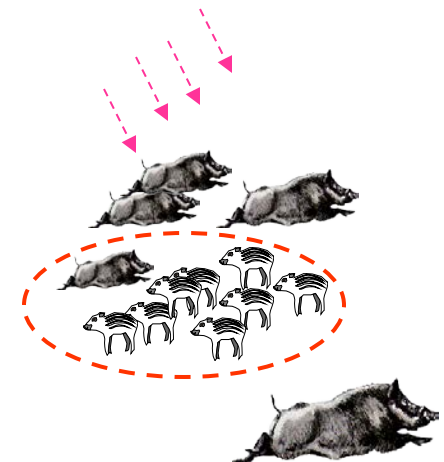
#### Journal of Applied Ecology

Journal of Applied Ecology 2014, 51, 1133–1141

doi: 10.1111/1365-2656.12281

Making use of harvest information to examine alternative management scenarios: a body weight-structured model for wild boar

Martine Courbon<sup>1,2,3,4</sup>, Jean-Michel Collin<sup>2</sup>, Sabine Kervang<sup>2,3</sup>, Olivier Gimenez<sup>2</sup>, Carole Torg<sup>2</sup>, Eric Baudin<sup>2</sup>, François Klein<sup>2</sup> and Jean-Dominique Leclercq<sup>2</sup>



# 5. Conclusions & perspectives

## Pathogen management

- How to prevent disease introduction & spread
  - Hunters/public/farmers training
  - **EARLY WARNING** at a global scale
  - Notification/awareness of translocations
  - Viscera and carcass hygiene
  - **VACCINATION** as possible additive tool



# 5. Conclusions & perspectives

## Interface management

- How to live with wildlife diseases?

- Public, farmers, hunters awareness
- Biosecurity in farms: a recurrent TABOO topic
- Good practices and integrative/participative approaches



**SOCIAL DIMENSION !!!!**





# Conclusions & perspectives

## 3. Research needs!

- **Research need**

- **NEW TOOLS** for monitoring wild swine **ABUNDANCE** (#density)
- **MANAGEMENT** of wild swine
- **QUANTIFYING INTERFACE** with pastures/farms
- **Experimental approaches** (ex: feed ban, pasture mgt)
- **Integrative/participative approaches** → **NEW TOOLS**
- **Social acceptance & collaboration** with **LOCAL** stakeholders



Thanks for your attention!

