

Data collection on African Swine Fever virus for epidemiological analysis

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Outline

- › Gene comparisons
- › Description of virus shedding and excretion
- › Economic analyses of risk-based surveillance strategies

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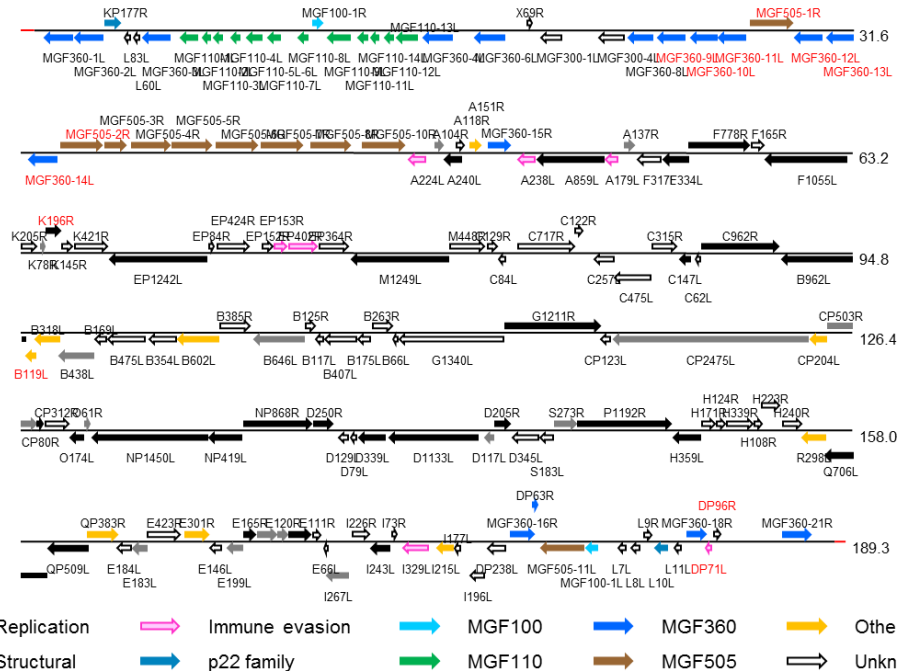


Linda Dixon and the ASF group (Pirbright Institute)

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ASF virus

Large double-stranded DNA virus (with ~ 150-167 genes). Replicates in the cytoplasm of infected cells. Presence of Multigene Families (MGF) in the genome MGF 360 and 505/530: host range and virulence



Georgia 2007/1

Aims

- To assess the genetic variability of ASFV isolates that differ in pathogenicity

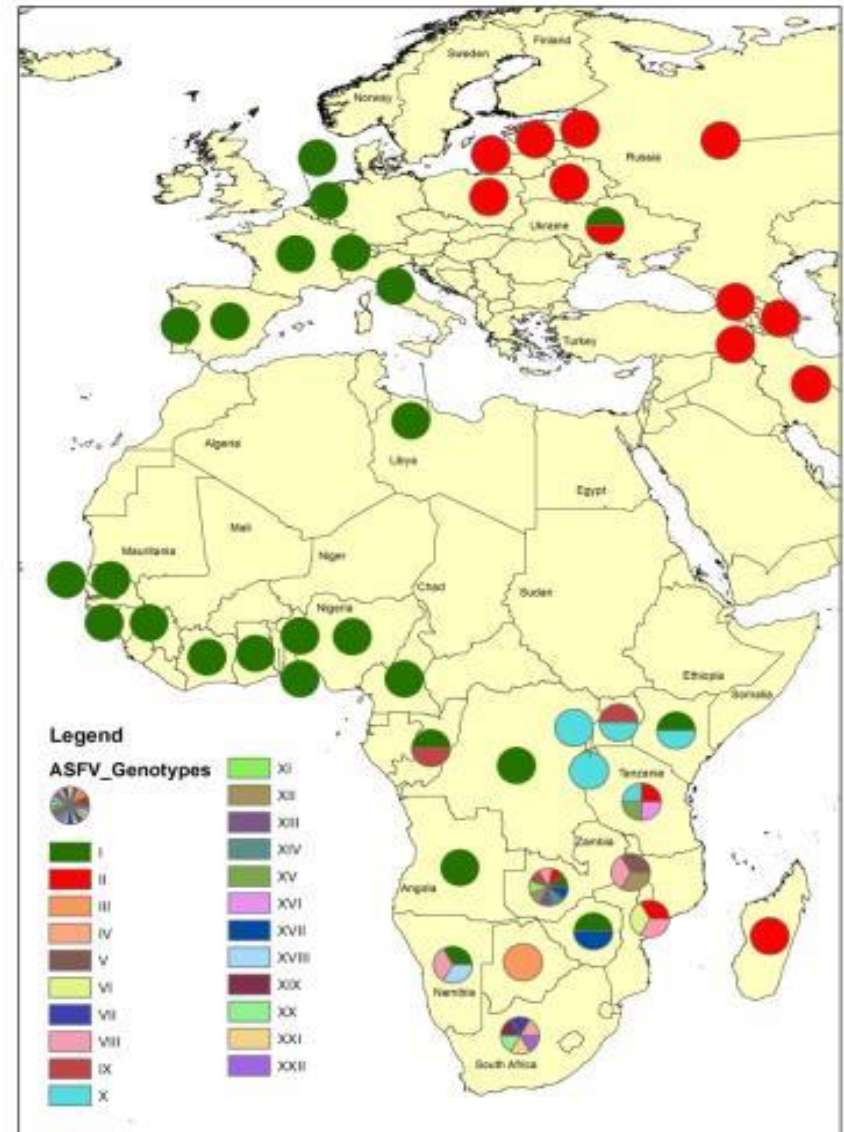
Study design

Data collected: Highly pathogenic isolate (Benin 97/1), non-pathogenic isolate (OURT 88/3) and tissue culture-adapted isolate (BA 71V)

Analysis: Complete genome sequencing of isolates

Study design

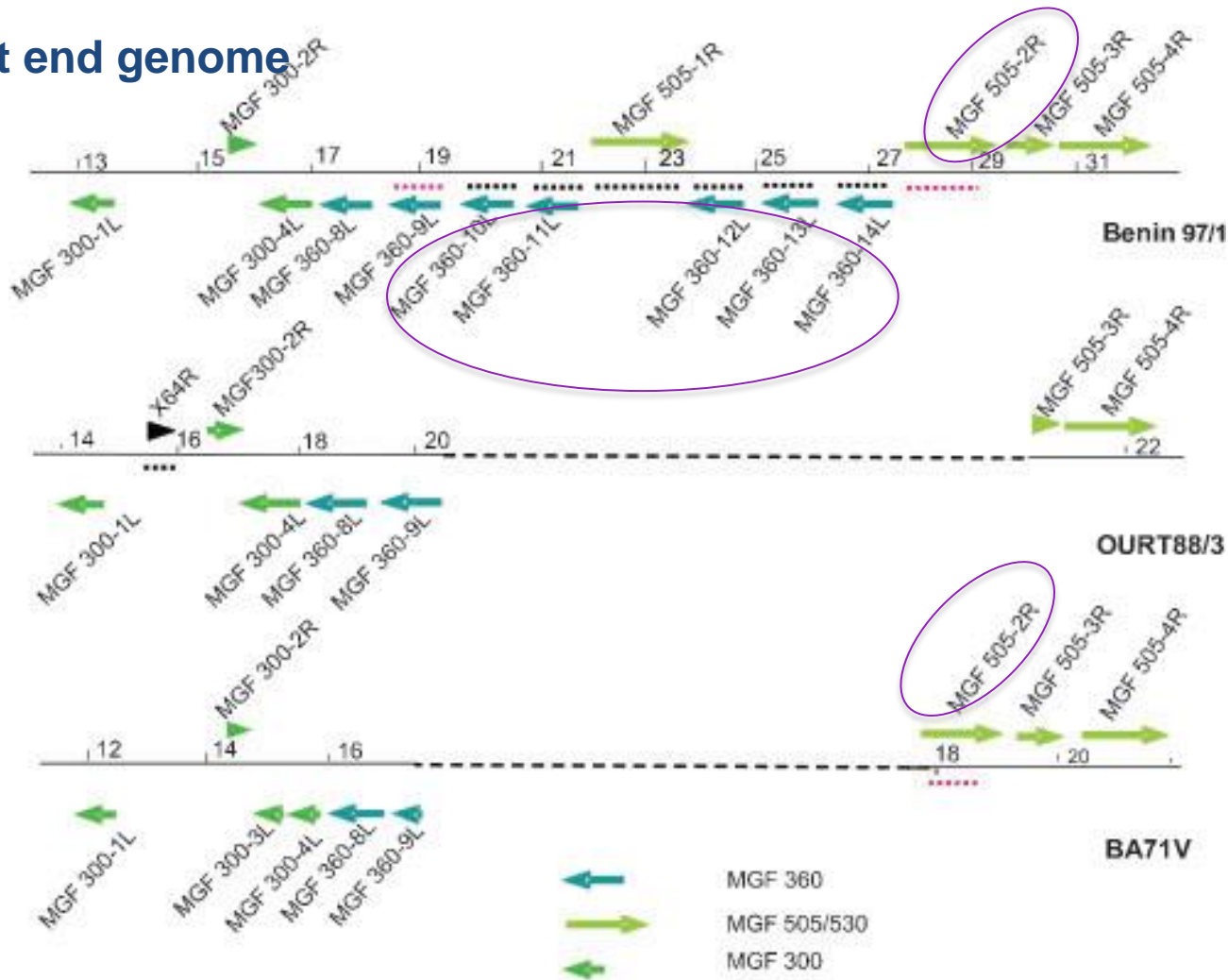
- Great diversity, genotypes defined by partial sequencing of the gene encoding VP72
- All 3 isolates are closely related, same Genotype I



Historical distribution of African swine fever virus genotypes, from 1957 to 2015 (modified from Costard et al, 2010).

Results

Left end genome



Compared to the Benin 97/1 isolate, the OURT88/3 and BA71V isolates have deletions from a genome region encoding members of MGF 360 and MGF 505/530.

Results

Other studies:

- Deletion of same MGF 360/505/530 from Pretoriskup isolate reduced viral growth in macrophages and virulence in pigs (Zsak et al., 2001)
- Insertion restored the ability of BA71V isolate to grow in macrophages (Zsak et al., 2001)
- Removal of MGF 360 reduced viral titres in infected *Ornithodoros* ticks (Burrage et al., 2004)

Conclusion

- Deletion of these genes from the OURT88/3 and BA71V genomes seems likely to provide one explanation for the attenuation of these virus isolates.
- Will aid the rational development of attenuated virus vaccines.

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Aims

- › To provide descriptive patterns of ASF-related clinical signs, levels of viraemia and virus excretion
- › To assess the transmission of ASFV among domestic pigs

Study design

- Intramuscular inoculation with Georgia ASFV strain
- Dose of 10^2 TCID₅₀/ml
- Scenarios: experimentally infected pigs with susceptible pigs in direct and indirect contact



Study design

- **Data collected:** blood (every two days), oral fluid (rope), oral, nasal and rectal swabs, urine and faeces (daily)
- **Analysis:** virus titration and real-time PCR of samples



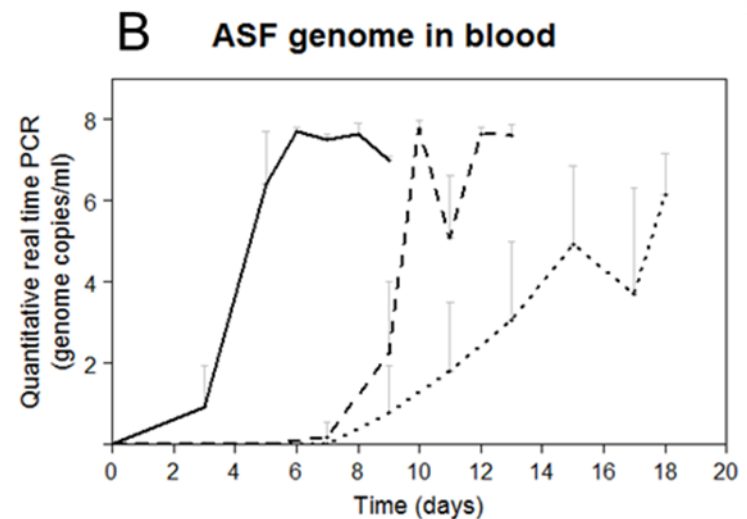
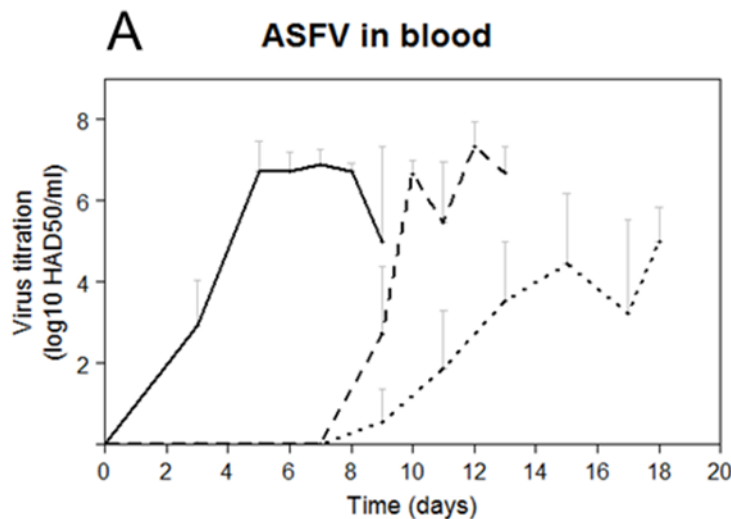
Results

- Main symptoms: fever, loss of appetite, lethargy
- Death 7-13 days post inoculation (dpi)



Results

- Infectious for 1-7 days
- Shedding high levels of ASFV up to 10^9 HAD₅₀/ml detected in blood and up to 10^5 HAD₅₀/ml in saliva, urine or faeces



This provides the range of infectious excretions from domestic pigs.

Results

- Direct contact pigs: infectious after 9-11 days post exposure (dpe)
- Indirect contact pigs: infectious after 11-18 dpe

Direct and indirect (close) contact with infectious pigs is an effective mechanism of ASFV transmission.

Conclusions

- Acute and fatal disease for individual pigs
- Unspecific symptoms and rapid death within 9 days
- High shedding and excretions
- Transmission possible by direct and indirect contact, probably linked with blood contact

- **Prolonged infection courses?**

Cannot be excluded in the field (intramuscular inoculation/euthanasia/ethics reasons)

- **Effective indirect contact transmission?**

Need to be better investigated: contact patterns free-ranging pigs/wild boars, contaminated fomites...

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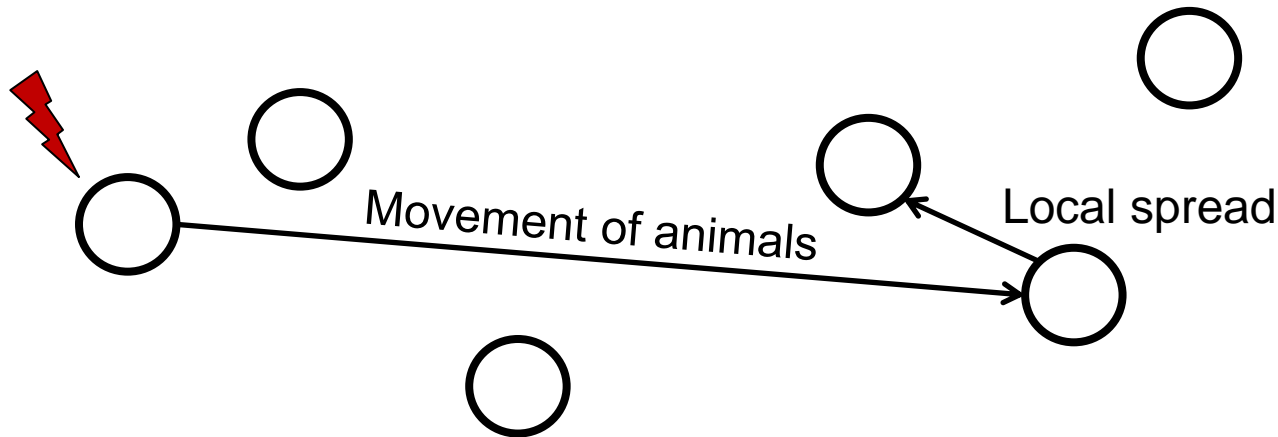


Timothee Vergne (RVC), Beatriz Martinez Lopez (UCDavies),
Eduardo Fernandez Carrion (UCM) and Anne Relun (CIRAD)
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Aims

- › To estimate the potential magnitude of an ASF epidemic in a disease-free country
- › To estimate the impact of different mitigation strategies
- › To estimate the cost-benefit of different mitigation strategies

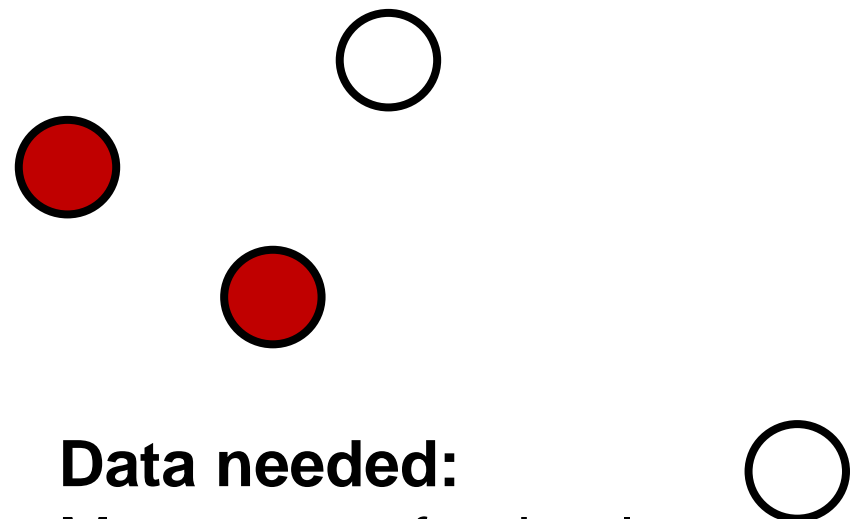
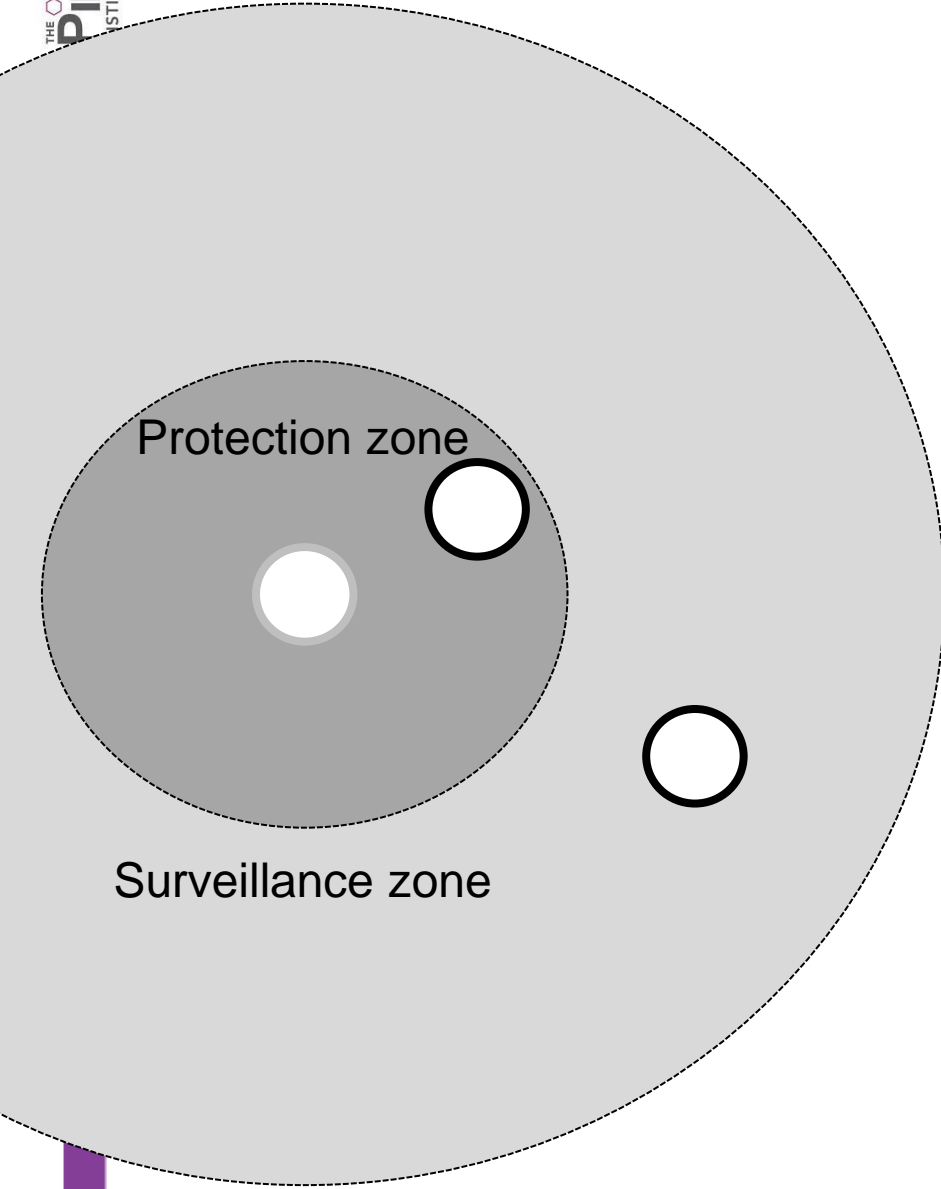
Study design: Be-FAST model



Data needed:

- Movement of animals
- Local spread
- Movement of vehicles
- Movement of people

Study design: Be-FAST model



Data needed:
Movement of animals
Local spread
Movement of vehicles
Movement of people

Study design

Simulations of ASFV spread in farm populations

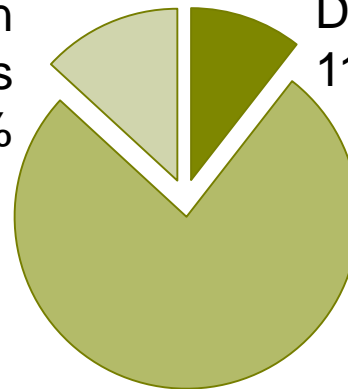
- › Measure of the **epidemiologic impact**
 - Nb of infected farms
 - Duration of the epidemic...
- › Measure of the **economic impact**
 - Direct costs (intervention measures)
 - Direct consequential costs (preventive measures)
- › Baseline surveillance strategy (BSS)
- › BSS + 3 alternative risk-based surveillance strategies (ARSS) (cost-benefit analyses)

Results under baseline surv. str.



- › 90000 farms (backyard, multiplier, indoor and outdoor commercial farms)
- › Epidemic likely to be of **limited magnitude**
 - Less than 6 infected farms: probability > 0.75
 - Less than 2 months: probability > 0.75
- › Economic impact breakdown

Movement restrictions in farms in protection zones
13%



Direct costs in infected farms
11%

Movement restrictions in farms in surveillance zones
76%

Results under alternative surv. str.

- BSS + Risk-based surveillance targeting highly connected farms, workshops/awareness campaigns for:
 - Lots of inputs
 - Lots of outputs
 - Highly connected to highly connected farms
- **Effective** in reducing the size of the epidemic
 - 55-75% chance to lead to fewer outbreaks
- But are **not likely to be cost-beneficial**: less infected farms **but high cost** due to workshops/awareness campaigns
 - ~80% chance that total cost for BSS+ARSS was highly superior to BSS

Conclusions

- › **To be applied to other European contexts?**
 - Data on animal movements
 - Transmission parameters (literature)
 - Economic data
 - On pig production
 - On pig market values

- › **Alternative strategies?**
 - **Radii** of surveillance and protection zones
 - **Duration** of surveillance and protection zones

Thanks for listening

Acknowledgements



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MADRID

