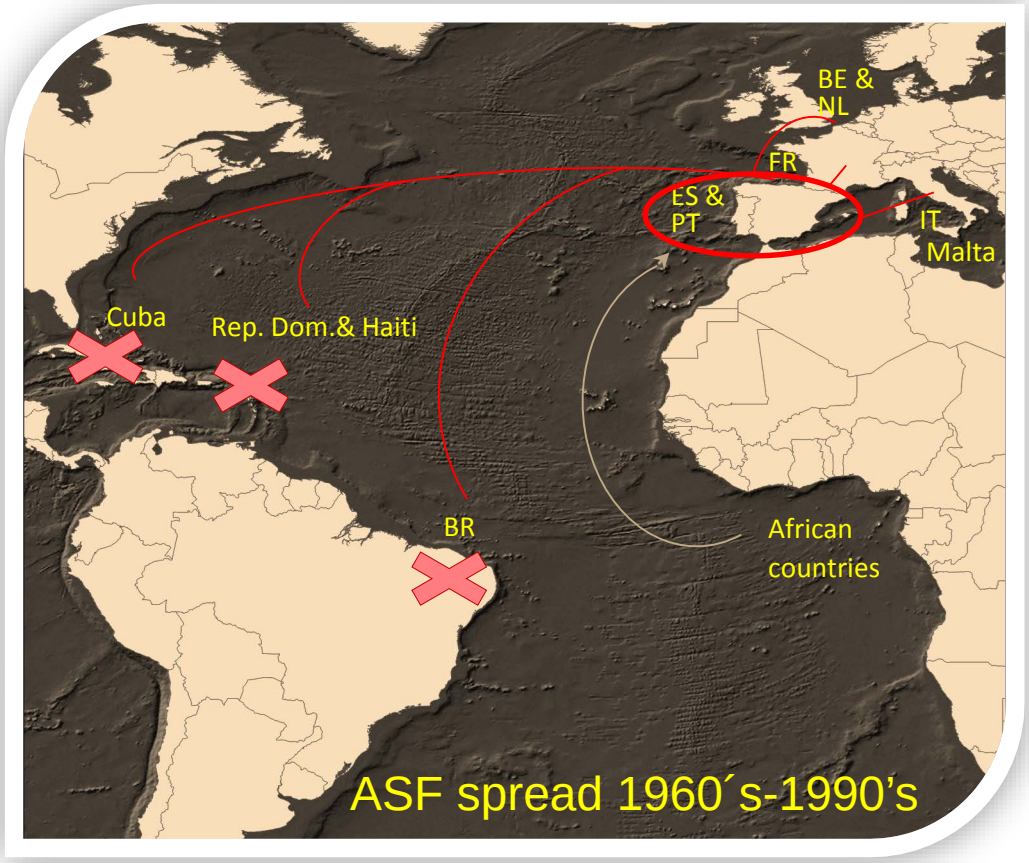
Tools to improve the performance of African Swine Fever surveillance in free countries

RiskSur case studies

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement N° 305169.

ASF has serious and irreversible consequences



- No vaccine
- Erradication in the past:
  - Total depopulation: Cuba, Rep.Dom, Haiti, BR, Malta
  - Adequate surveillance and control of transmission

    ES, PT: 32-35 years
    IT (mainland): 1967, 1980
    FR: 1964, 1967, 1974
    BE: 1985-1986
    NL: 1986

- Present since 1978 without transboundary spread: IT (Sardinia) → current erradication plan (2015-2017)

Genotype I

ASF has serious and irreversible consequences

ASF risk of spread today

- No vaccine
- Erradication in the present:
  - **FAR AWAY!!!**
- Present with transboundary spread:

1	Caucasus: since 2007
2	RF: since 2007
3	UKR: since 2012 BY: since 2013
4	UE countries: since 2014
5	African countries: 22 genotypes present!

What to look for?

Surveillance components for ASF early detection used in 2013

- Sampling and Testing dead or sick wild boar
- Sampling and Testing hunted wild boar
- Sampling and Testing suspect pig holdings*
- BIP Inspection personal luggage
- Testing home slaughter
- Sampling and Testing meat and products animal origin
- Inspection C&D procedures
- Sampling, Testing and quarantine imported pigs

- *ASF tests were carried out only in symptomatic/dead animals*

* Suspect pig holdings: with clinical evidence, epi link to ASF+, untreated swill feeding, probability of exposure, vectors (CD2003/422/EC)

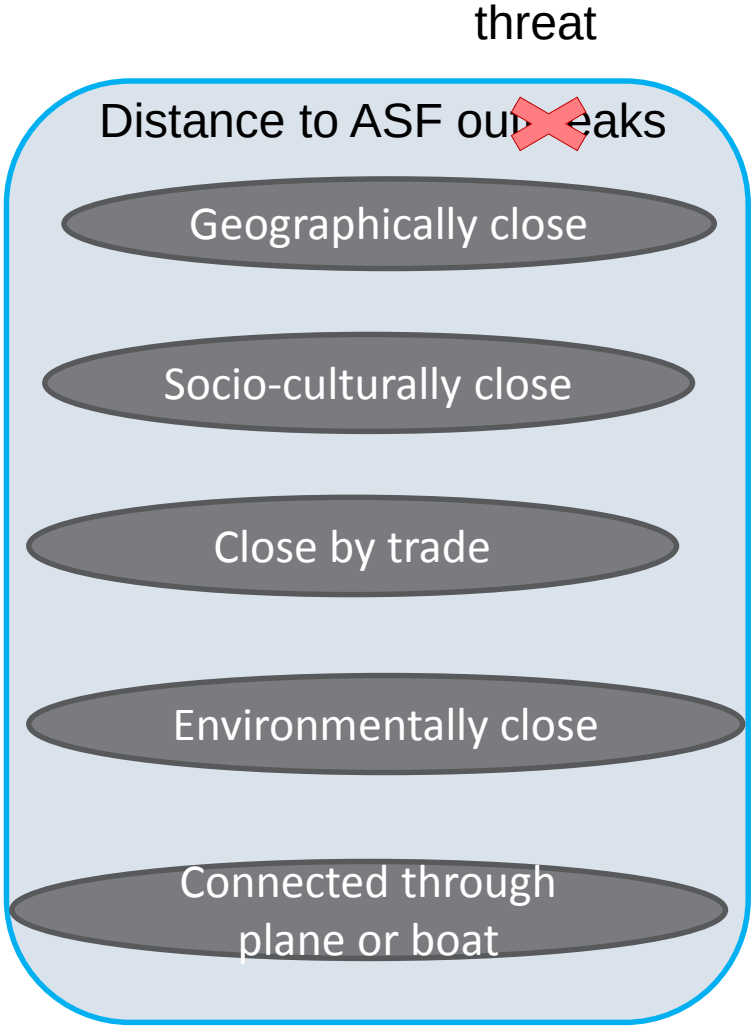
What to look for?

What to look

Evaluation of the level of ASF threat

Threat at origin

Routes of introduction



Where to look for?

Mapping of ASF high risk areas in 2013

Lithuania

Latvia

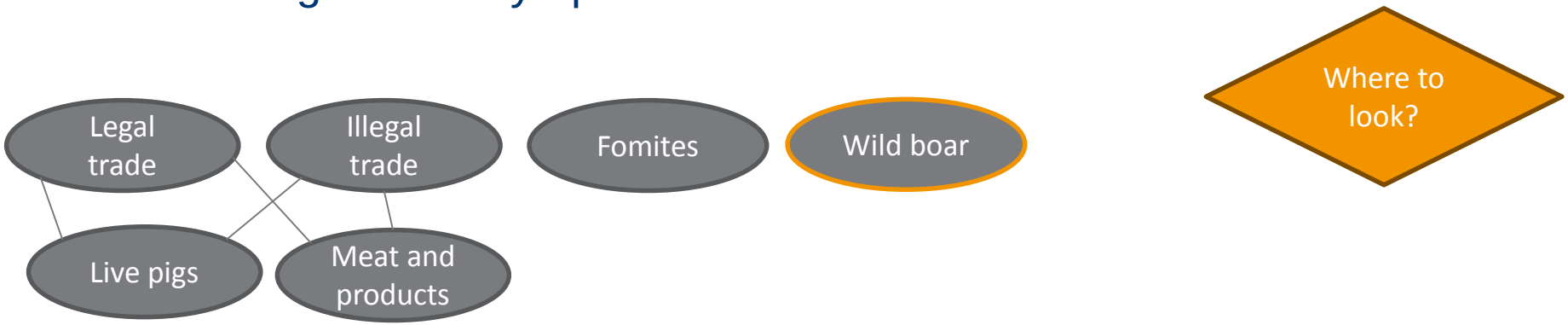
Poland

Only borders with infected countries are considered at high probability of exposure

- Surveillance carried out only in those areas

Evaluation of the routes of introduction and spread

- For each administrative unit or disaggregated in the country
  - Assessment of ASF routes of introduction (Mur et al., 2014) according to country-specific scenarios



What is the probability that at least one infected wild boar survives, moves and enters?
What is the probability that wild boar hunters transport the virus elsewhere?

Evaluation of "transport" until destination

Evaluation of the routes of introduction and spread

(cont.)

- For each route of introduction, identify population at risk of exposure
- For each route of introduction and population at risk, identify routes of spread, super-spreaders and maintenance characteristics

Evaluation of exposure and consequences

Suitability or vulnerability maps

- For each administrative unit or disaggregated in the country

Where to look

- Pig holdings: classified by biosecurity (proxy: number of pigs/farm)
- Free-ranging pigs
- Feral pigs
- Wild boar shared habitat (proxy abundance)

- Local spread (direct and indirect):
  - Distance between and from pig holdings
  - Distance from wild boar corridors
  - Distance from free-range pigs
- Local and long distance spread(direct and indirect):
  - Contacts between pig holdings
- Local and long distance spread (untreated swill feeding):
- need to know habits!!
  - Home-killing
  - Hunting practices
  - Distance to slaughterhouses, hotels, ports waste…

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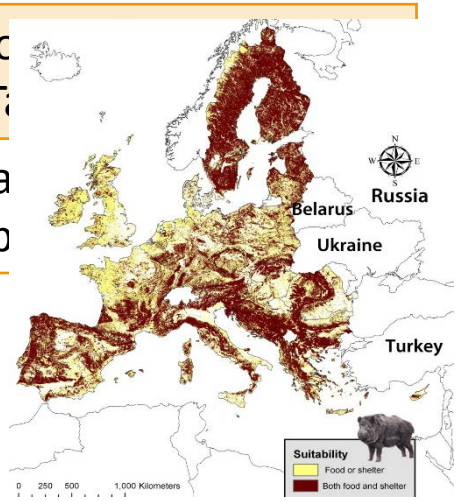
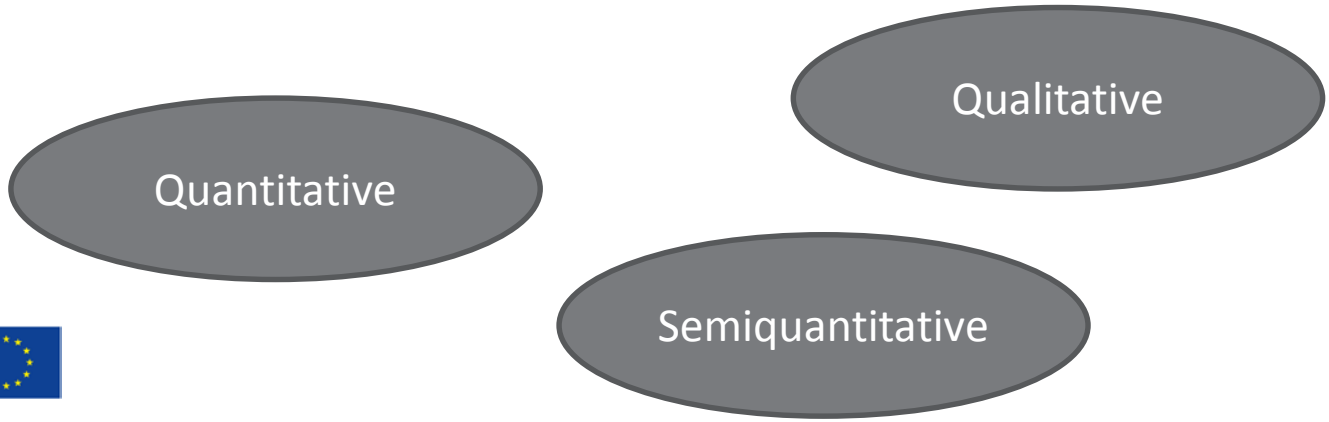


De la Torre et al., 2014

Many tools available

- Mapping of risk factors (adding risk factors or weighted risk factors)
- Association of risk factors with risk of infection (classical stats, bayesian)
- Spatial association of risk factors with risk of infection (cluster analysis)
- Transmission potential (SEIR models) with risk factor mapping
- Etc,etc



Risk-based ASF early detection surveillance

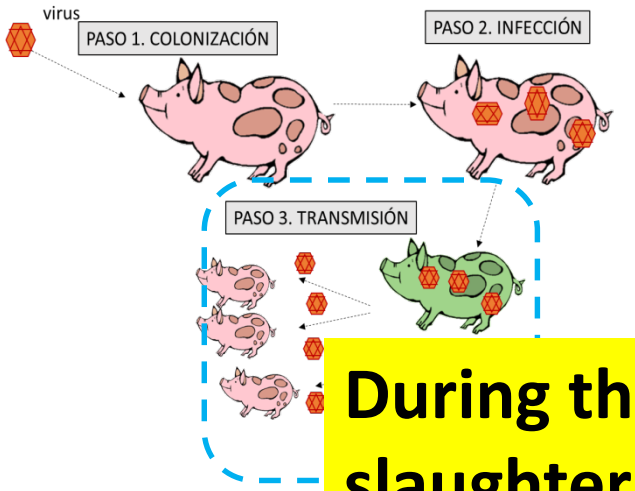
- Plenty of analytical tools available….but not under one same ToolBox yet
- We’re probably a step behind…exploratory tools and understanding the epidemiology of the disease are equally important
- These tools have to be integrated in the design and evaluation framework to obtain the best efficiency at the least cost

How to look for ASF?

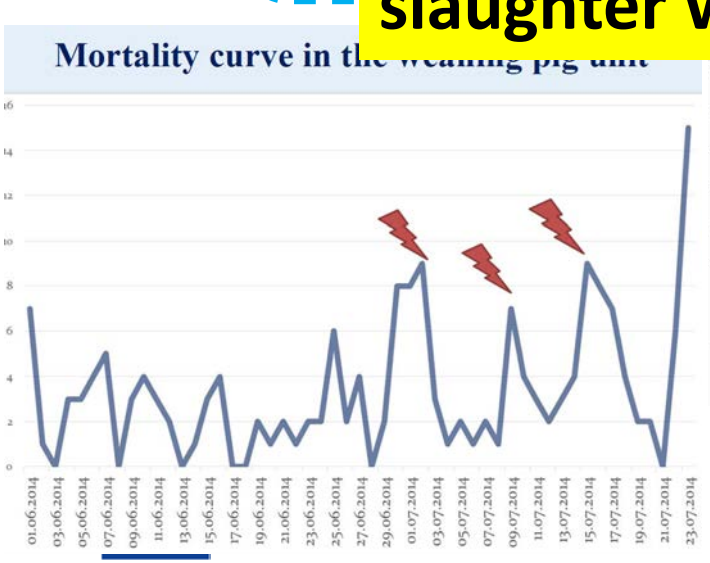
- *"The short viremia and high mortality associated with ASF make it virtually impossible to detect the disease through active surveillance".*

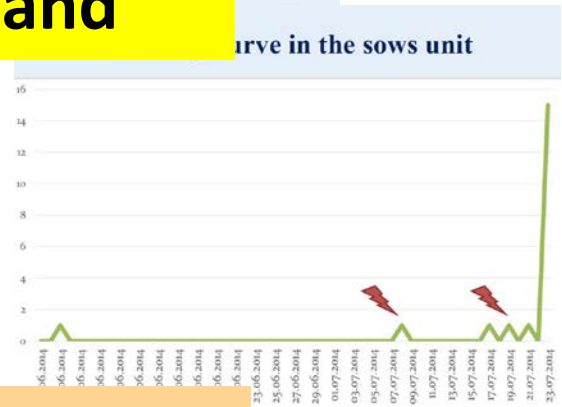
Generalized concepts lead to a misconception of the disease epidemiology i.e. source of virus is not considered

‘Early detection’ at a high biosecurity farm in Lithuania



During the high risk period, pigs for slaughter were shipped to Poland





Estimated date of infection: 3-5 July

ASF suspicion: 21 July

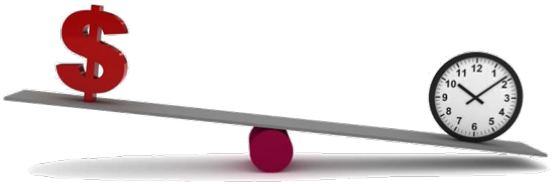
ASF confirmat: 24 July

How to look for ASF?

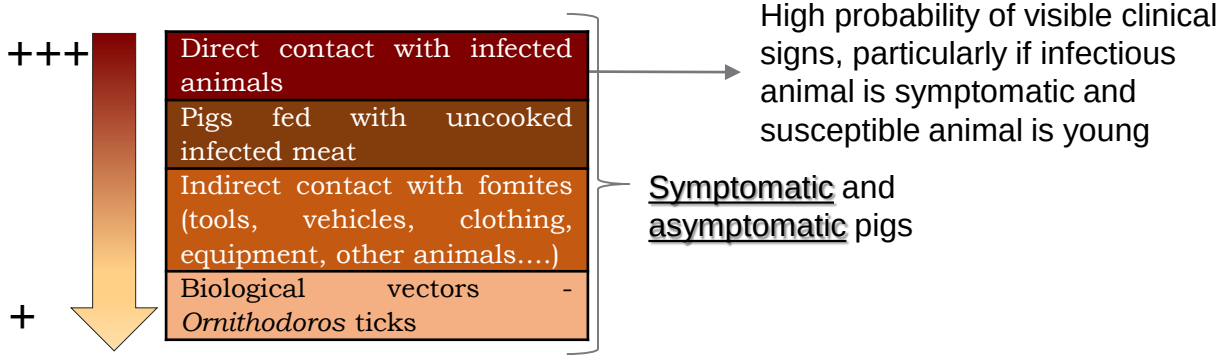
- *"Numbers of found dead animals and number of wild boar sampled and tested prove the high efficiency and efficacy of the passive surveillance in the early detection of ASF"*

Efficiency measured by number of samples taken rather than by evaluating a high level of performance relative to inputs

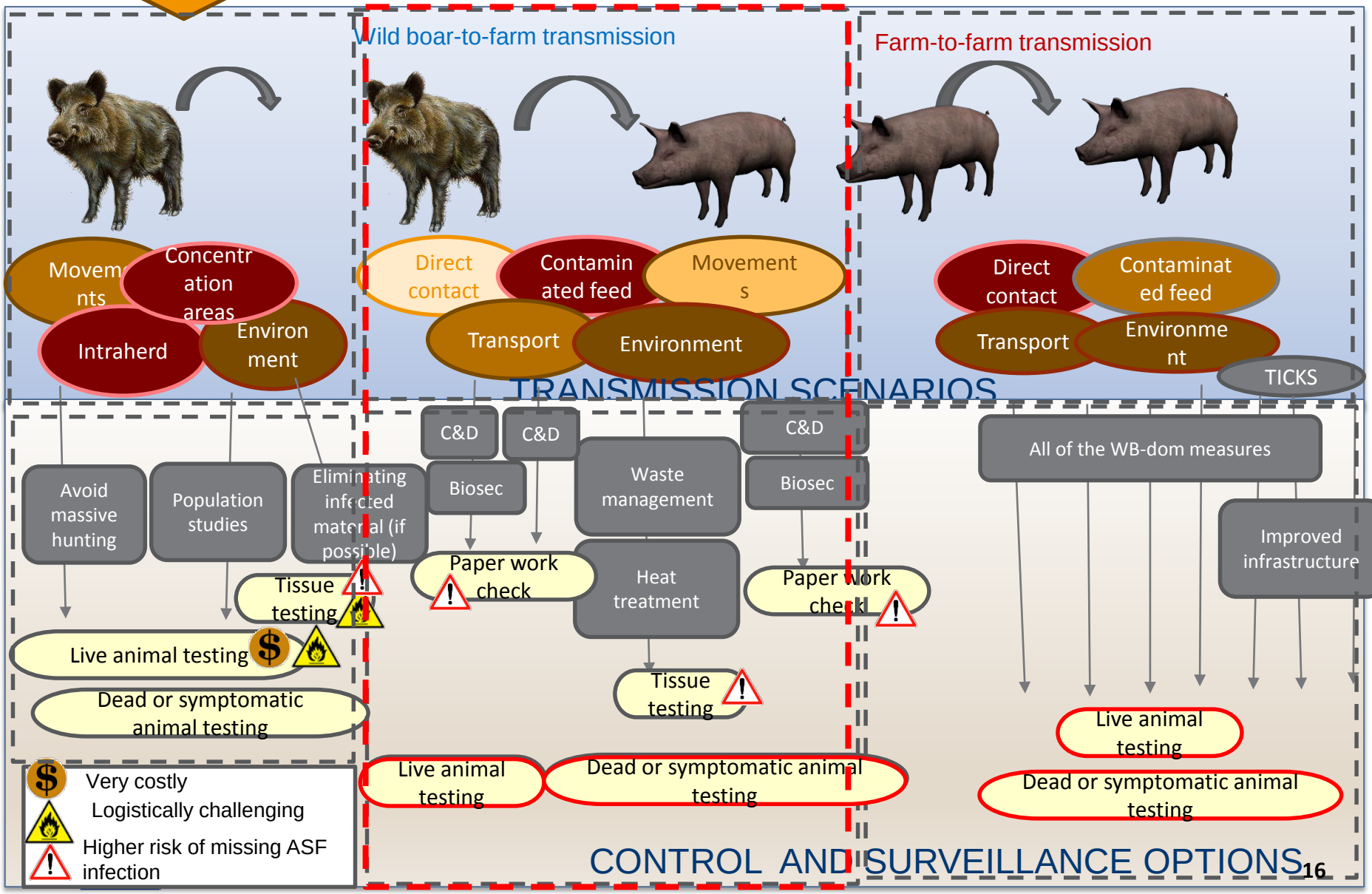
Cost-effective surveillance programme



- Risk ranking transmission scenarios:
  - Probability of source being infective: amount of infective virus at source



  - Probability of contact between infective source and susceptible
  - Probability of the susceptible animal developing infection and being infectious
  - Evaluation of surveillance options according to feasibility and risk of missing infection early


Wild boar-to-farm transmission
Farm-to-farm transmission
Movem nts
Concentr ation areas
Intraherd
Environ ment
Direct contact
Contamin ated feed
Movement s
Transport
Environment
Direct contact
Contaminat ed feed
Transport
Environme nt
TICKS
TRANSMISSION SCENARIOS
Avoid massive hunting
Population studies
Eliminating infected material (if possible)
Tissue testing
Live animal testing
Dead or symptomatic animal testing
C&D
C&D
Biosec
Paper work check
Waste management
Heat treatment
Tissue testing
Live animal testing
C&D
Biosec
Paper work check
All of the WB-dom measures
Improved infrastructure
Live animal testing
Dead or symptomatic animal testing
Very costly
Logistically challenging
Higher risk of missing ASF infection
CONTROL AND SURVEILLANCE OPTIONS

Risk-based ASF early detection surveillance

- Identifying areas at higher probability of exposure (probability of becoming an index case)
- Identifying consequences (number of secondary cases, duration of outbreaks) for each type of index case
- Identifying the number of subjects that need to be covered over a certain time period to ensure detection at 95% confidence level

	when	where	how
Passive surveillance	 Always	Whole country	Awareness, training, speed, new diagnostic methods
Active surveillance	 Increased level of threat	Areas and means depend on transmission scenarios and consequences!	

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