Using incomplete data to characterise the risk of African swine fever in the Russian Federation, 2007-2014

Timothée Vergne[1], Fedor Korennoy[2], Lisa Combelles[1], Andrey Gogyn[3], Dirk Pfeiffer[1]

Contact: tvergne@rvc.ac.uk

All authors are involved in the European project ASFORCE dedicated at targeting research efforts on African Swine Fever

SVEPM – Ghent, 2015

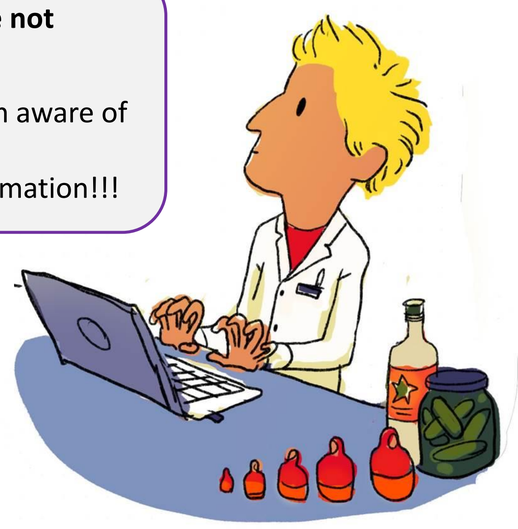
Background

Objectives

I want to **characterise the risk** of African swine fever in the Russian Federation using the outbreaks that were officially reported to veterinary services.

But wait! It is most likely that **some outbreaks were not reported**...

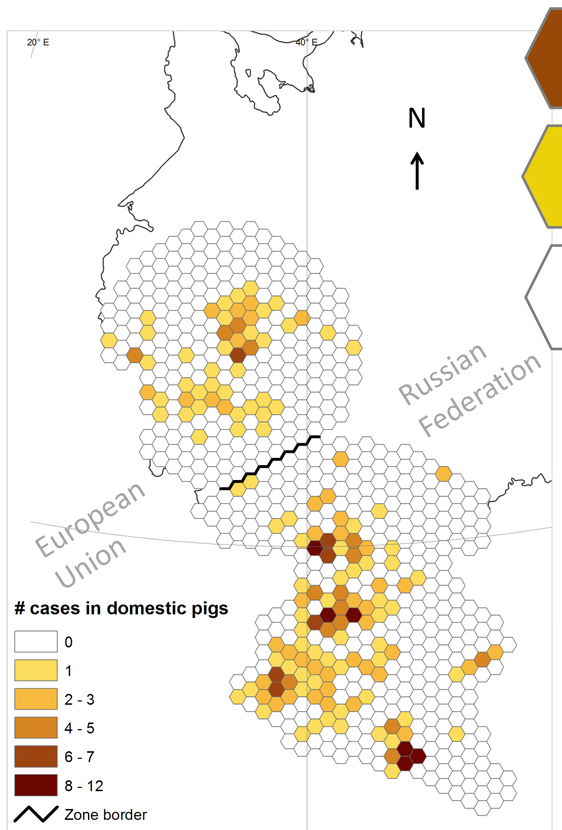
So the spatial distribution of the outbreaks that I am aware of **does not represent the true distribution**...
... and this might potentially **bias** quite a lot our estimation!!!



We need to be careful here.

Zero-inflated count models might be useful as their structure allows infected epidemiological units having no reported outbreaks.

Data



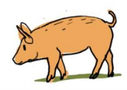
Many reported outbreaks =
Disease present
Very likely to be detected (good reporting or many outbreaks)

Few reported outbreaks =
- Disease present
- Unlikely to be detected (bad reporting or few outbreaks)

No reported outbreaks =
- Disease absent or disease present and undetected

Explanatory variables that were investigated to characterise the risk of ASF in the Russian Federation, 2007-2014:

Human variables
- *Human population density*
- *Road network density*
- *Distance to the regional capital*
- *Distance to the lab*

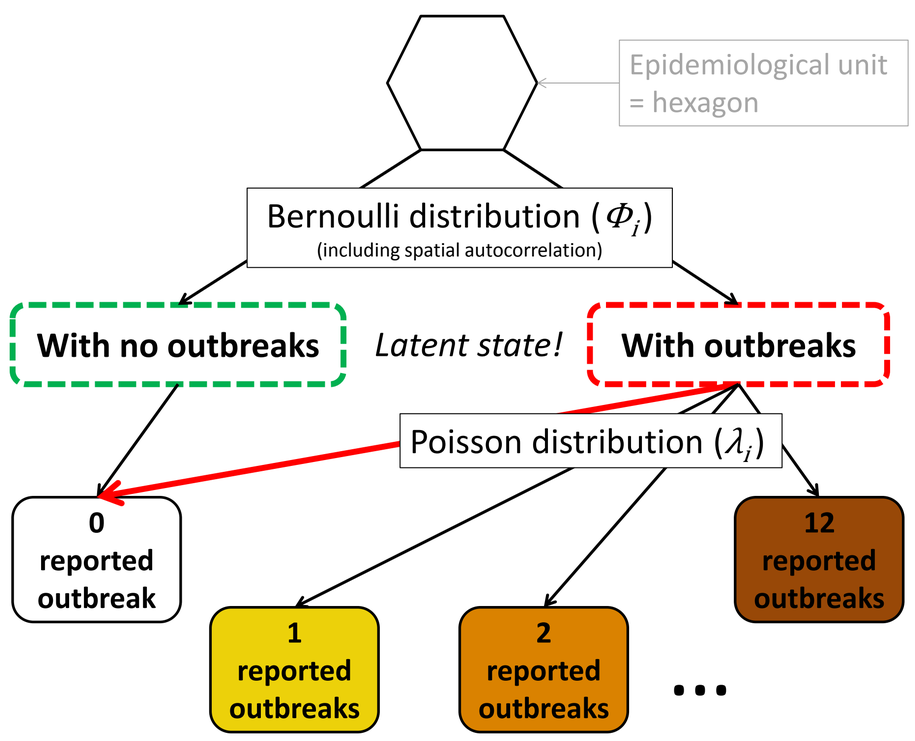


Swine variables
- *Density of low biosec farms*
- *Density of high biosec farms*

Environmental variables
- *Forest coverage*

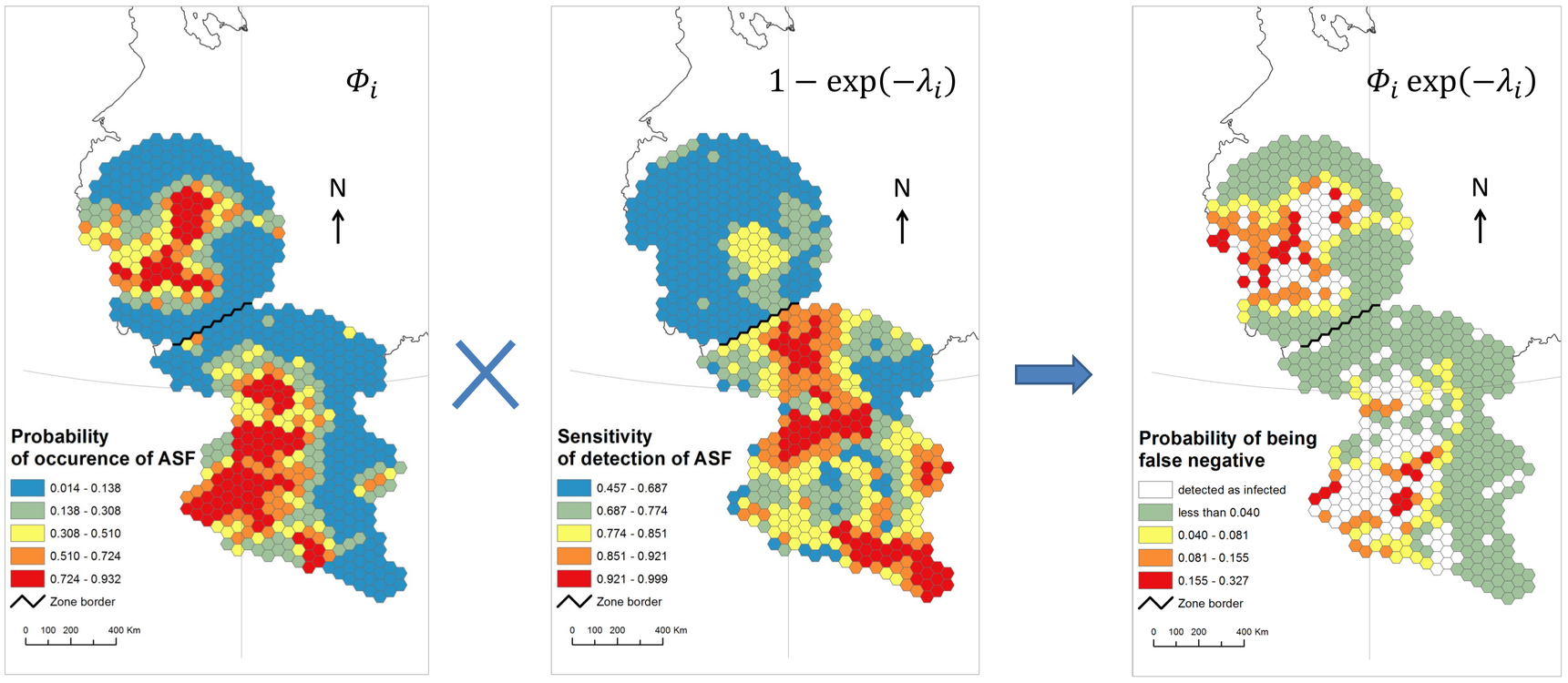
***Map**: Spatial distribution of reported ASF outbreaks in the European part of the Russian Federation, 2007-2014*

Spatial zero-inflated Poisson model



$$P(Y_i = y) = \begin{cases} (1 - \Phi_i) + \Phi_i \exp(-\lambda_i) & if\ y = 0 \\ \Phi_i \dfrac{{\lambda_i}^y \exp(-\lambda_i)}{y!} & if\ y \geq 1 \end{cases}$$

Results and Discussion



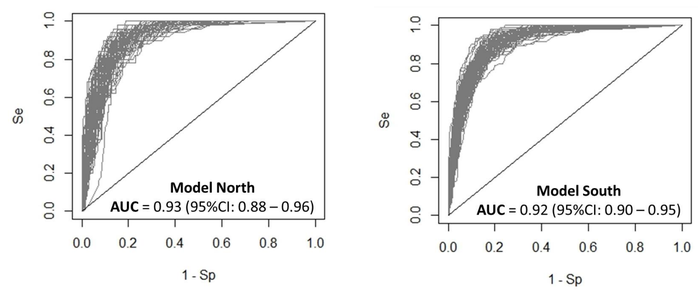
Risk of ASF occurrence, 2007-2014
- *Human population density (S)*
- *Spatial autocorrelation*

Probability of reporting ASF if outbreaks occurred, 2007-2014
- *Human population density (N&S)*
- *Density of high biosec farms (S)*
- *Distance to the lab (S)*

Probability for a hexagon to have been a false negative (FN), 2007-2014

Nb of **FN** in the North= 11.1 (95%CI 5.4-20.9)
Nb of **FN** in the South = 9.7 (95%CI 5.5-16.5)

Good predictive ability that at least one outbreak is reported



Human population density increases both:
- the likelihood of at least one outbreak to occur
- the average number of reported outbreaks given at least one occurred

No effect of the forest coverage → Limited role of wild boar?

Limitations:
- Only linear effects were investigated
- Interactions were not tested
- Limited power

1 Veterinary Epidemiology, Economics and Public Health Group, Royal Veterinary College, London, UK
2 Federal Center for Animal Health, Vladimir, Russian Federation
3 National Research Institute for Veterinary Virology and Microbiology of Russia, Pokrov, Russian Federation

Acknowledgments:
These studies are supported by the EU ASFORCE project (EC, FP7-KBBE.2012.1.3-02, #311931)
We also give a big hug (well, maybe not all co-authors, but at least me) to Louis Tardivier for designing the original cartoons