Seeing through the fog of limited sensitivity in wild boar ASF surveillance data in S. Korea

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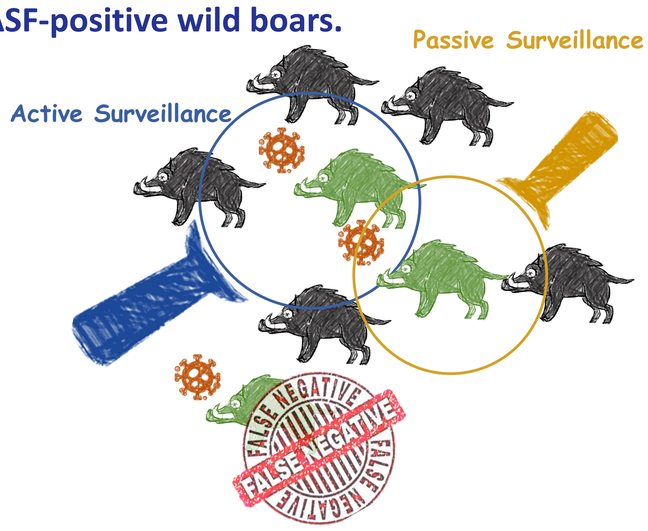
Background

- Since Sep 2019, more than **651 ASF cases in wild boars** and 14 farm outbreaks have been notified in South Korea.
- Korea government launched **active and passive surveillance system for wild boar**.
- However, wildlife surveillance systems have **limited detection sensitivity.**
- It is highly likely to create confusions as to whether the identified risk factors **are associated with the risk or reporting of the ASF-positive wild boars.**



Study Design

To account for imperfect detection,

Spatial Zero-inflated Poisson model

$$P(Y = y_i) = \begin{cases} (1 - \pi_i) + \pi_i\, e^{-\lambda_i} & if\ (y = 0) \\ \pi_i \dfrac{\lambda_i^{y_i} e^{-\lambda_i}}{y_i!} & if\ (y \geq 1) \end{cases}$$

$$logit(\pi_i) = \alpha_0 + \sum \alpha X_1 + \omega_i + v_i$$

$$log(\lambda_i) = \beta_0 + \sum \beta X_2$$

Presence/Absence

Presence!! π_i

Absence!! $1 - \pi_i$

Number of reports

Abundance

$$\pi_i \frac{\lambda_i^{y} e^{-\lambda_i}}{y!}$$

Sensitivity

 # Report = 0

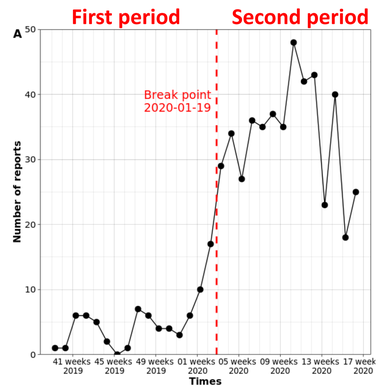
True Negative

$(1 - \pi_i)$

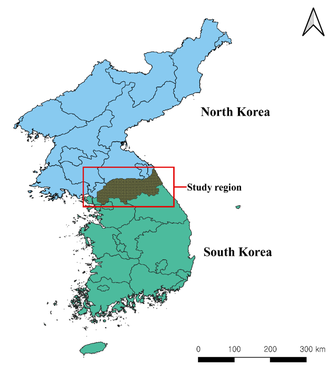
 # Report = 0

False Negative

$\pi_i\, e^{-\lambda_i}$



- Study periods-



- Study region -

Covariates

1. Ecological variables
   - EVI, NDWI, rice paddy, surface water, wetland, precipitation
   - Wild boar suitability
2. Topographical variables
   - Elevation, slope, Heat load index
3. Potential related factors
   - Distance to North Korea
   - Human population density

Results & Discussion

Presence ?

1st Period: Distance to North Korea

2nd Period: Endemic transmission

Presence!!

Number of reports

Abundance

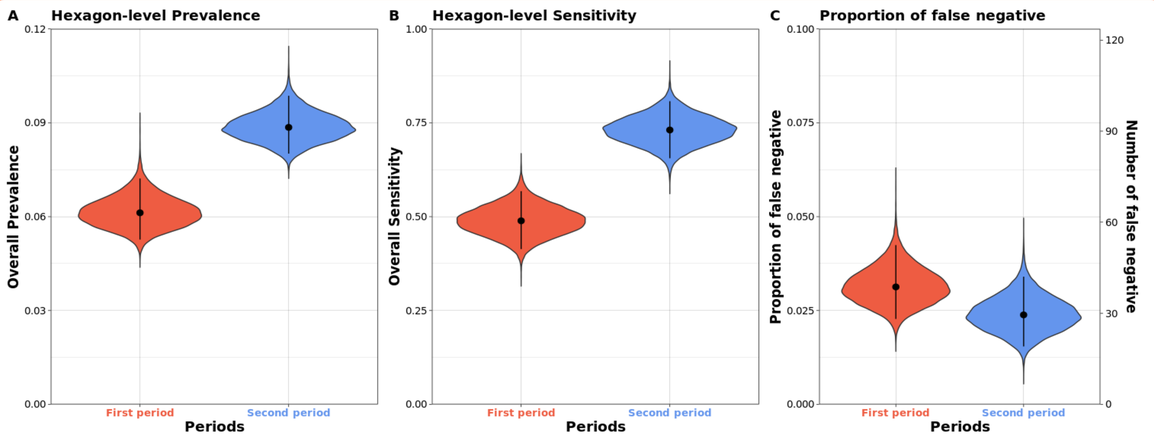
1st , 2nd Period: Wild boar population

1st , 2nd Period: Wet and cool area

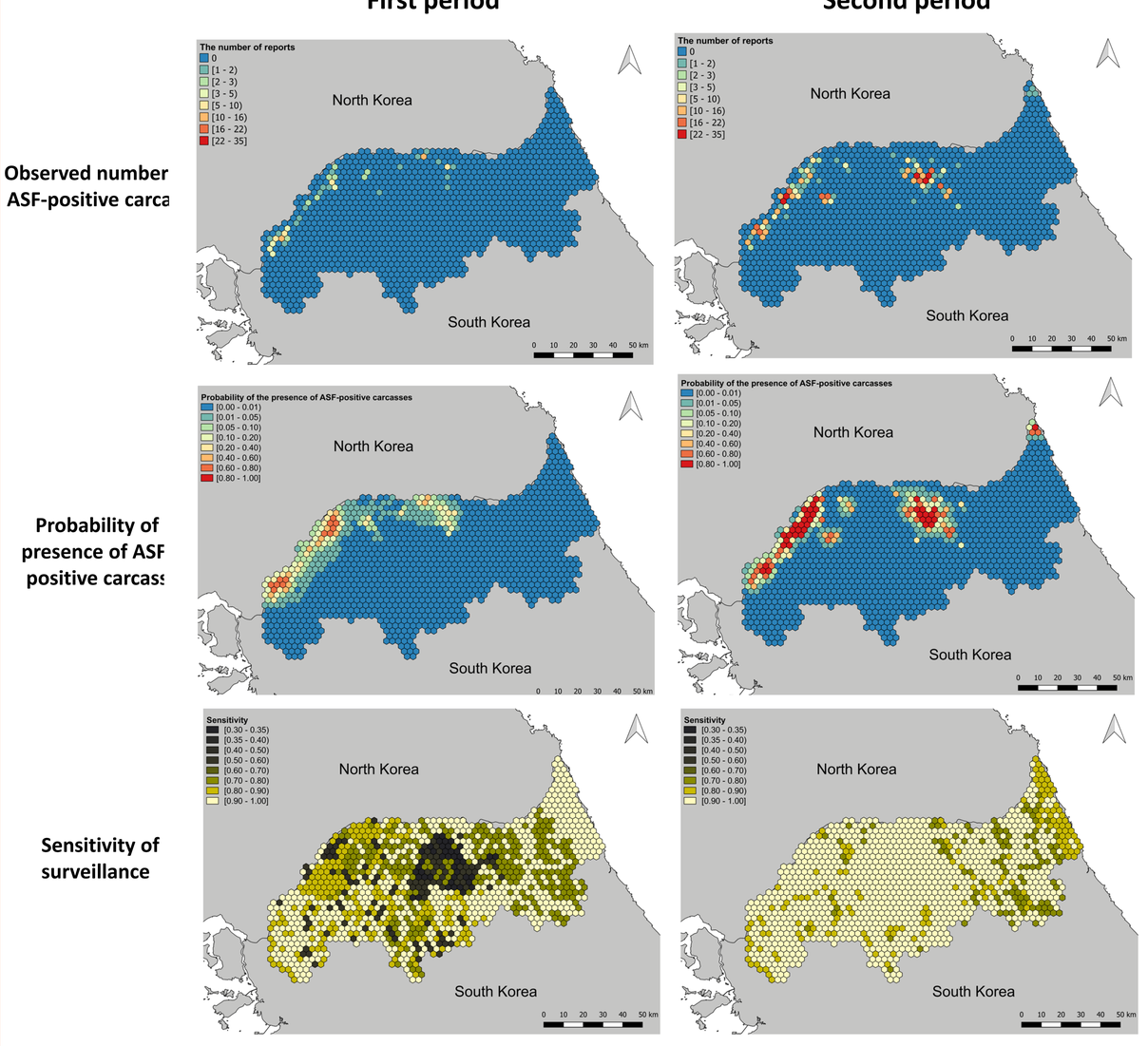
Sensitivity

1st Period: Human population

2nd Period: Elevation, Reported regions



- **Increased reports of ASF-positive wild boars results from**
  - **Increased risk of ASF & Increased sensitivity of surveillance**
- **Unreported regions that have ASF-positive carcass left**
  - **Source of spatial spreading**



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Conclusion

- **The epidemiological situation seems to have changed into an endemic status and further appears to be getting worse.**
- **Although the sensitivity of surveillance increased, it is possible to improve the sensitivity based on this study.**
- **The factors identified in this study could be useful for risk-based surveillance systems.**