

# Modelling the spatial distribution of mosquitoes at different geographical scales

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## Background

- Arthropod vectors are sensitive to climatic and environmental factors
- Determining the distribution of vectors is an essential step in studying the risk of transmission of a pathogen
- Knowledge of the spatial distribution of vector species is important for estimating levels of risks of VBDs and for enabling better targeting for surveillance and helps in designing control measures
- Risk maps are a useful tool to assess and visualize the risk of establishment and spread of vector-borne diseases

### Species distribution models:



## Field data

- Occurrence/abundance mosquito data
- *Culiseta annulata*, *Anopheles claviger*, *Ochlerotatus punctor* and *Anopheles plumbeus*
- Cross-sectional study in the Netherlands
- Weekly operated CO<sub>2</sub>-baited traps
- 766 catches
- April-October 2010-2013

## Environmental data

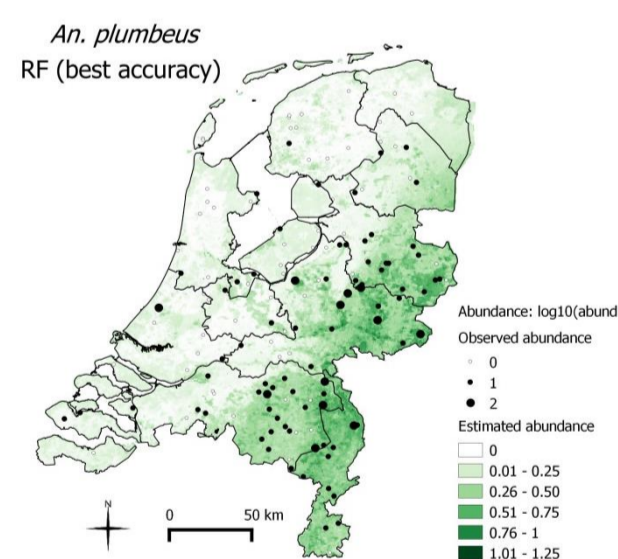
- MODIS Middle infra-red
- MODIS Day-time land surface temperature
- MODIS Night-time land surface temperature
- MODIS Enhanced vegetation index
- MODIS Normalised difference vegetation index
- CMORPH Precipitation
- WorldClim Precipitation
- MODIS Digital elevation model
- Human population density
- Corine land cover



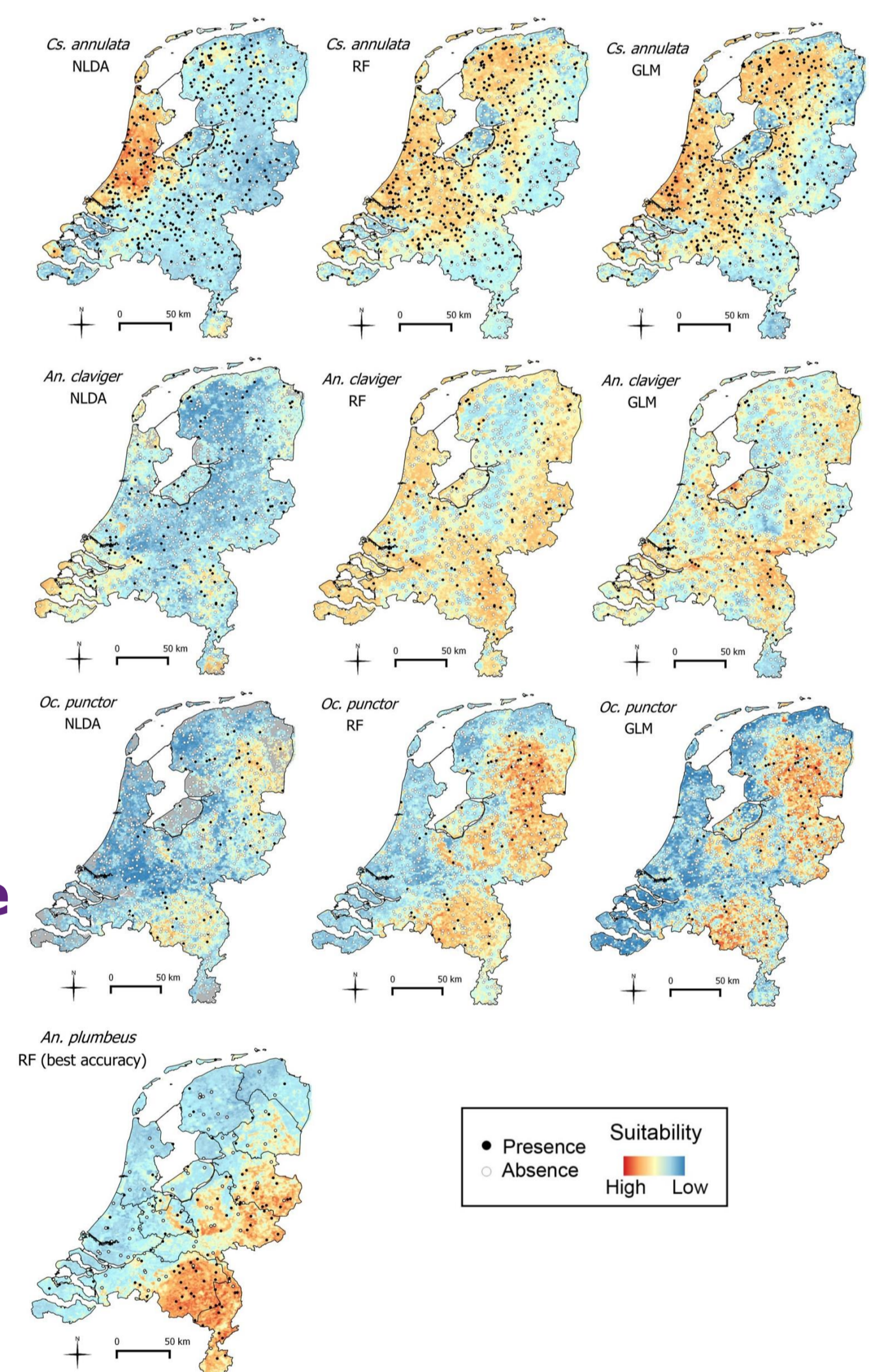
## Statistical models

- Non-linear discriminant analysis (NLDA)
- Random forest (RF)
- Logistic regression (GLM)

## Map of estimated abundance (abundance data)



## Maps of environmental suitability (occurrence data)



Low resolution

## Field data

- *Aedes albopictus* egg abundance
- 55 ovitraps weekly monitored in Rome
- 8th July - 21st October 2011

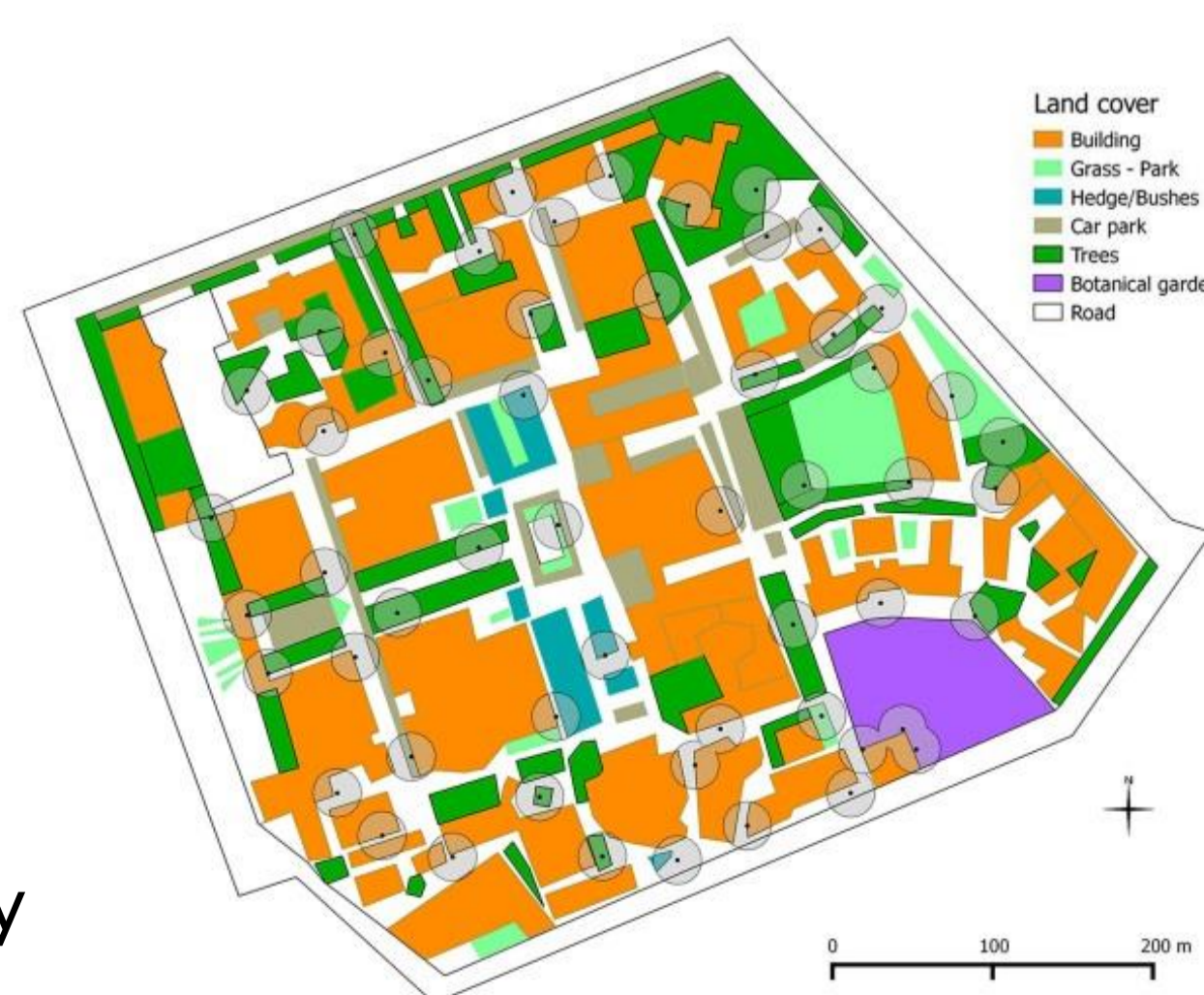
## Environmental data

- Land cover classes:
  - buildings, car parks, roads, grass, trees, hedges and botanical garden
- Solar radiation
- Month
- Meteorological data:
  - precipitation, temperature, humidity and wind speed

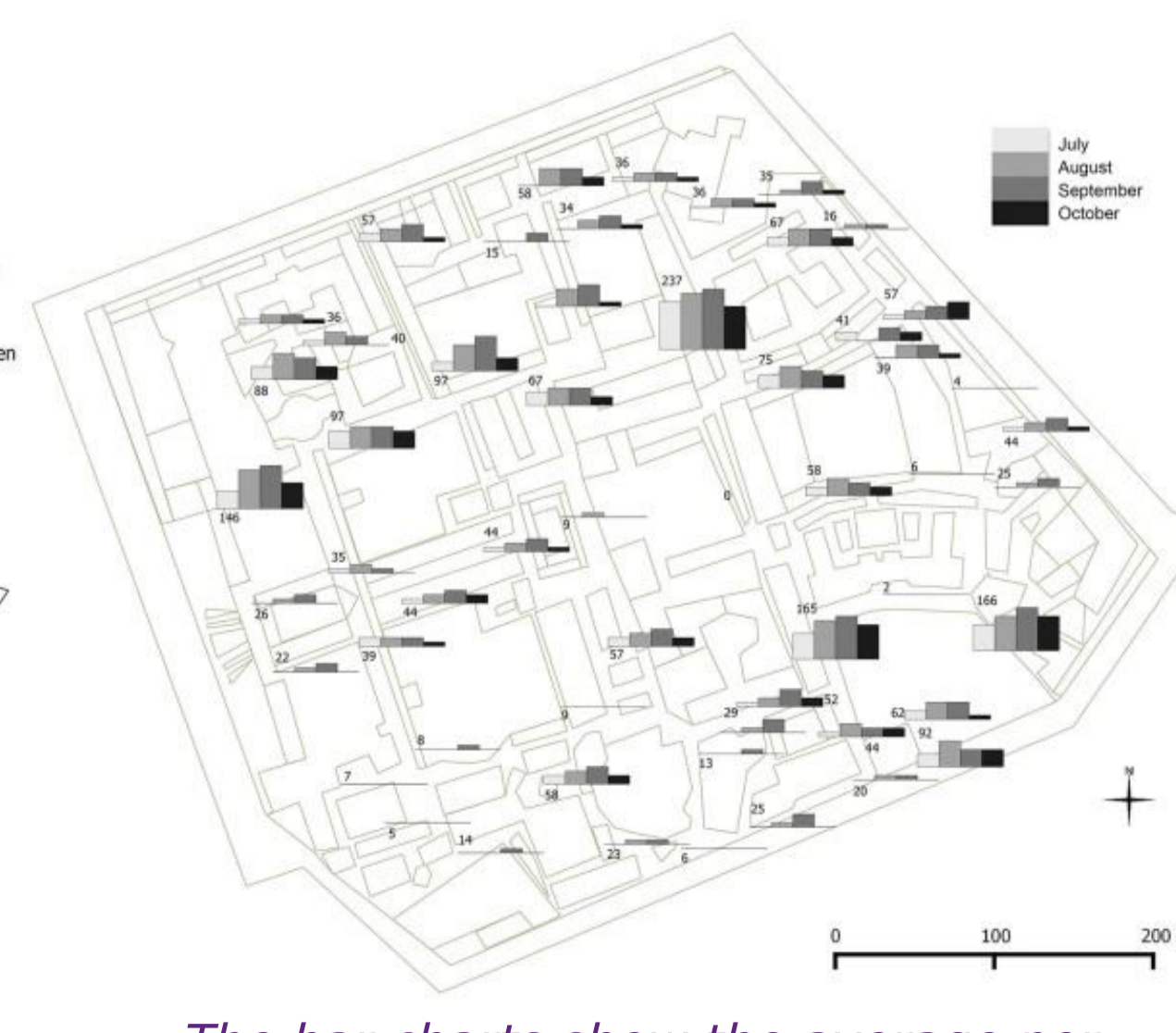


## Statistical models

- Poisson regression model
- Negative binomial regression model



Distribution of the ovitraps (black dots) in the campus of Sapienza University in Rome (Italy) with circular buffers of 15m radius around each trap.



The bar charts show the average per month of the weekly counts of eggs for each ovitrapping station. The numbers indicate the total number of eggs found in each trap.

## Results

- Negative binomial regression model (lower AIC)
- Best subset of environmental variables

Variable	Effect
Botanical garden	NS
Grass	-
Trees	+
Solar radiation	+
August	+
September	+
October	+
Temperature max	-
Humidity max	-

July: reference category for month

NS: not significant at 0.05 level

- Negative effect

+ Positive effect