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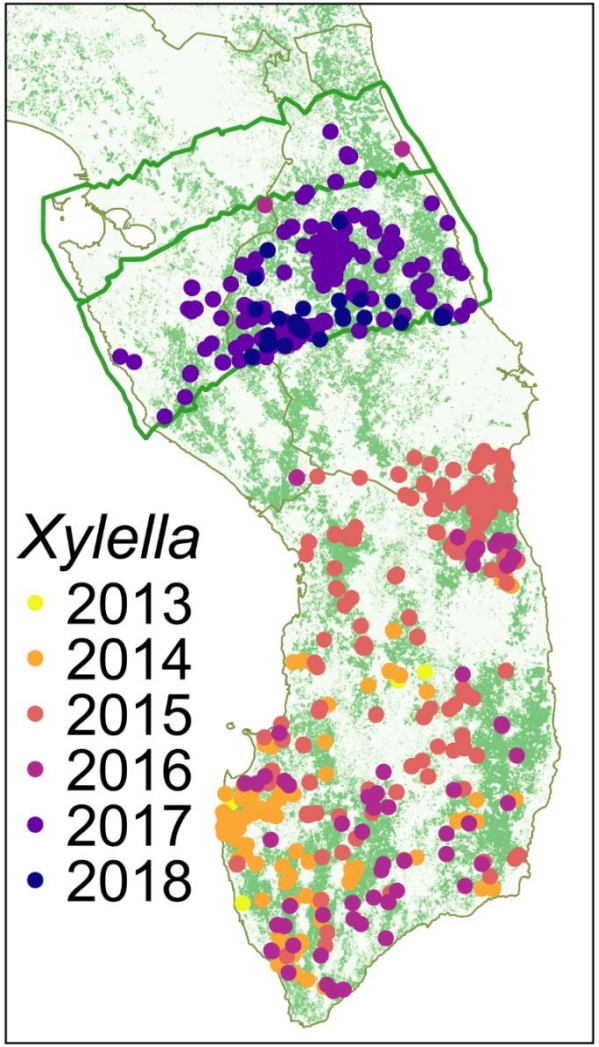


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# Developing a spatial epidemiological model to estimate *Xylella fastidiosa* dispersal and spread

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BE THE DIFFERENCE

## Why try to model *Xylella* spread?

To estimate epidemiological parameters difficult to measure directly, e.g.

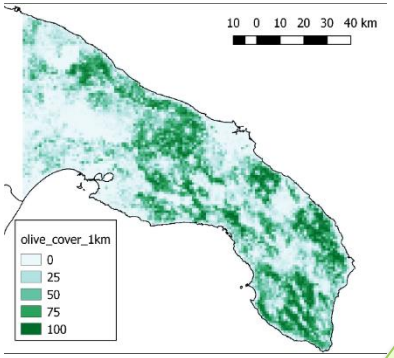
- Infectiveness
- Dispersal distances

To inform risk assessment and disease management, e.g.

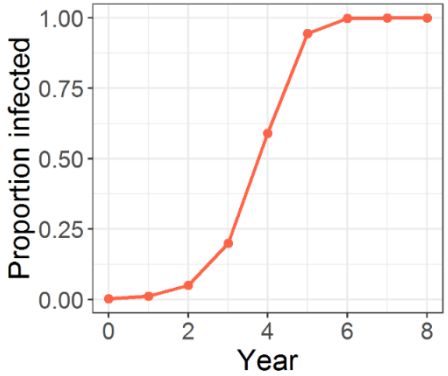
- Effect of landscape composition on spread
- Size of management zones

# Our approach to developing a spatial epidemiological model

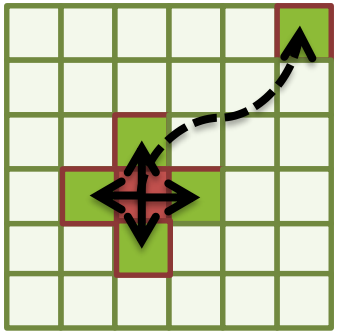
Susceptibility
(olive grove cover)




Infection dynamics
in infected groves




Dispersal (local diffusion +
long distance jumps)



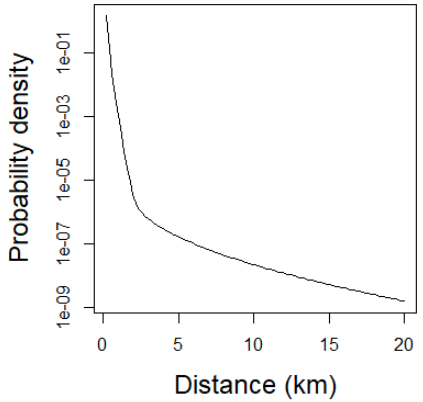
Simulated epidemic
spreading in the
landscape

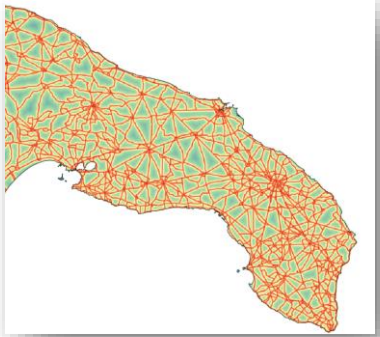
# Long distance dispersal – alternative models

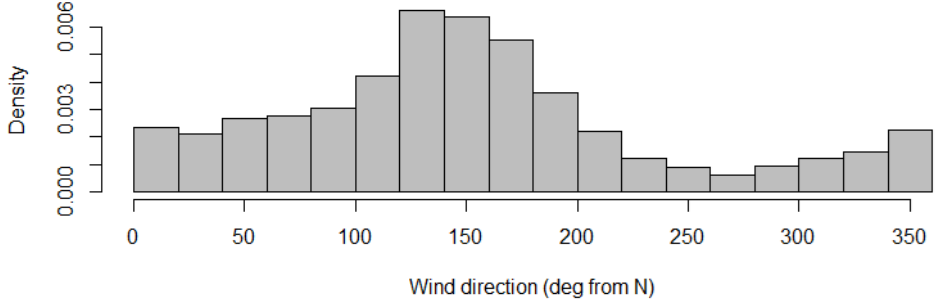
Long distance mechanisms:

- Basic (jump in a random direction)
- Road (jumps more likely near major roads)
- Wind (jump directions drawn from summer wind directions)

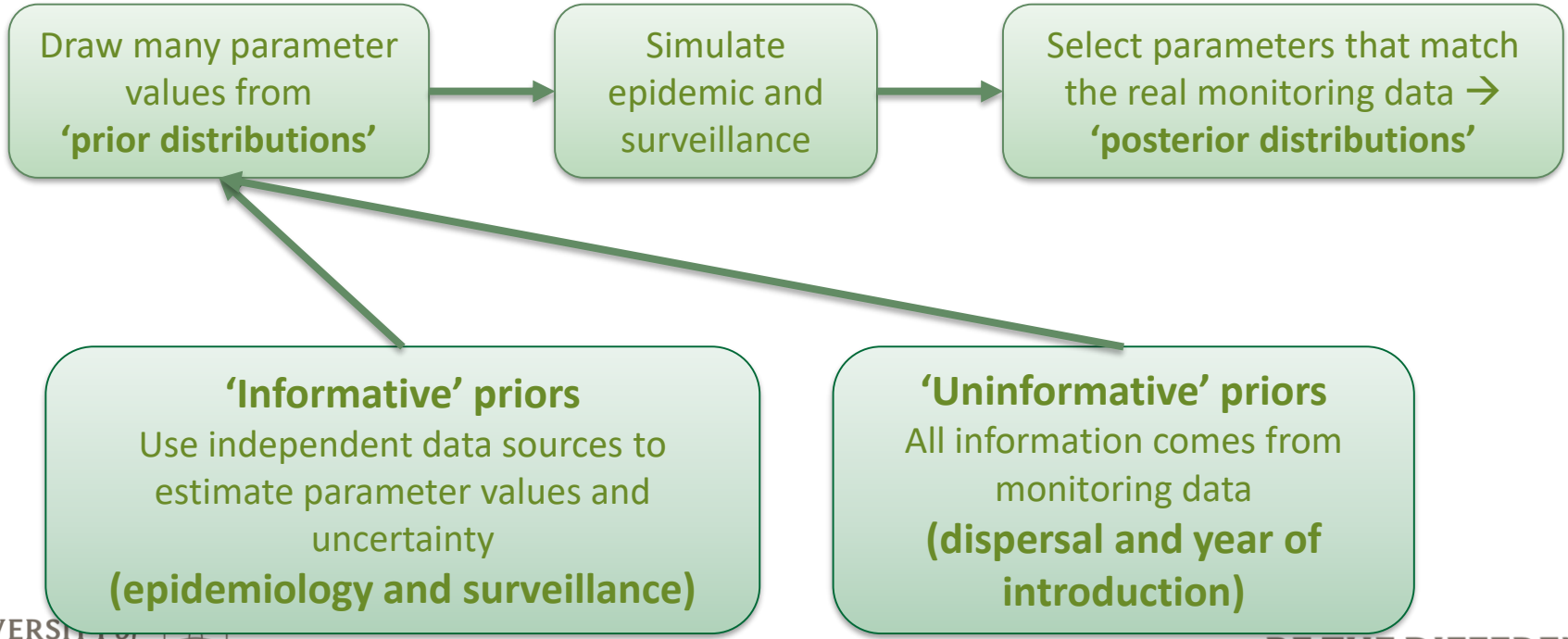
Which fits the best?





# Approximate Bayesian Computation (ABC)



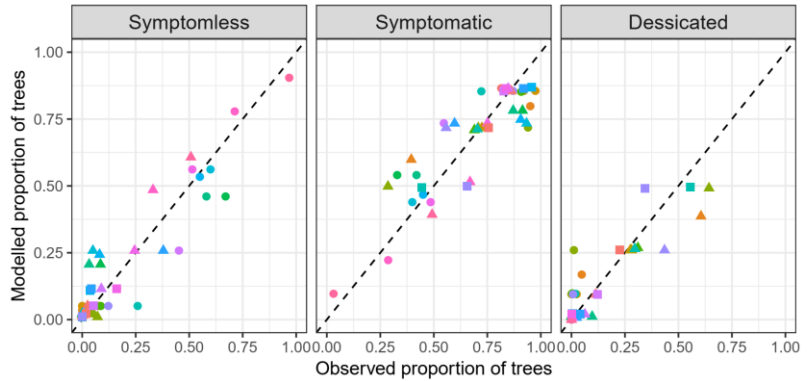
# Informative priors for epidemiology in infected olive groves

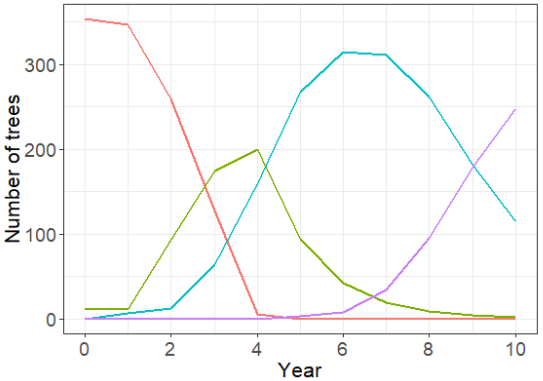
Model fitted to data from 17 plots:

- Symptomatic trees infect 17 (10-24) uninfected trees per year
- Asymptomatic trees 4% (0-15%) as infective as symptomatic
- No estimate of infectivity of dessicated trees!

Priors for spatial model

Observed vs fitted




Uninfected
Asymptomatic
Symptomatic
Dessicated

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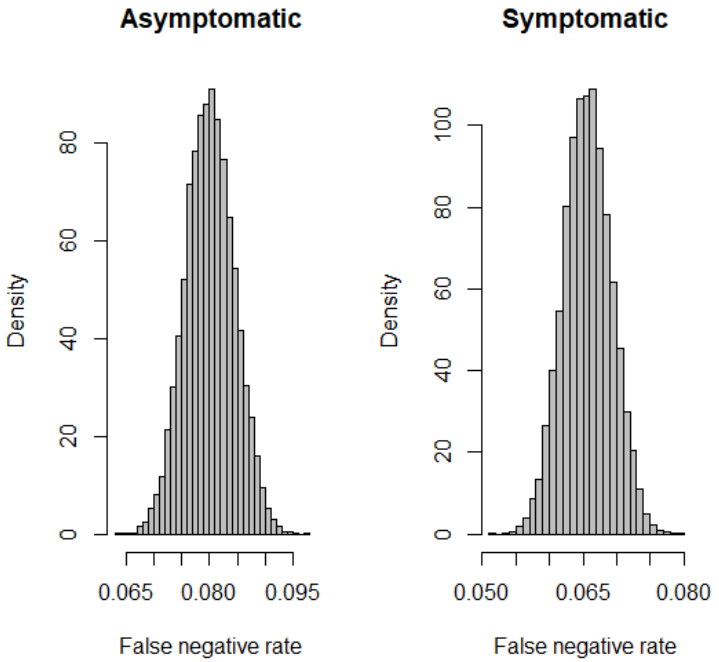
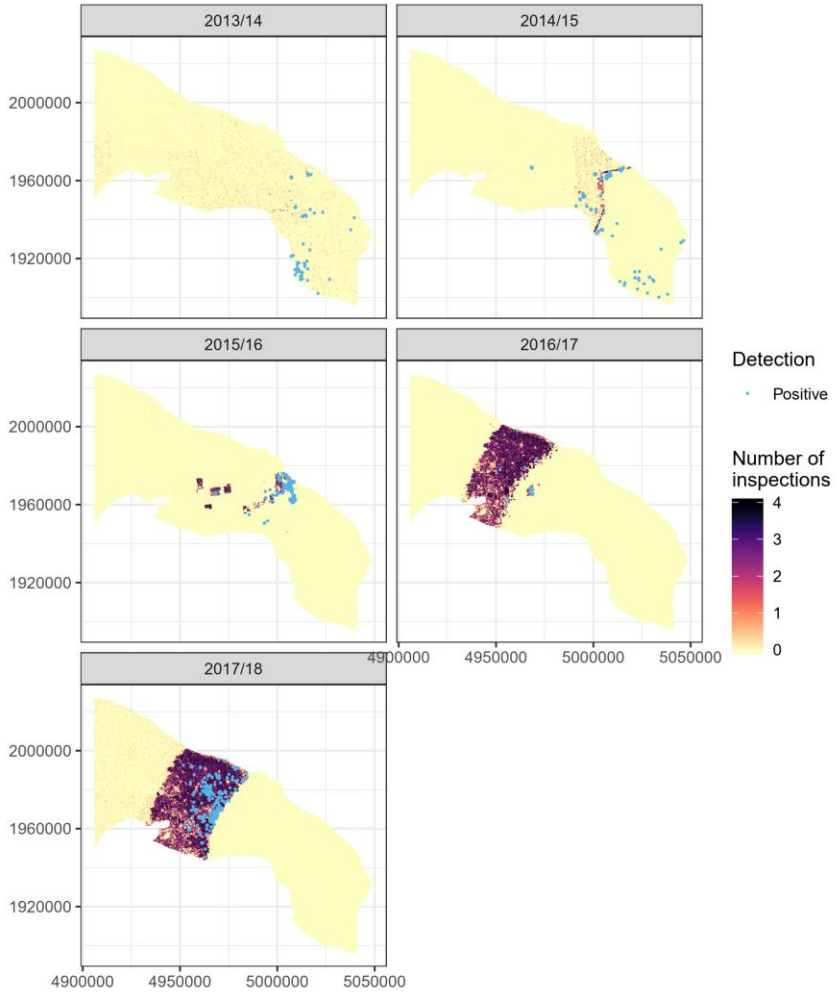
# Informative priors for surveillance

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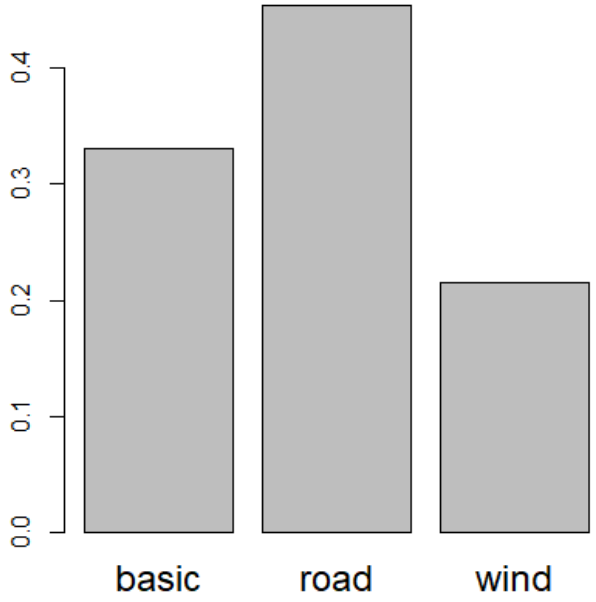
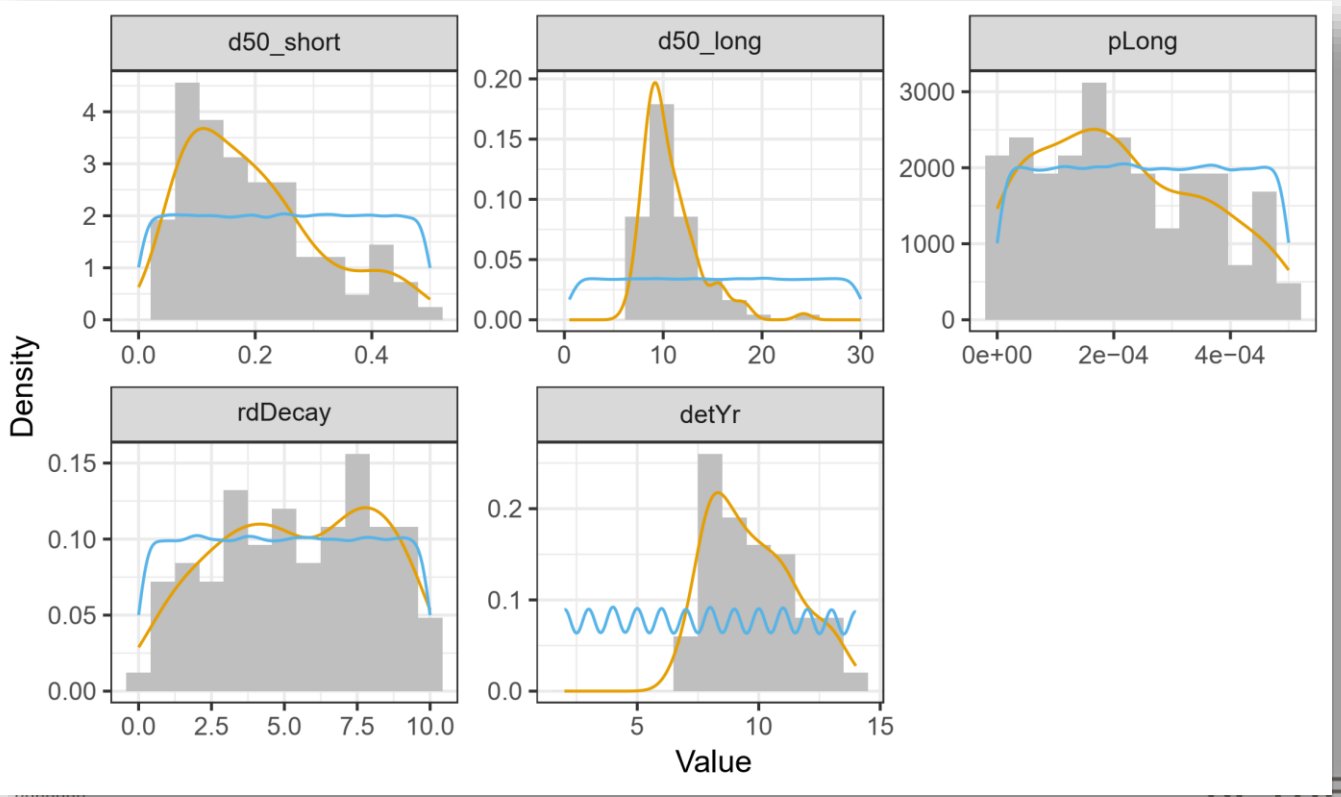
# Preliminary ABC results – which long distance jump model fits best?

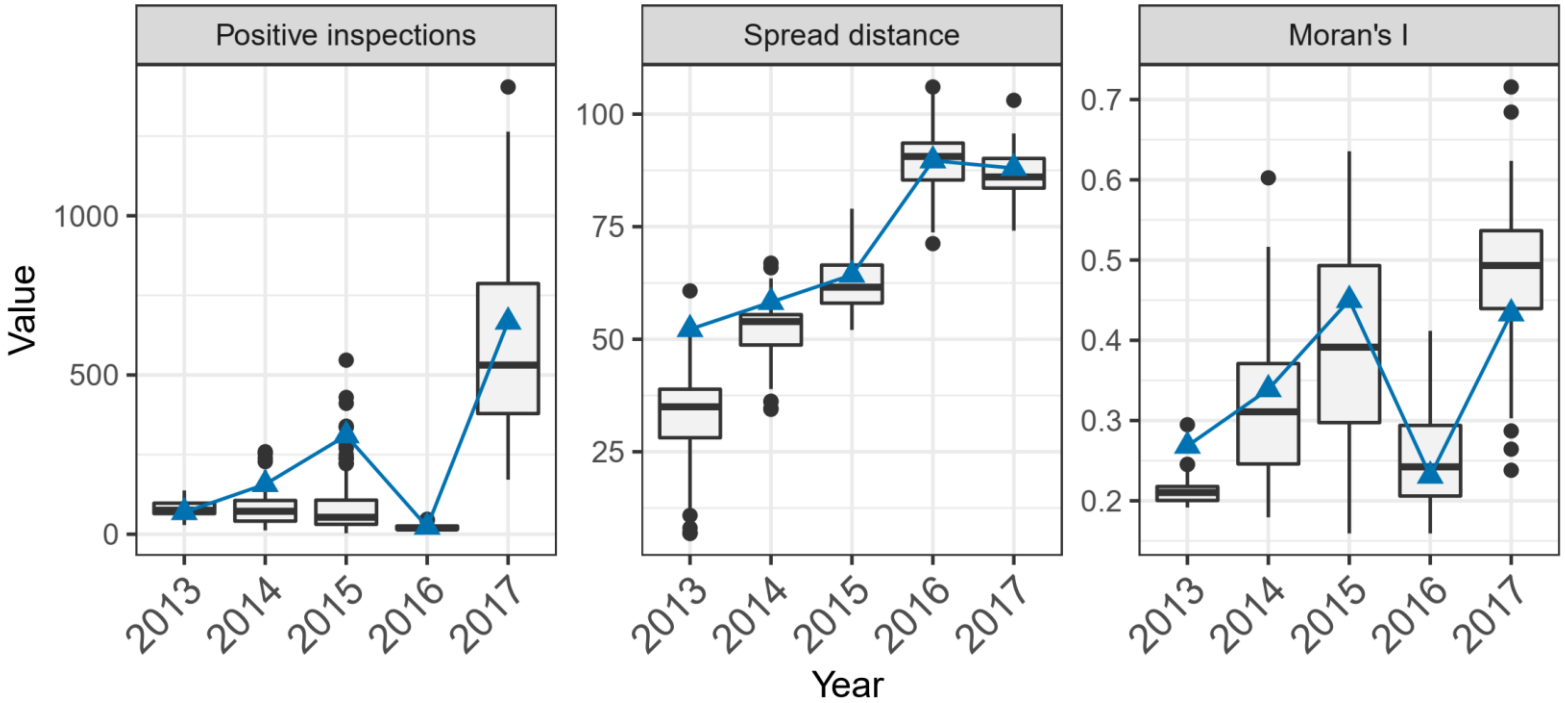
Representation in posterior



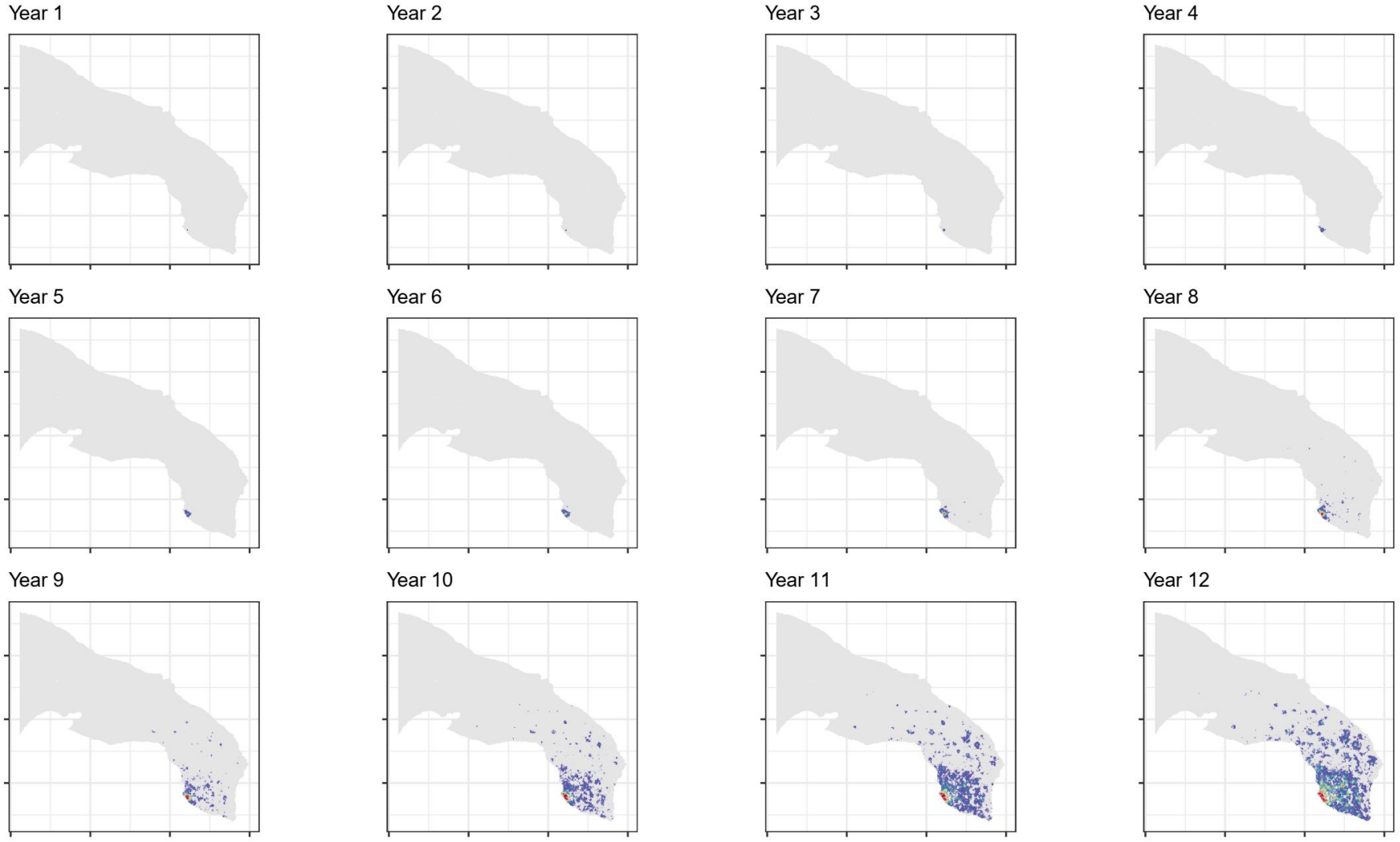
# Preliminary posterior estimates from the ABC



# Posterior predictive checks for road model




Boxplots = model outputs
Triangles = observed data


Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
Year 11
Year 12

## Conclusions

We are attempting to estimate epidemiological parameters by fitting models to data on *Xylella* dynamics and spread.

High infectivitiy of symptomatic trees and low infectivity of asymptomatic trees, but uncertainty about dessicated trees.

Spread is driven by local diffusion and long distance jumps.

Some support for long distance jumps following the major road network.

## Acknowledgements

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# Thank you