Identification and potential uses of spatial patterns for predicting pest species outbreaks

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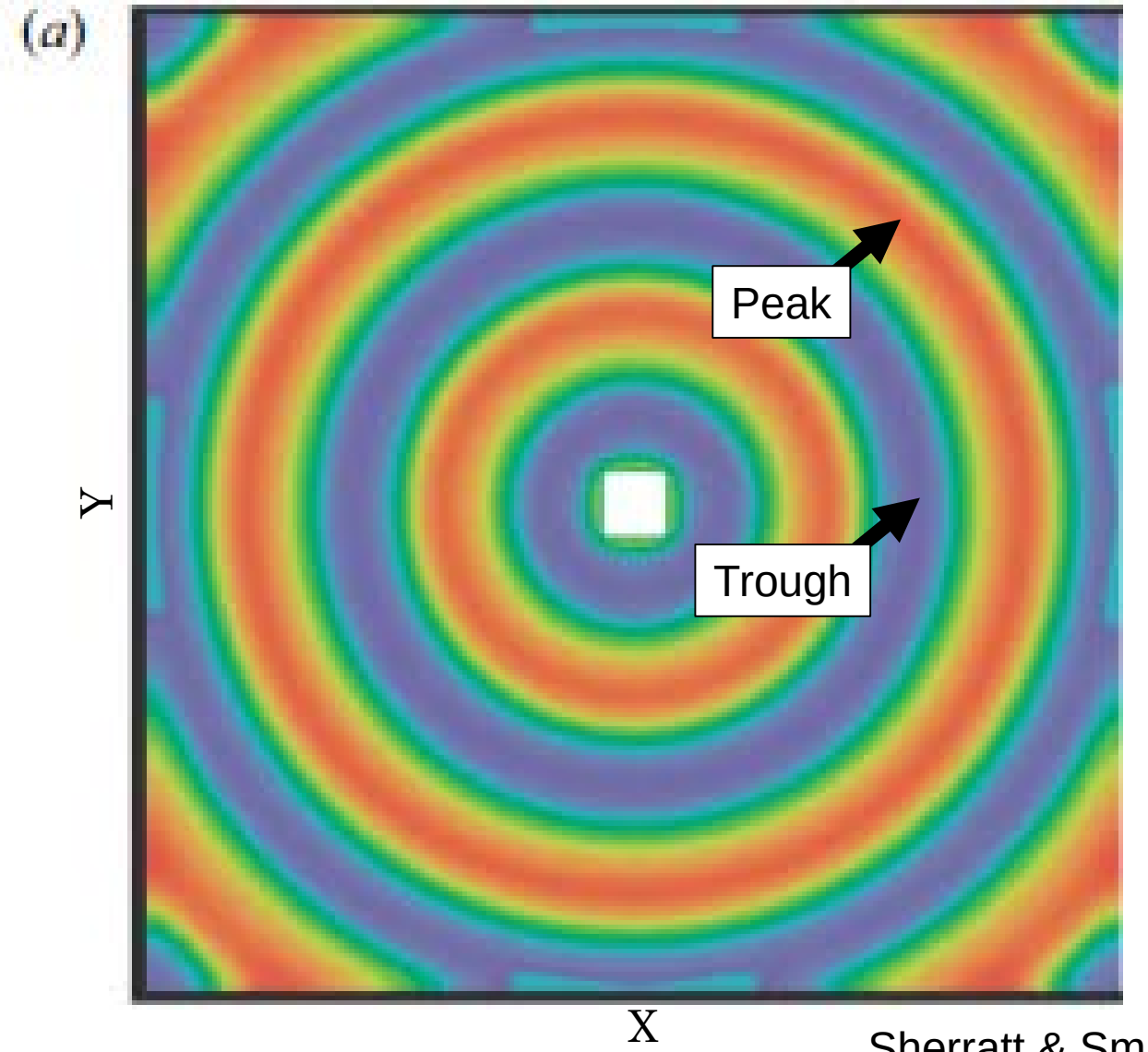
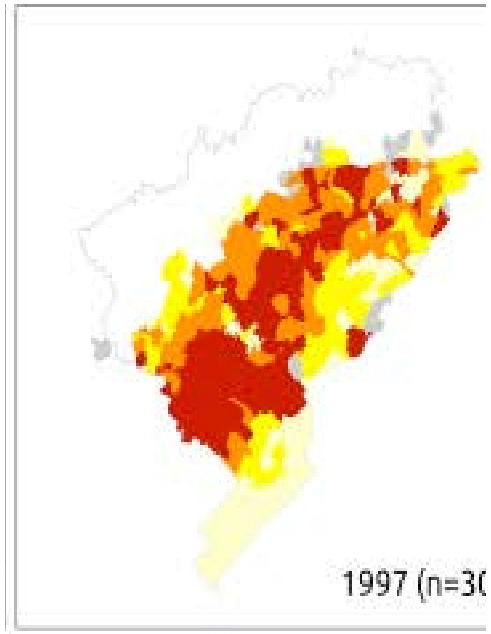
Asynchrony of populations in time

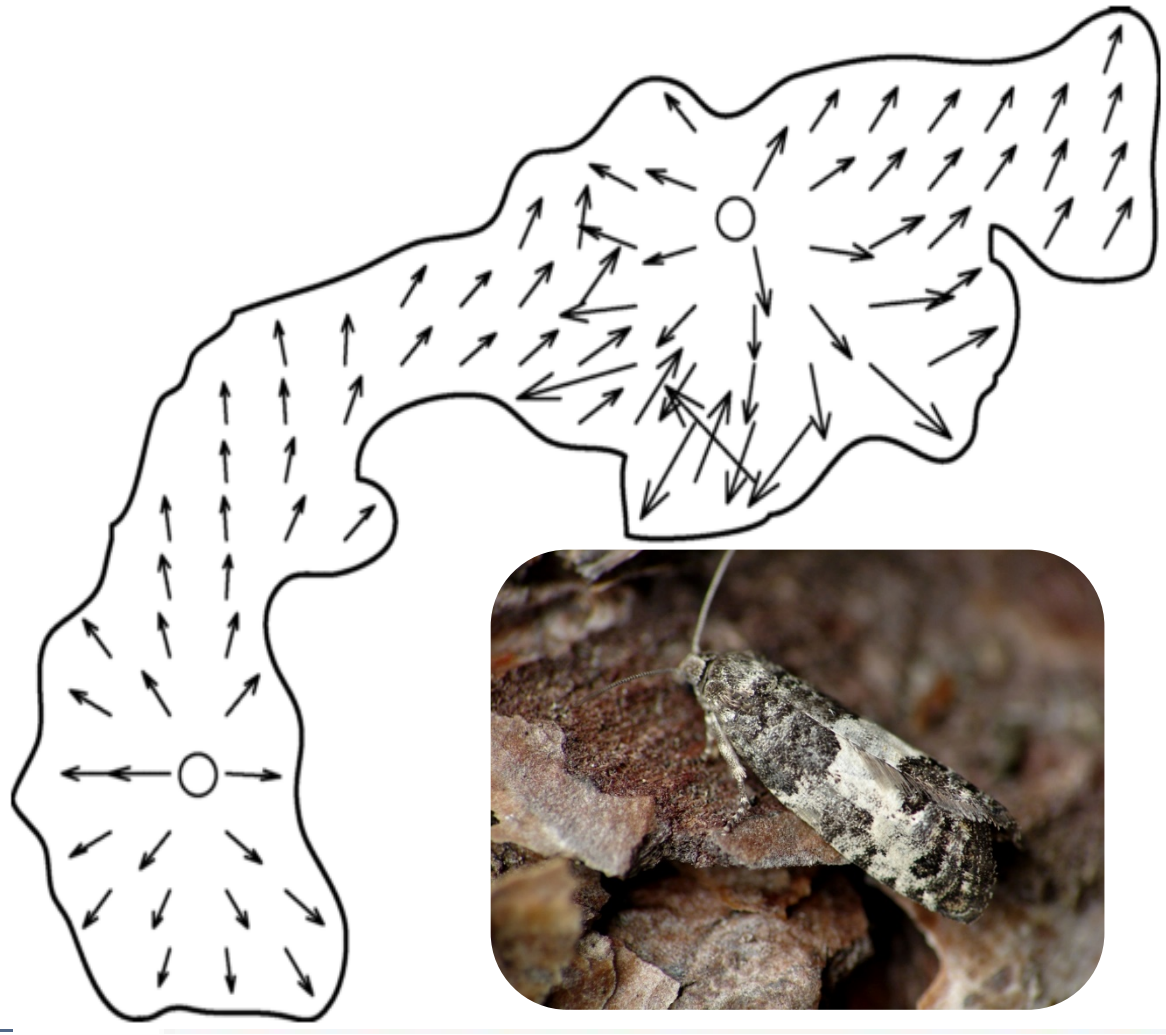


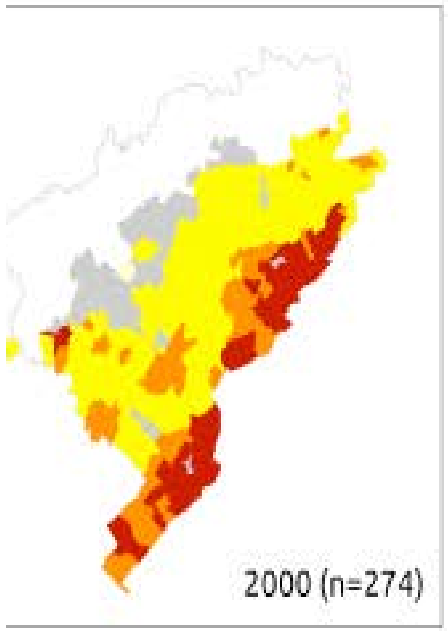
Sherratt & Smith, 2014; Lambin et al, 1998

Spatio-temporal asynchrony

Looking at larger areas relative to pattern yields greater complexity







Johnson et al, 2014; Berthier et al, 2014; Sherratt & Smith, 2014

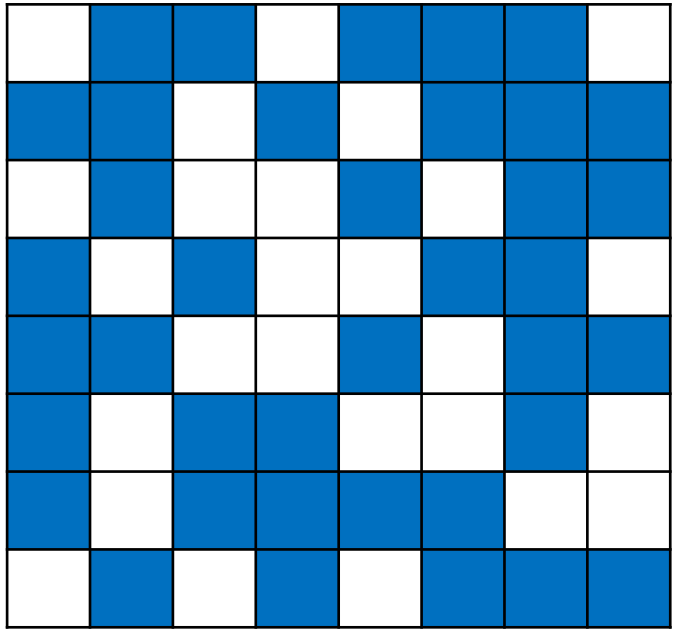
Invasion of Spain!!

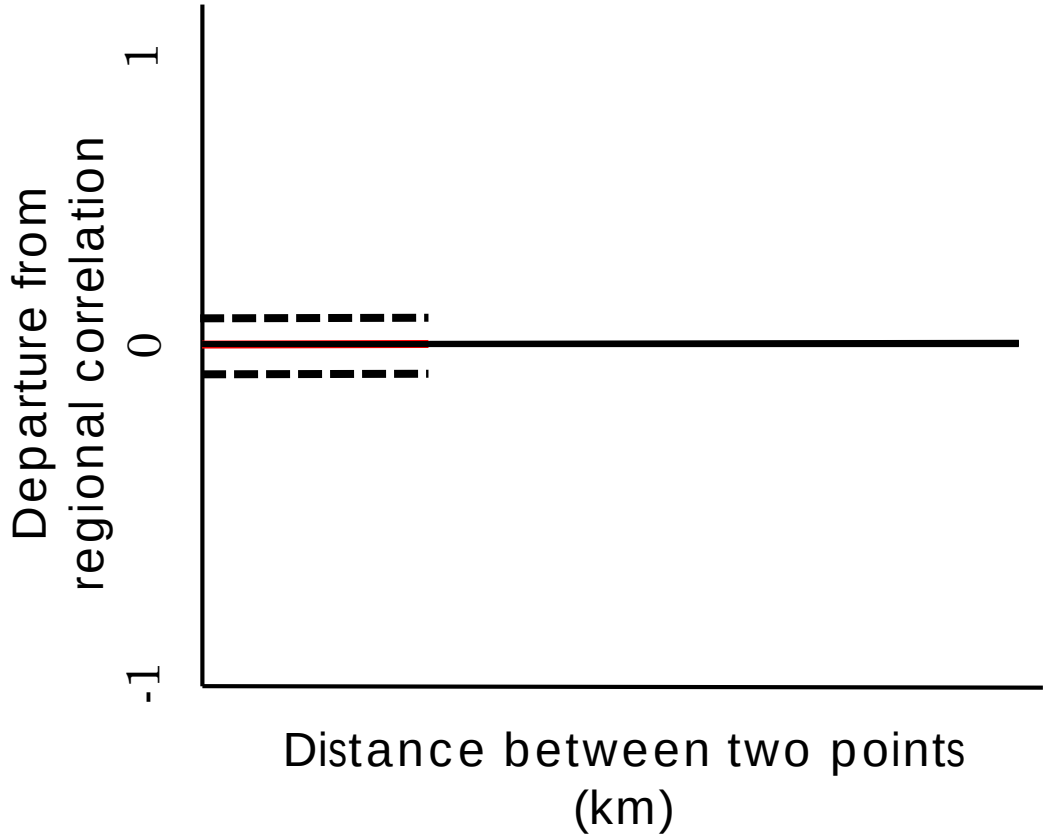
(By common voles)

85.555 transects from 94.000 km^2

How to characterise [a]synchrony

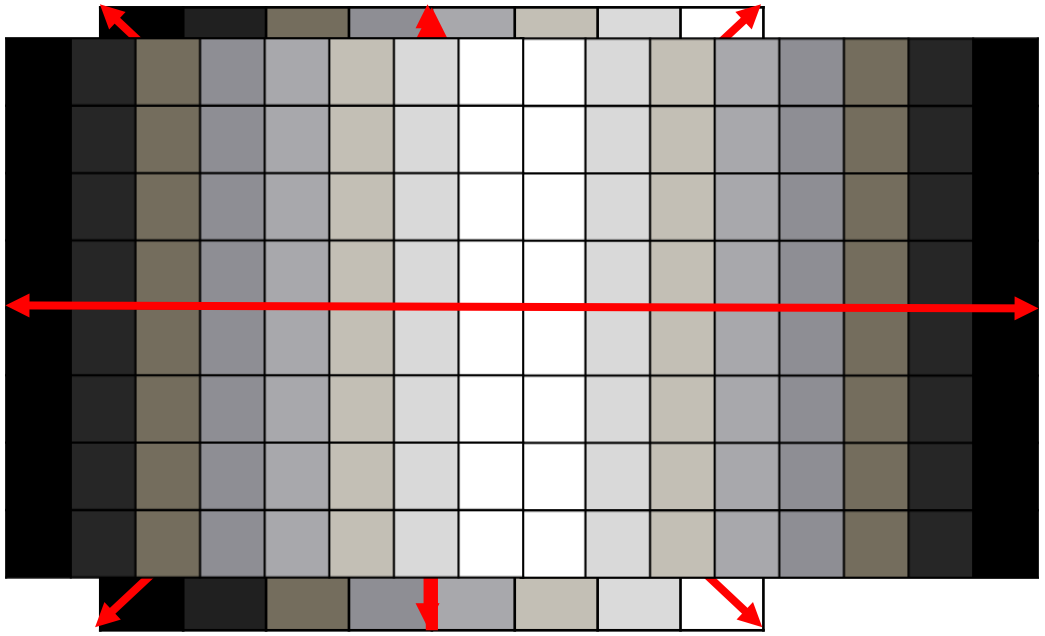
An example with a completely random population

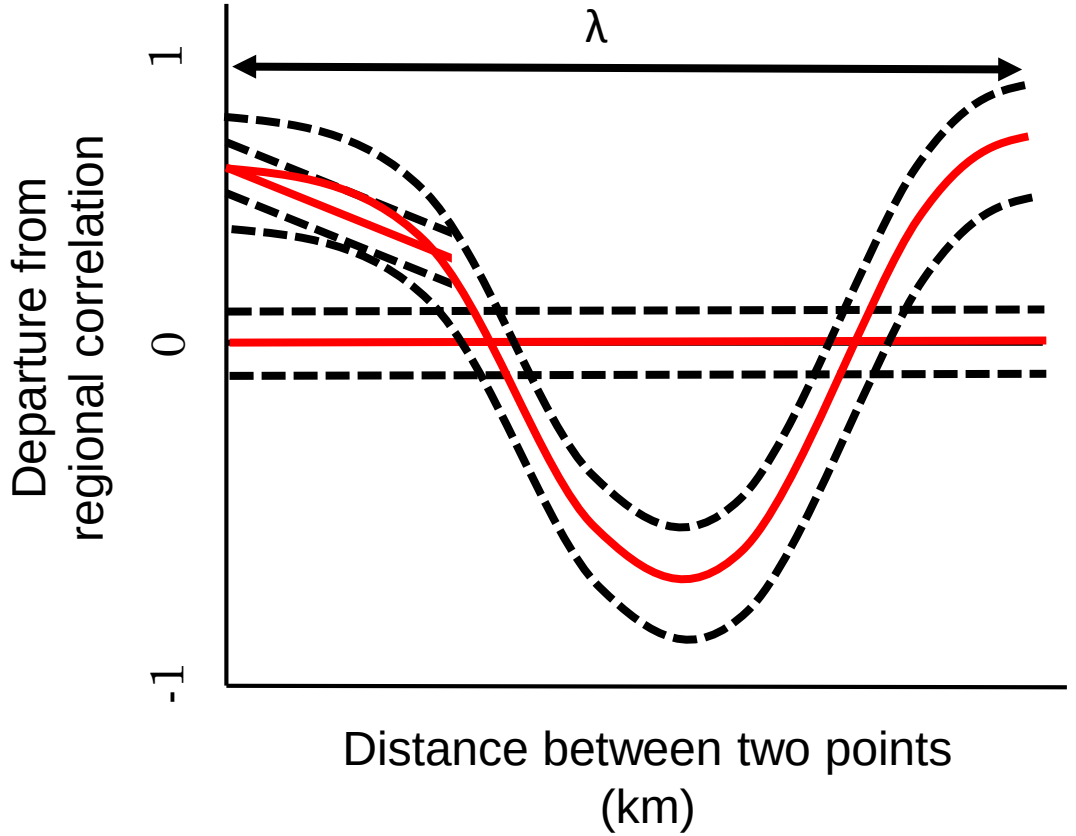




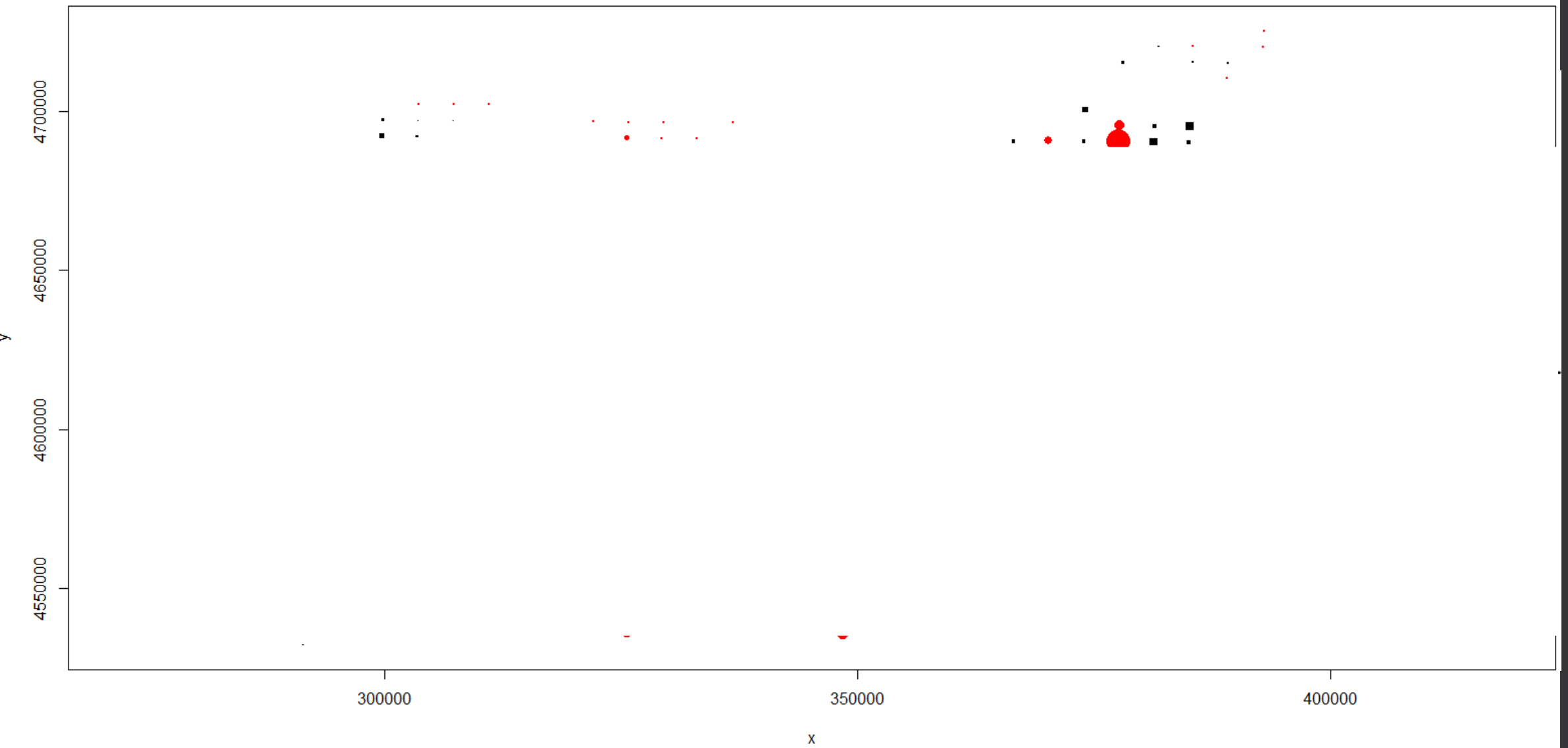
How to characterise [a]synchrony

An example with an asynchronous population



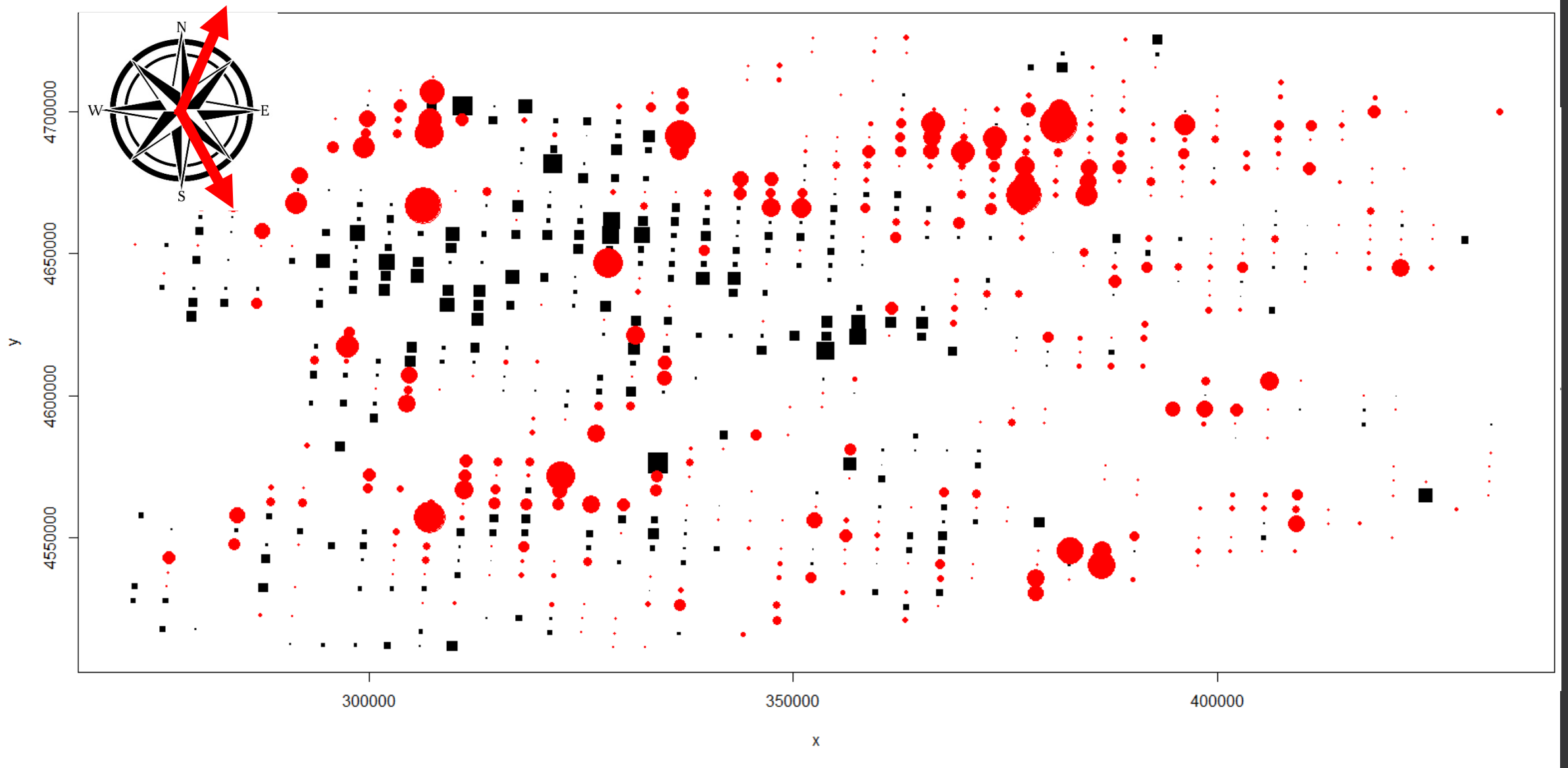


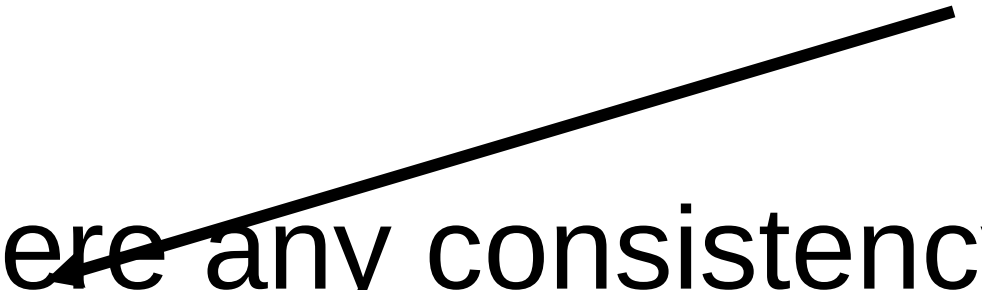
Synchrony of growth at low density!



Complex patterns at high density:

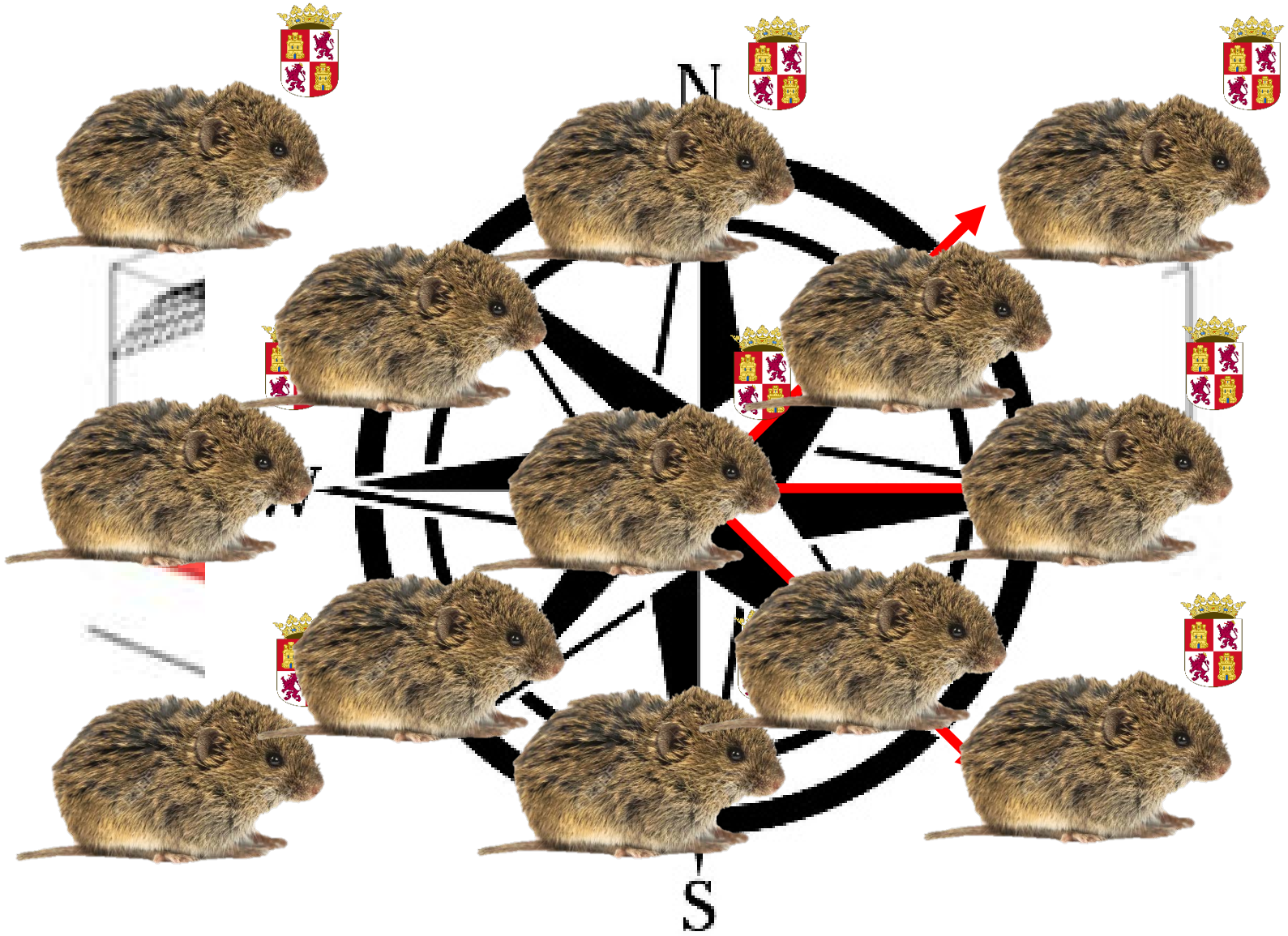
Anisotropy, wave like patterns and gradients



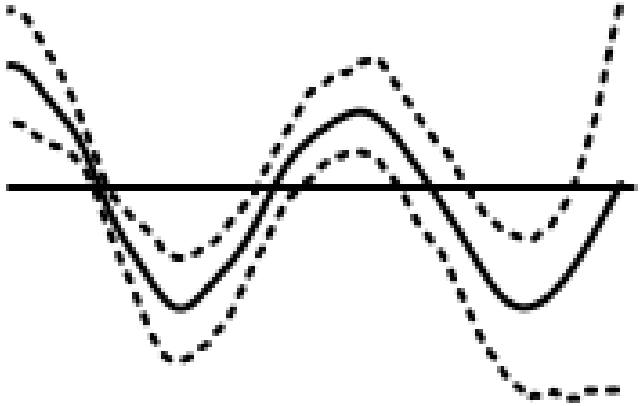


Is there any consistency in the patterns?

Rich pattern leads to complexity



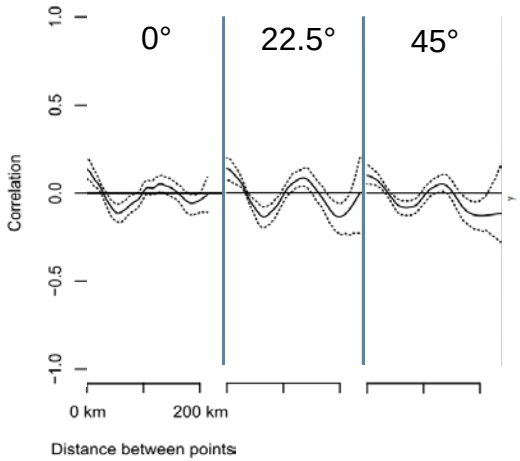
Why is this important?

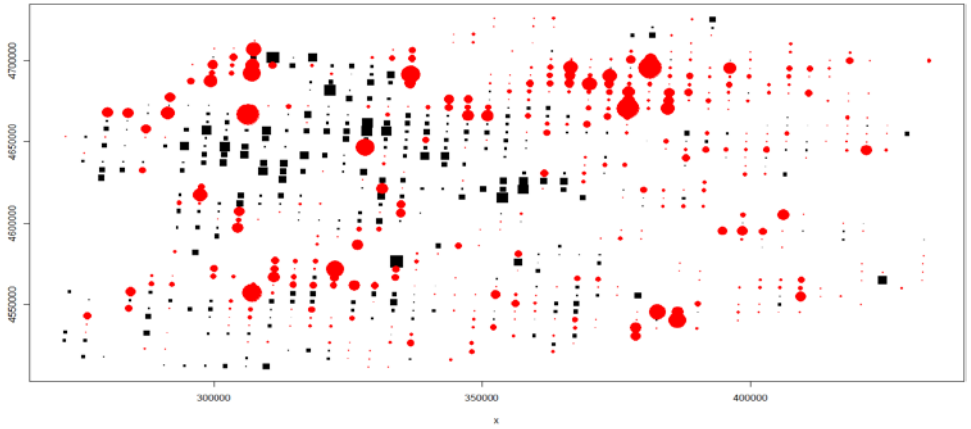


- No large scale synchrony despite large scale data
- Complex, time-varying spatial patterns in growth rate;
  - Directional and wave like at times
  - Related to N following period of high R?
  - Large scale stochastic events disrupt patterns?
- What about mechanisms?
  - Mobile predators can possibly drive patterns
    - Steep gradients within range of predators
- Implications for predictions?
  - Work towards outbreak detected in Location A allowing prediction of time till outbreak in Location B

Acknowledgements

Email: deon.roos@abdn.ac.uk





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