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Bacterial Parasite Communities of the Fossorial Water Vole *Arvicola terrestris* During a Period of High Abundance: Richness and Similarity in a Dynamic World

Petra Villette, Eve Afonso, Geoffroy Couval, Aurélien Levret, Jean-François Cosson, Patrick Giraudoux

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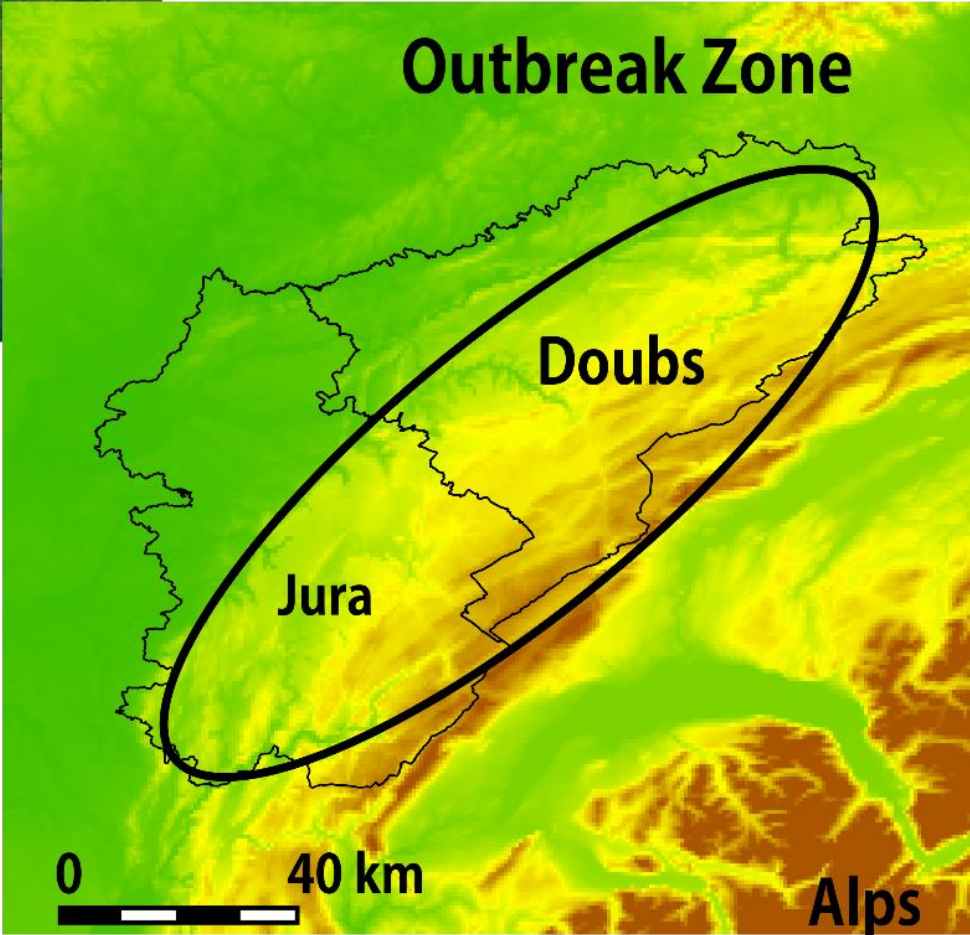
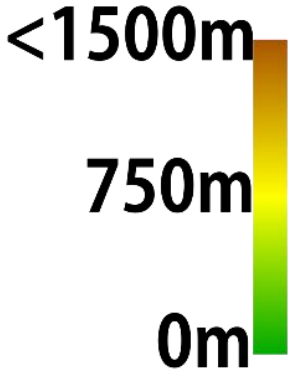
Bacterial Parasite Communities of the Fossorial Water Vole *Arvicola terrestris* during a period of high abundance: richness and similarity in a dynamic world

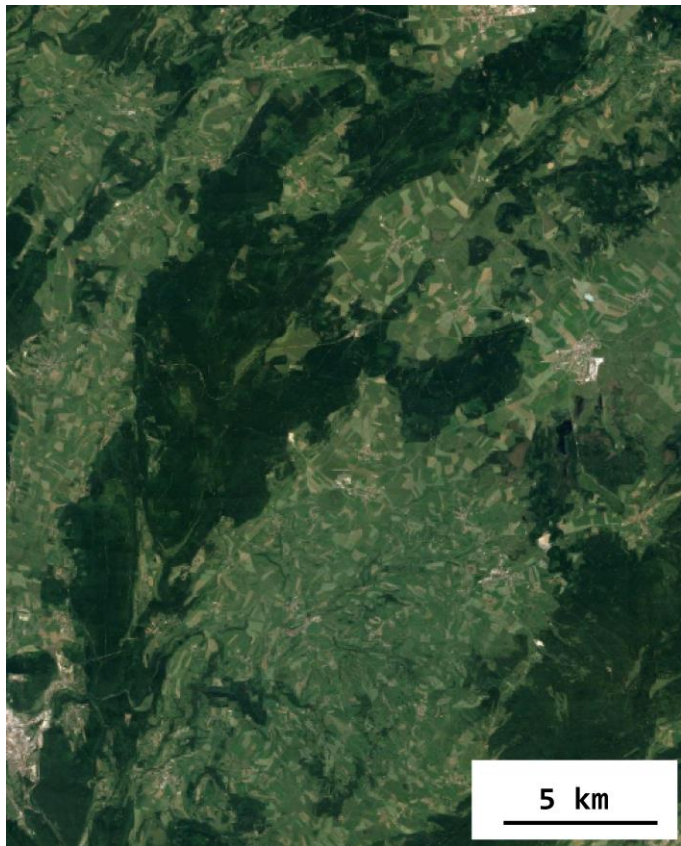


Petra Villette, Eve Afonso,
Geoffroy Couval,
Aurélien Levret, Jean-François
Cosson, Patrick Giraudoux



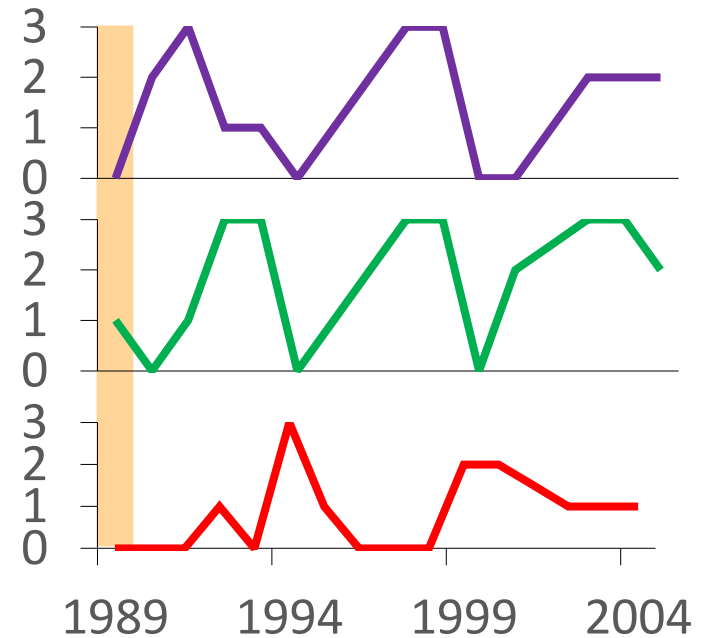
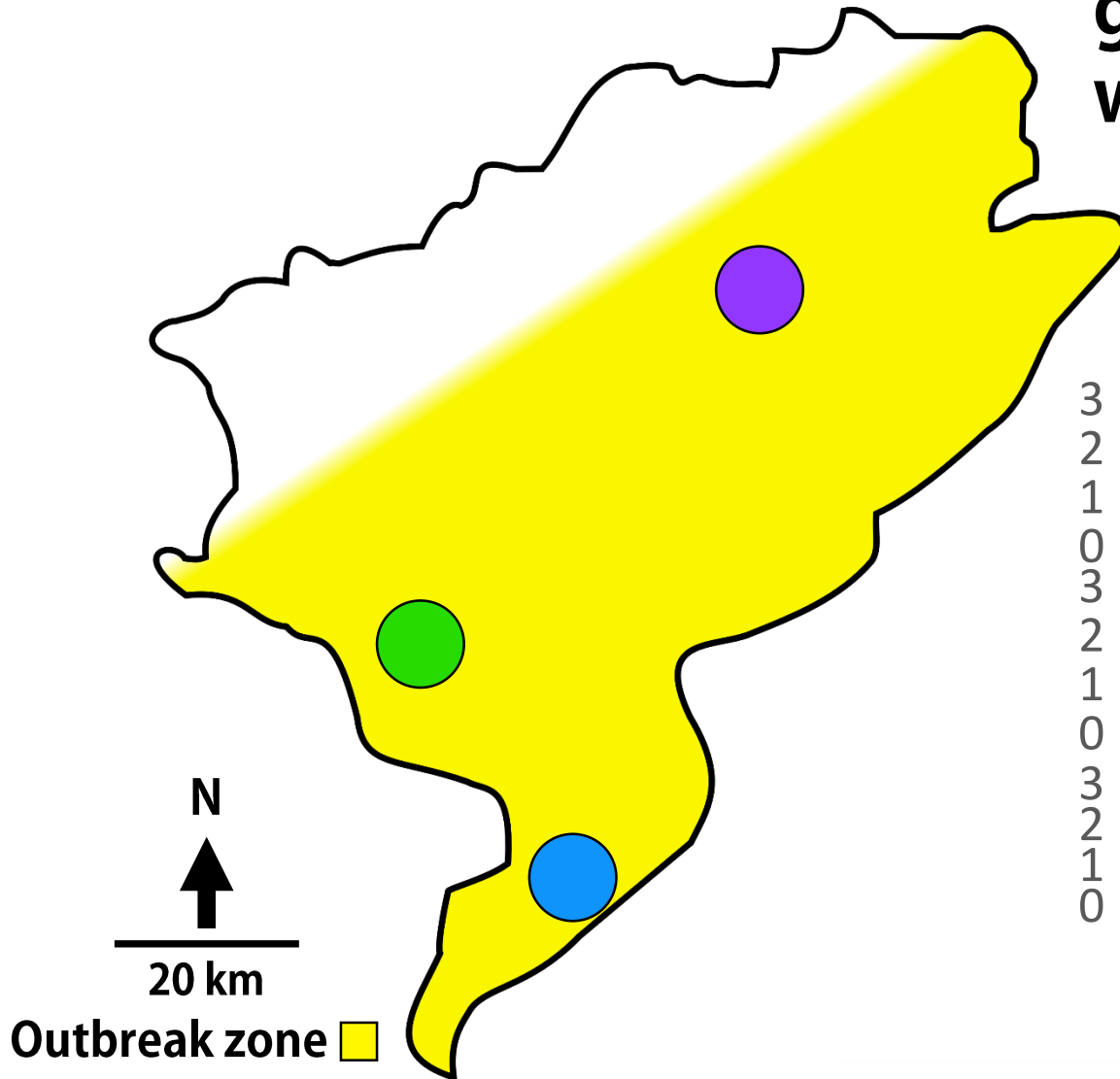
Arvicola terrestris in Franche-Comtè





Spatial Dynamics

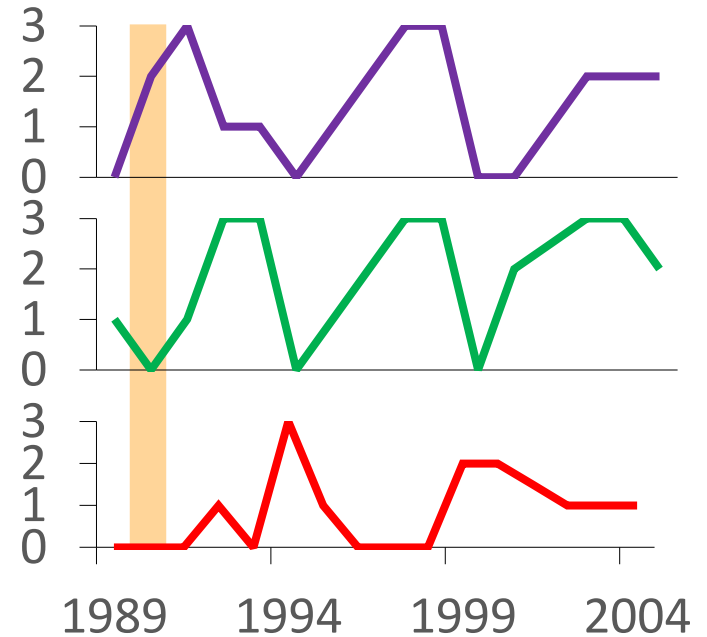
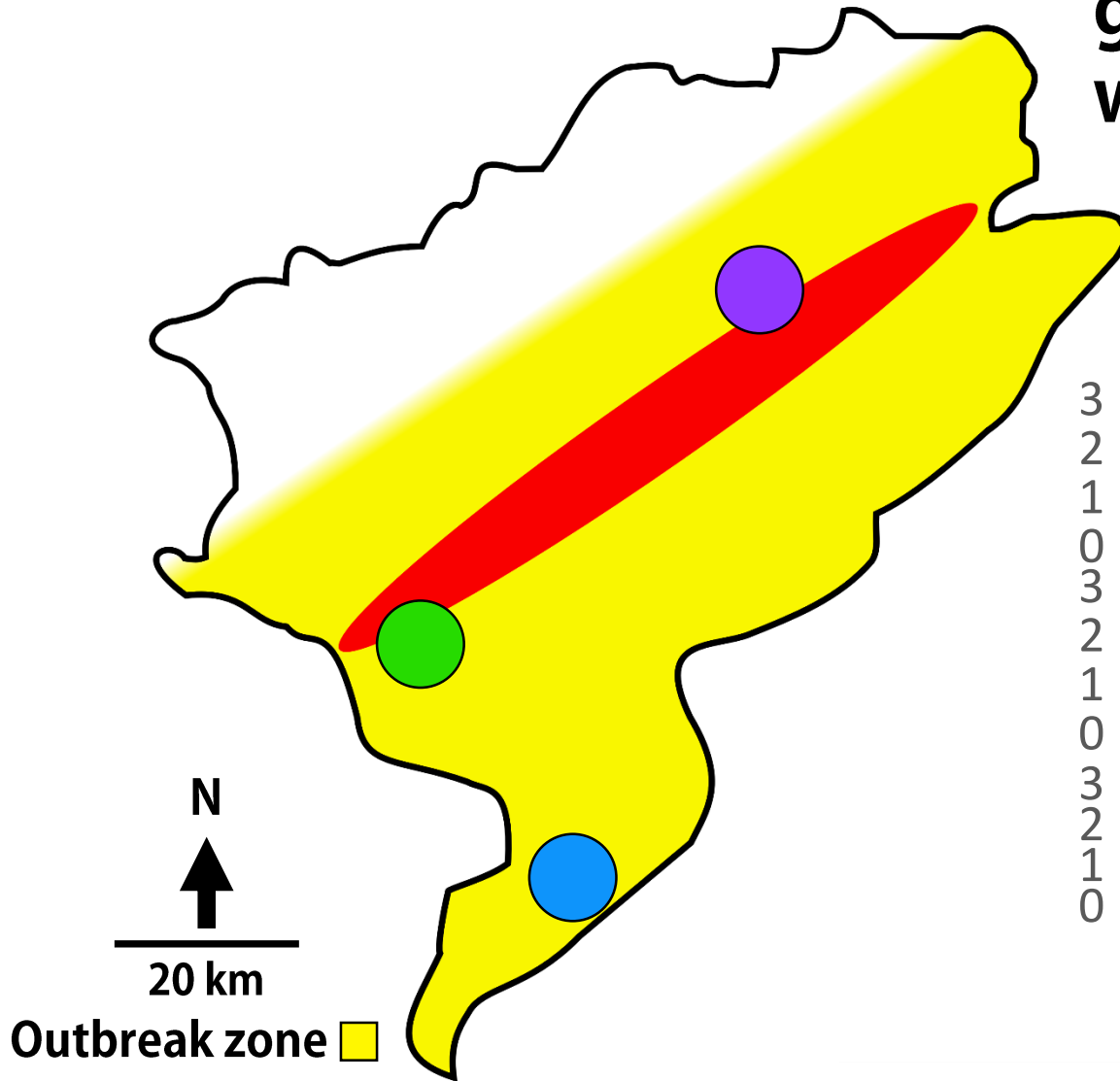
Lagged synchrony
generates travelling
wave



(Berthier et al 2014)

Spatial Dynamics

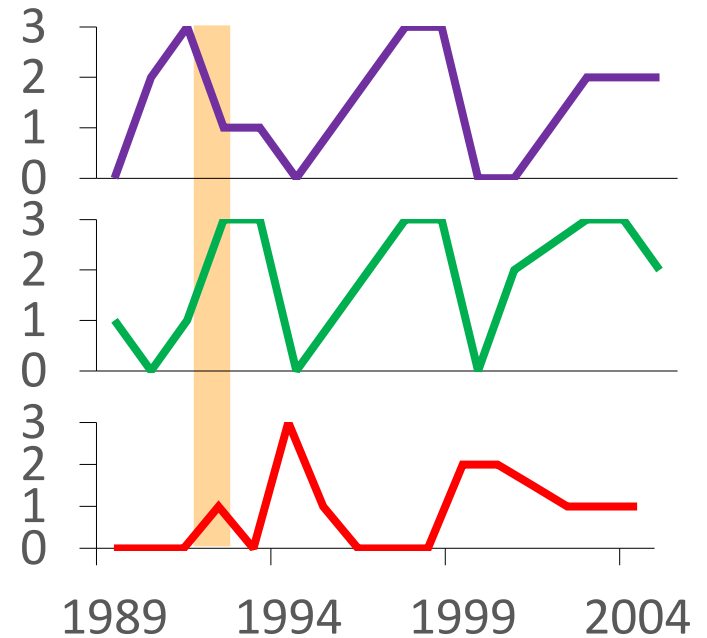
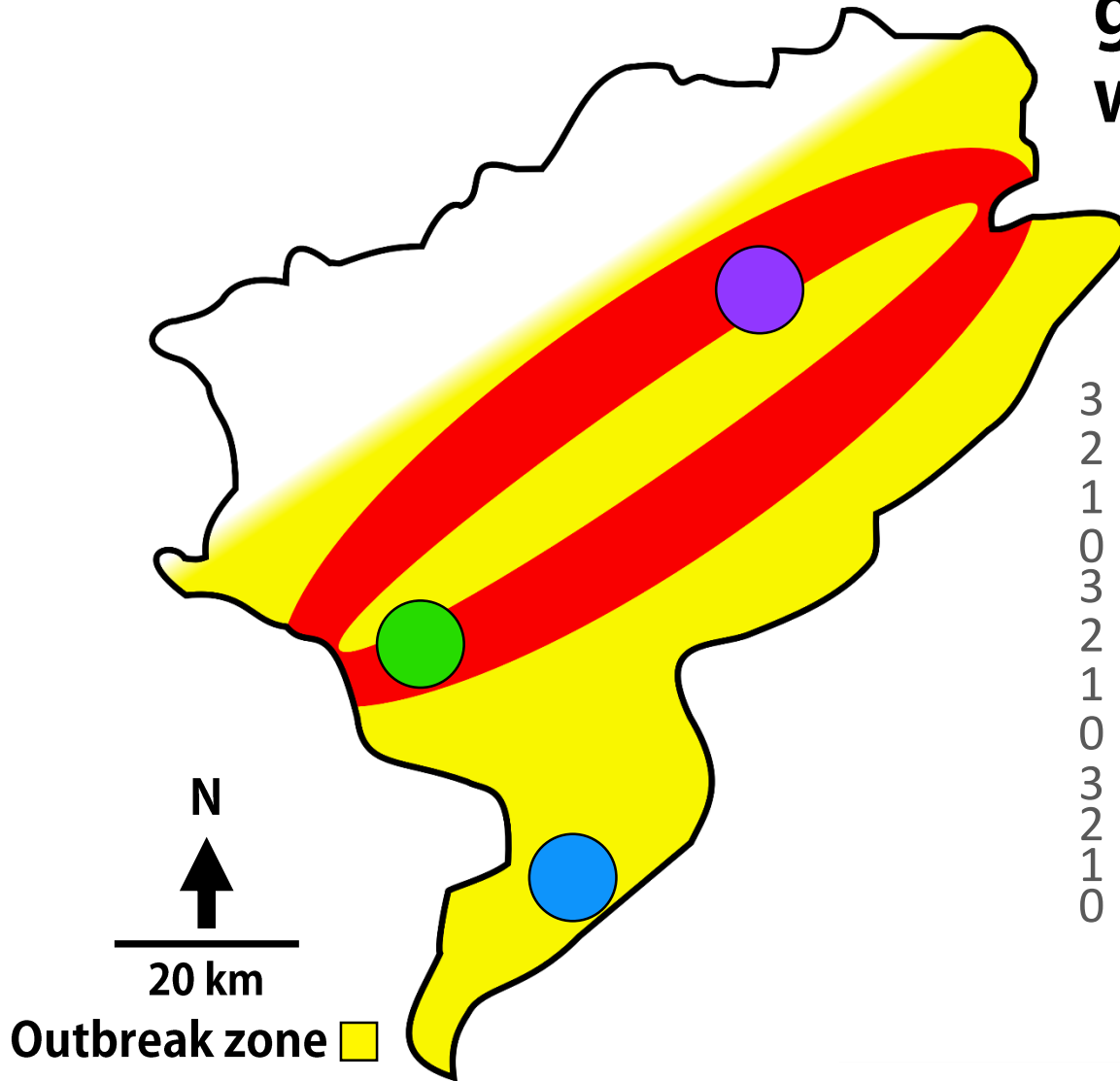
Lagged synchrony
generates travelling
wave



(Berthier et al 2014)

Spatial Dynamics

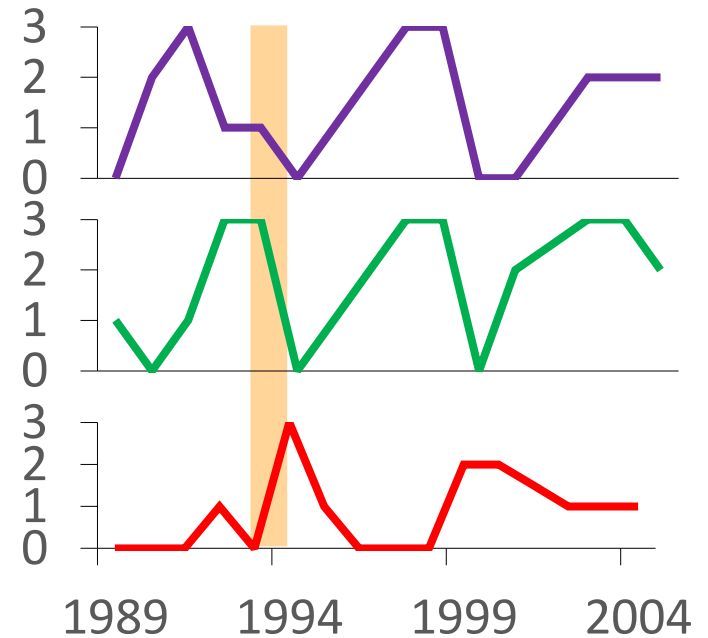
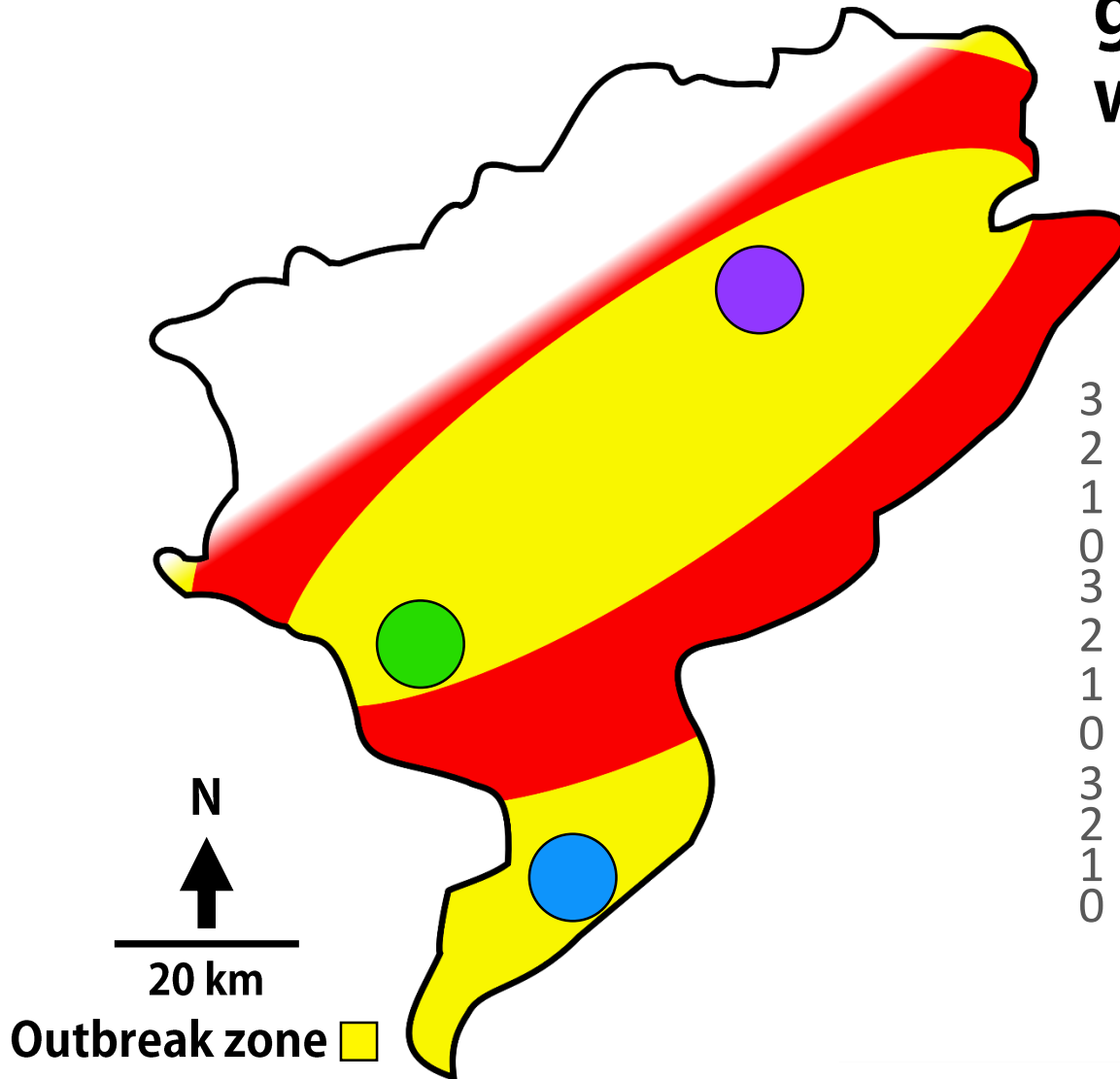
Lagged synchrony
generates travelling
wave



(Berthier et al 2014)

Spatial Dynamics

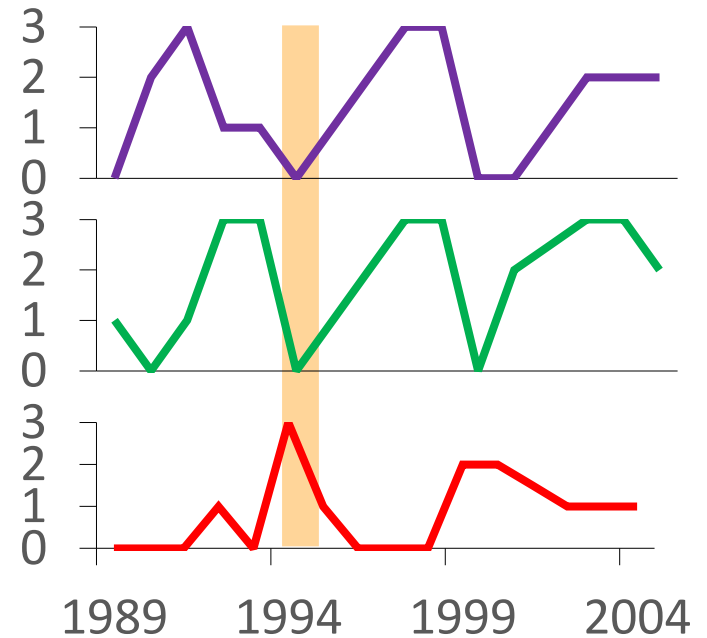
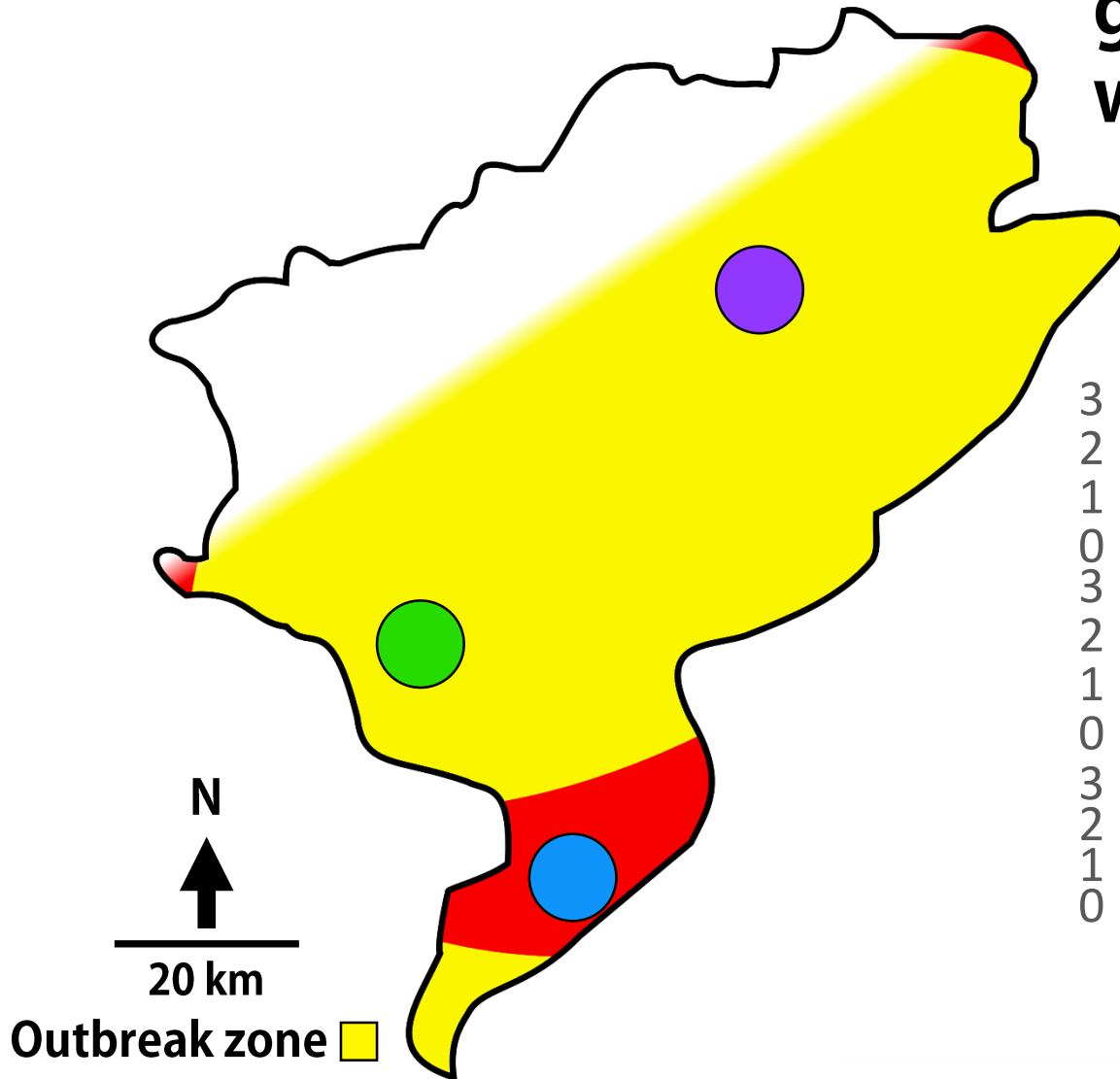
Lagged synchrony
generates travelling
wave



(Berthier et al 2014)

Spatial Dynamics

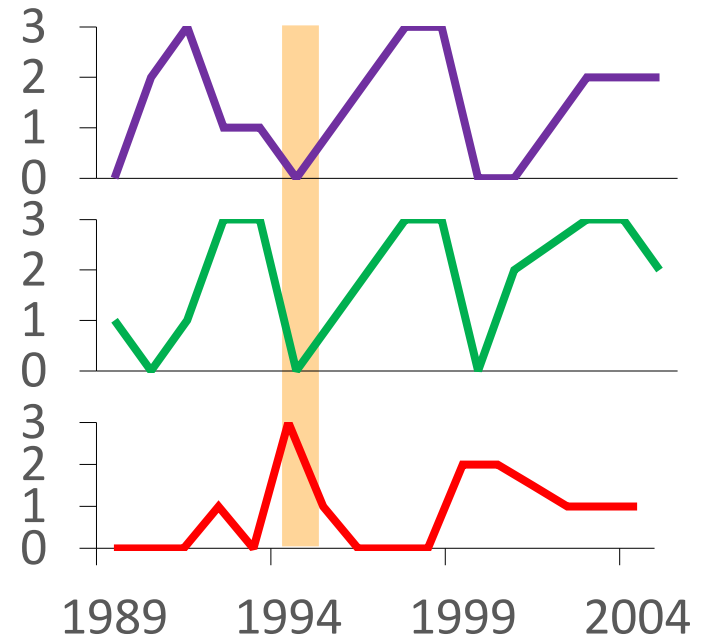
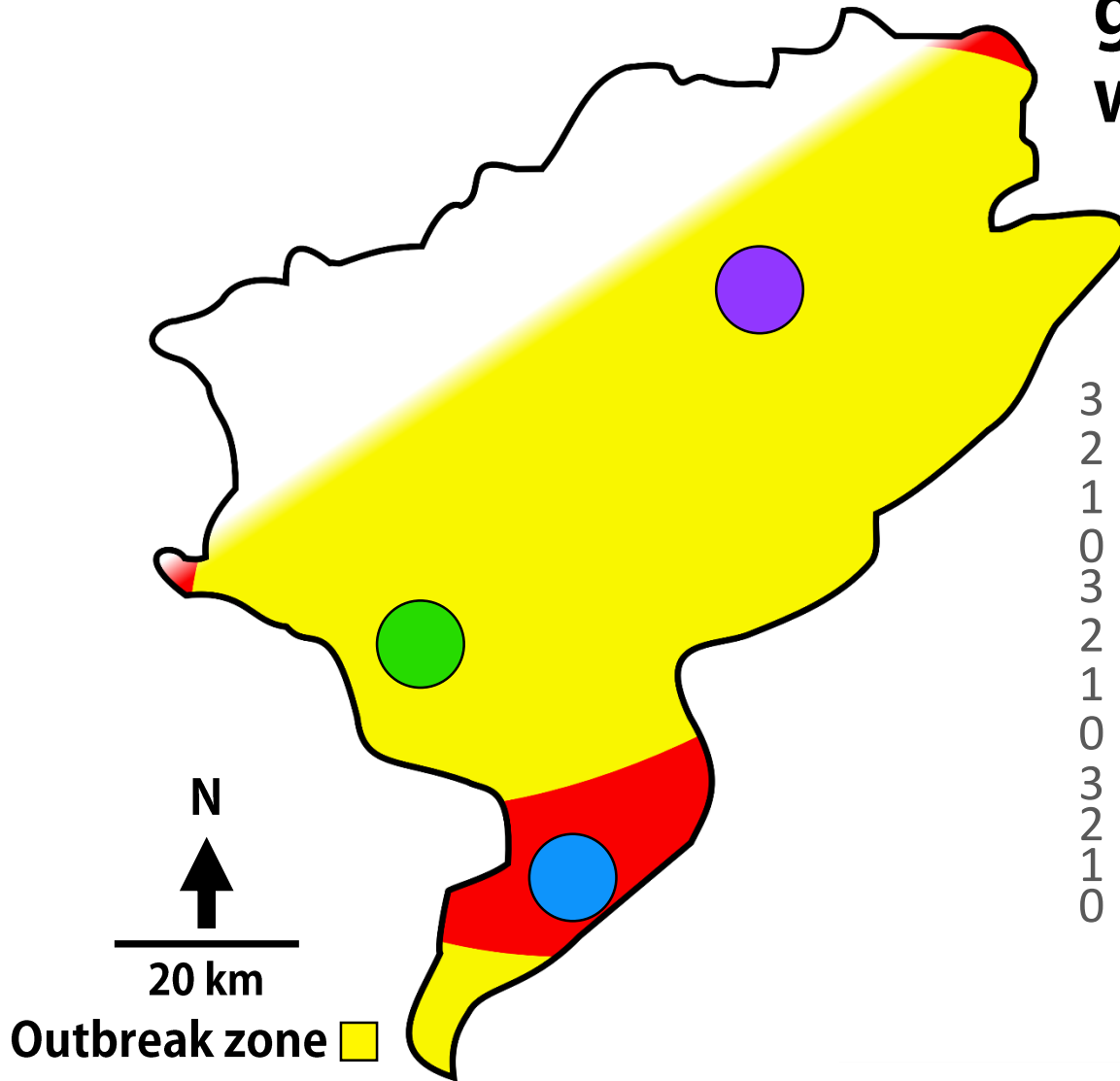
Lagged synchrony
generates travelling
wave



(Berthier et al 2014)

Spatial Dynamics

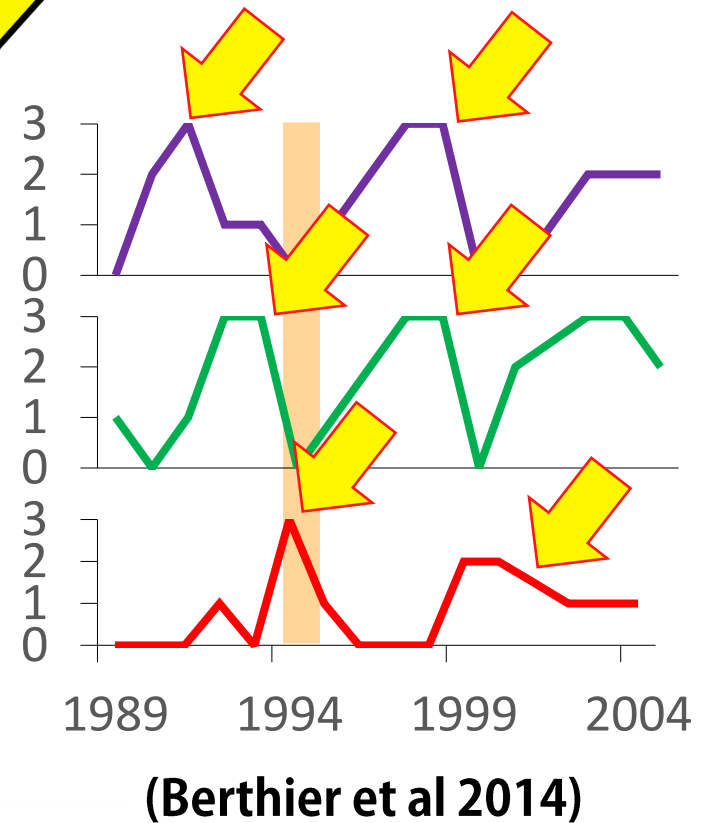
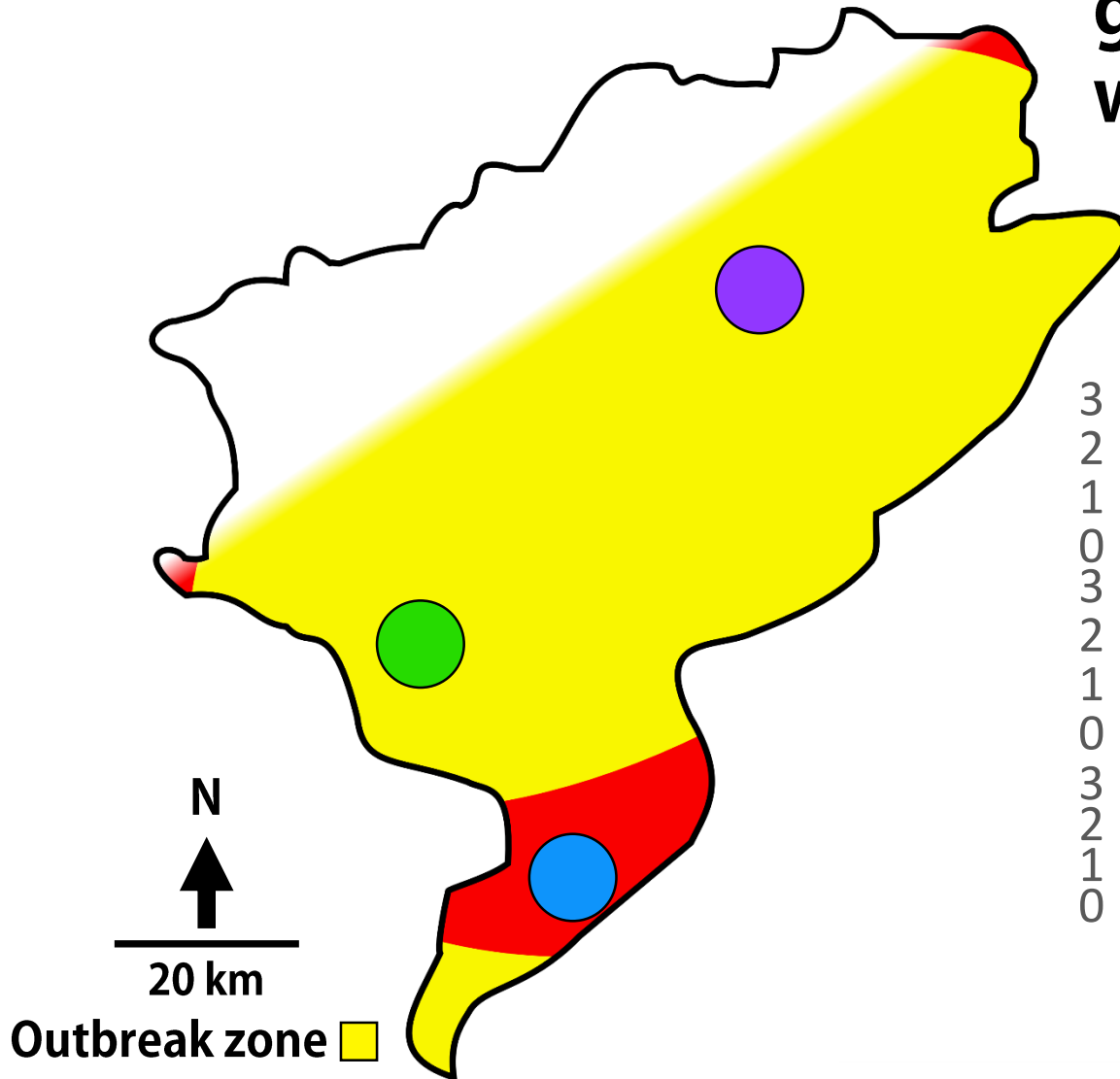
Lagged synchrony
generates travelling
wave



(Berthier et al 2014)

Spatial Dynamics

Lagged synchrony
generates travelling
wave



Decline hypotheses

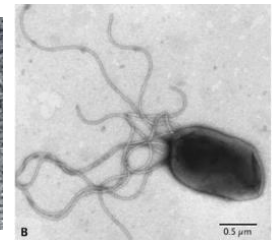
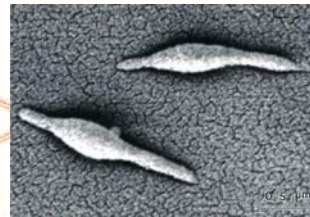
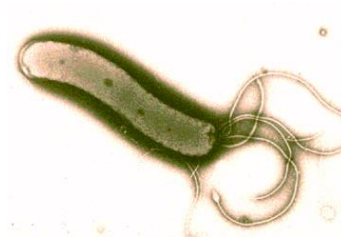
Predation -



Food limitation -



Parasites and Diseases -



Decline hypotheses

Predation -

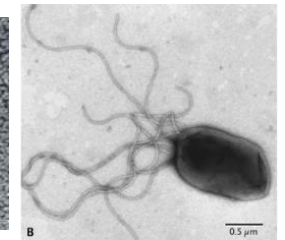
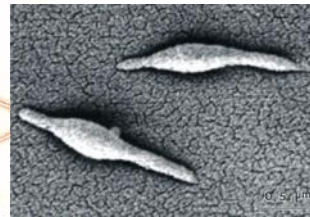
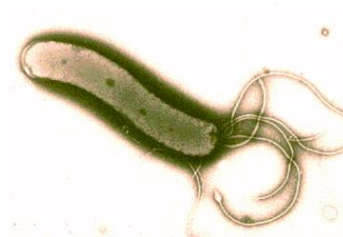


Food limitation -

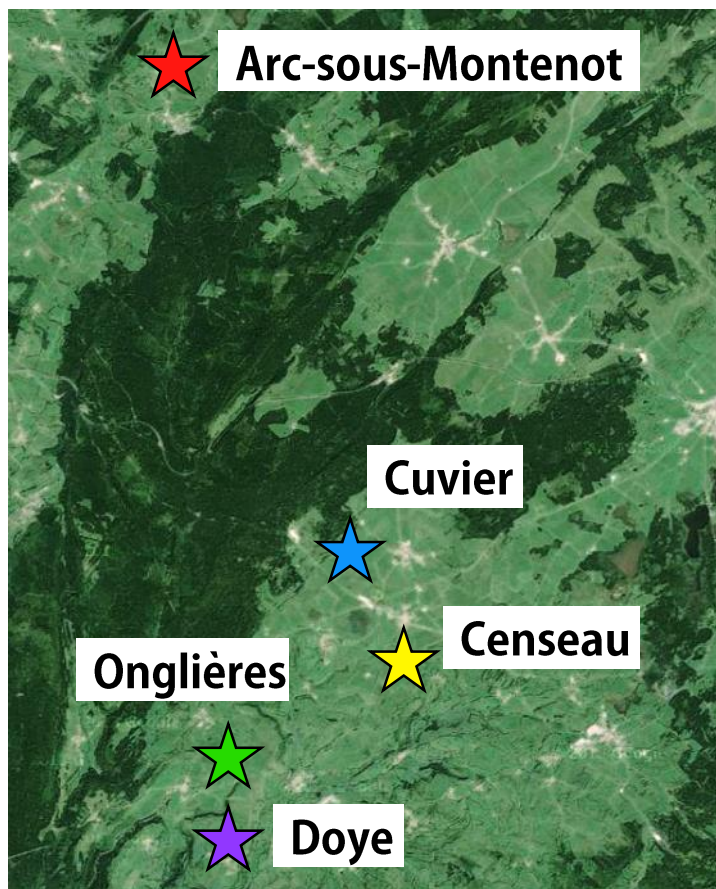


Parasites and Diseases

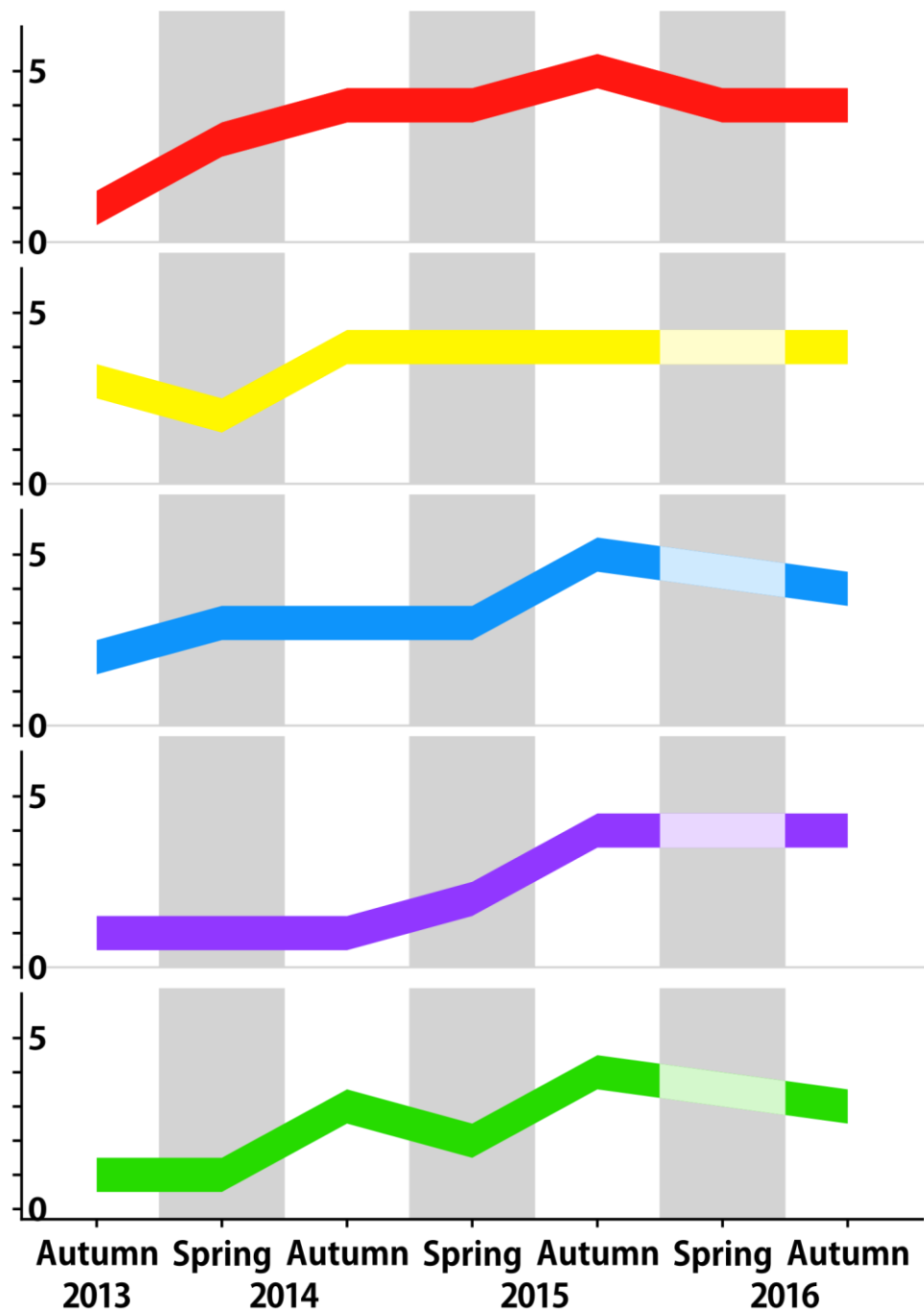
- **Communities**
- **Bacteria**



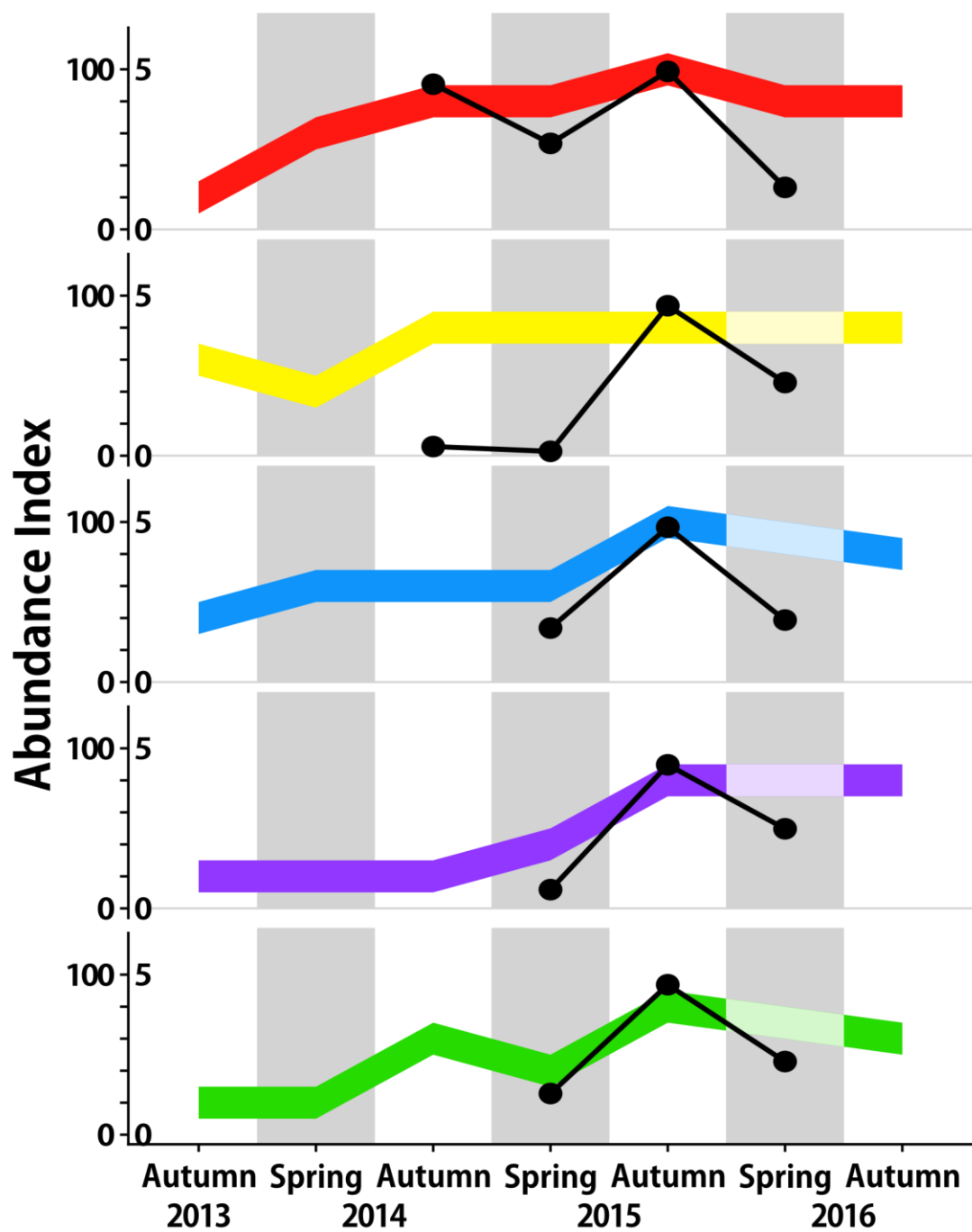
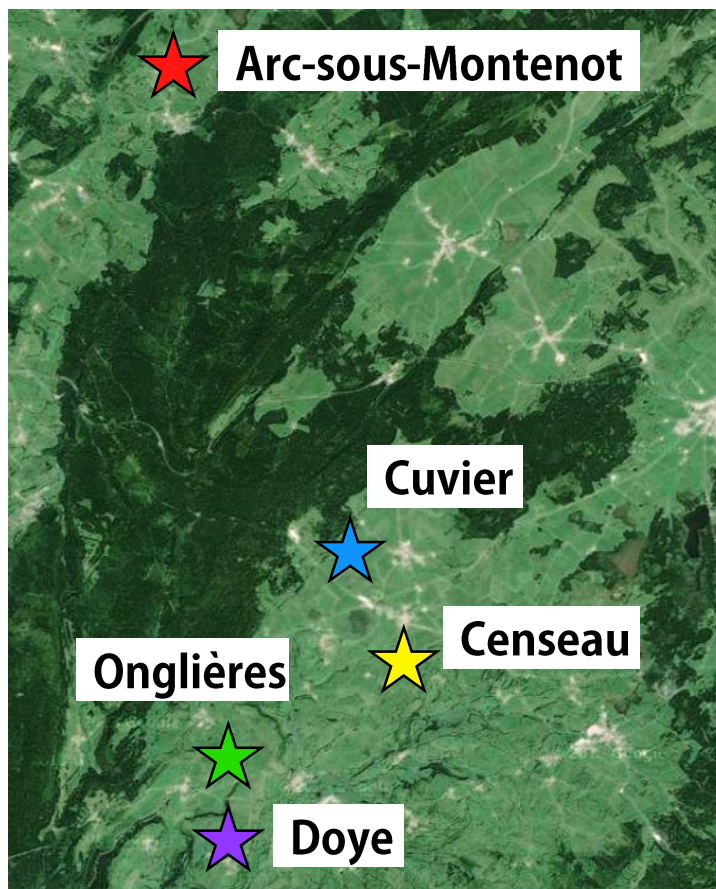
8 km



Abundance Index

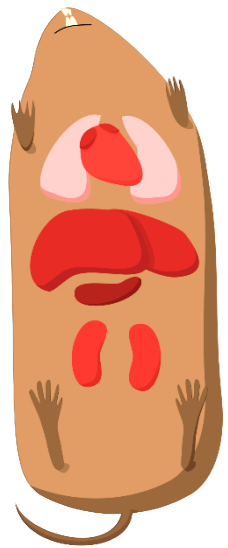


8 km

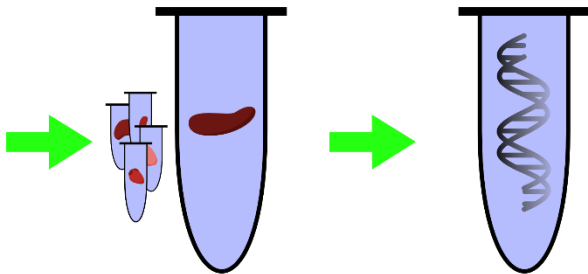




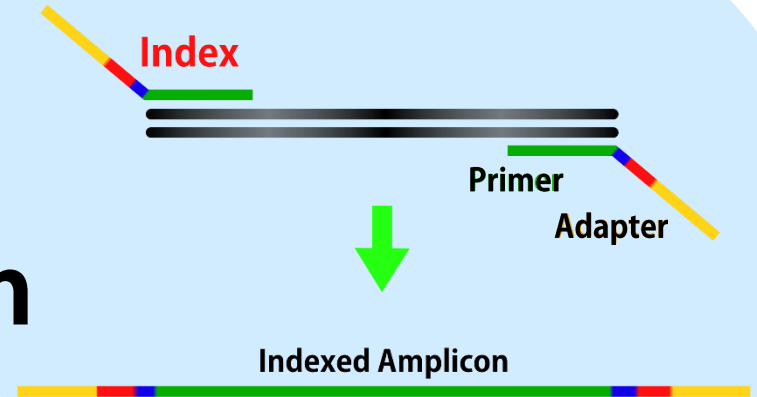




DNA extraction

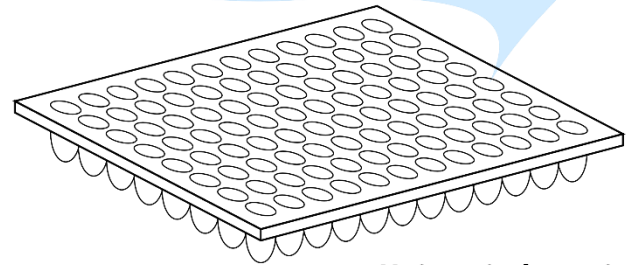
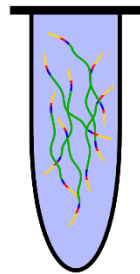


PCR amplification of V4 region of 16s rRNA gene

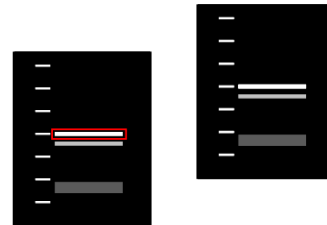


Next Generation Sequencing

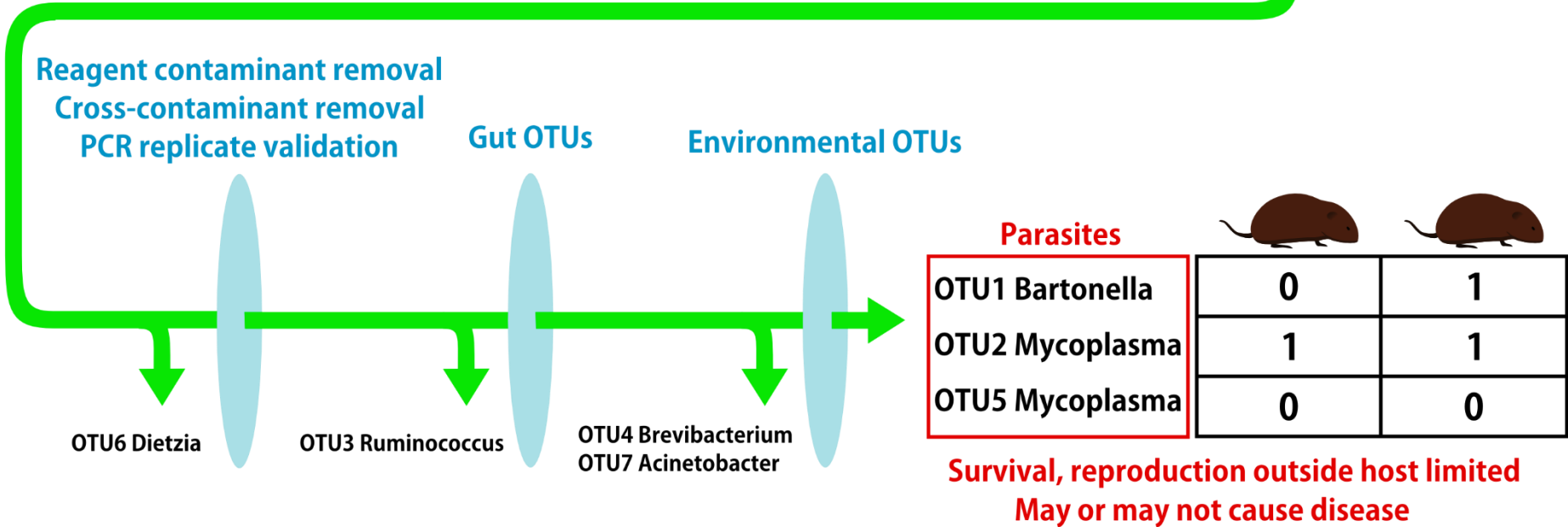
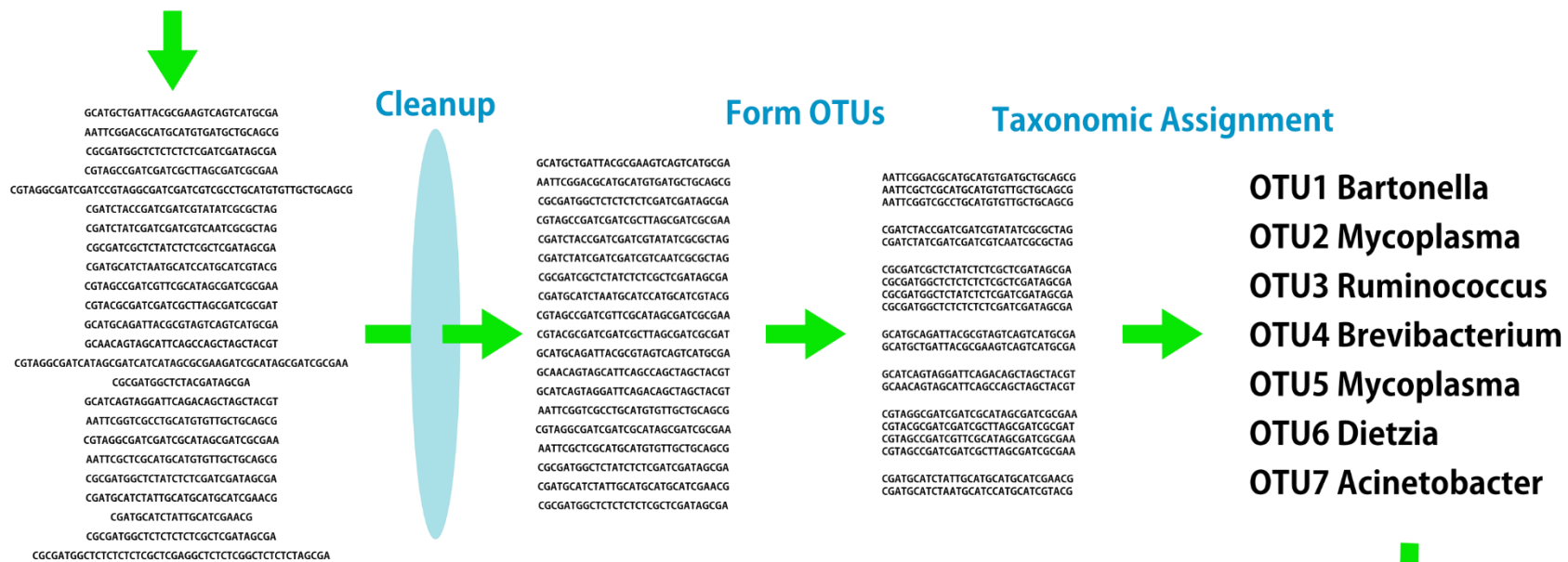
Pooled amplicons sent to sequencer



Unique index pairs in each well



Amplicons pooled, purified



OTU6 Dietzia OTU3 Ruminococcus OTU4 Brevibacterium
 OTU7 Acinetobacter

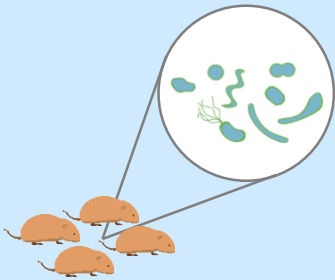
Peak Phase: Bacterial Parasite Richness Bacterial Parasite Community Similarity

Scales

Infracommunity



Component Community



Intrinsic Factors

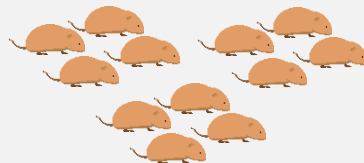
Age Class



Sex



Abundance (Local, Commune)



Extrinsic Factors

Location

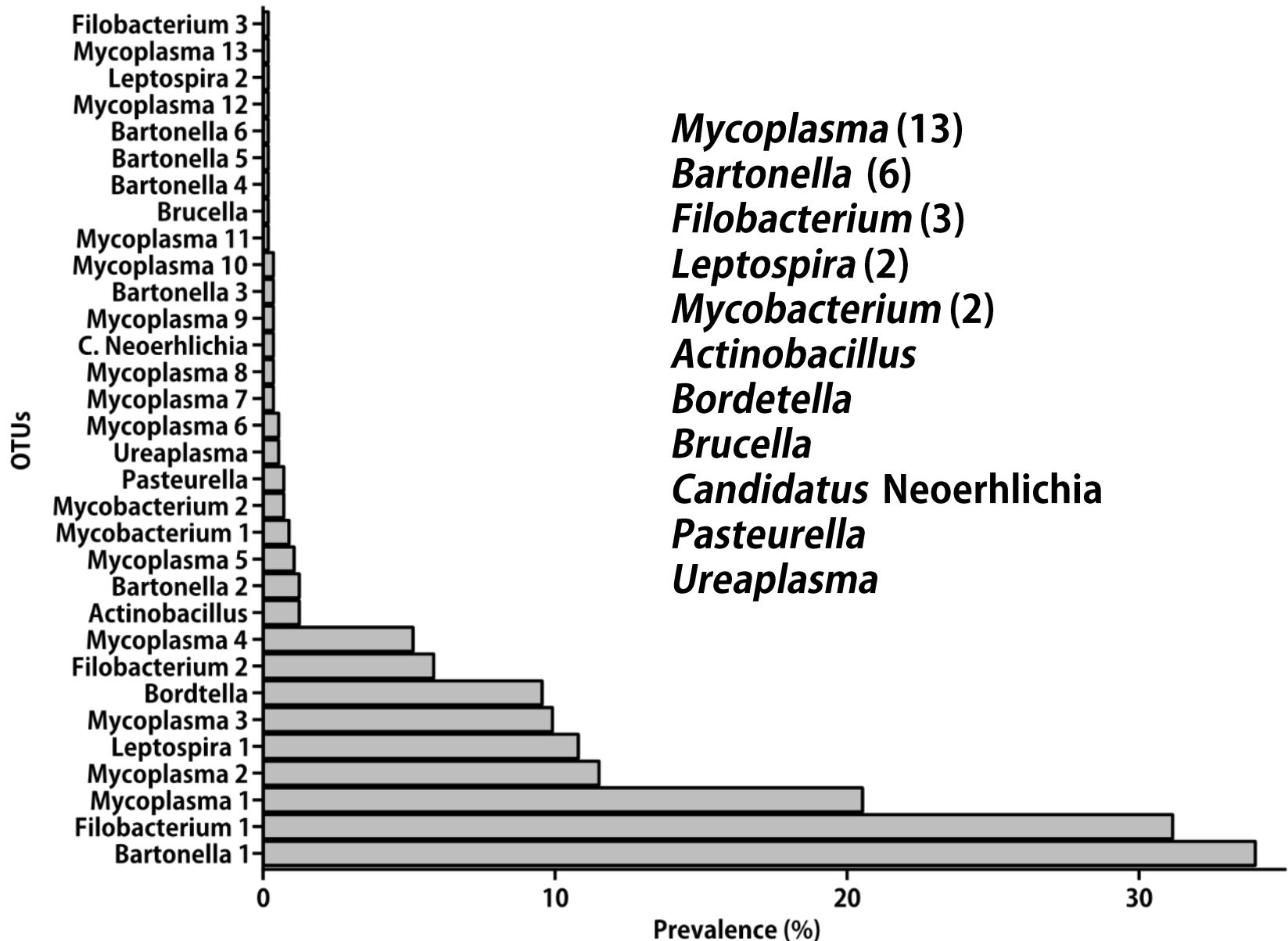


Date (Season, Year)



2014 2015 2016

Bacteria

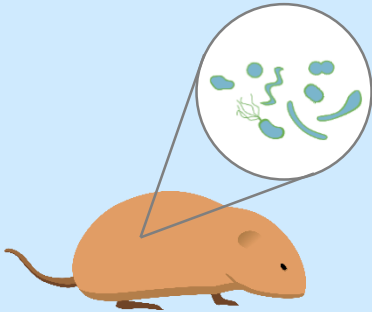


Questions:

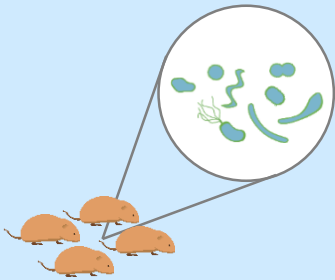
Parasite Richness
Parasite Community Similarity

Scales

Infracommunity



Component Community



Intrinsic Factors

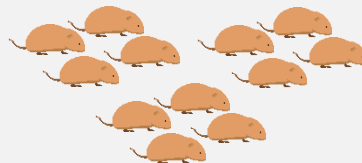
Age Class



Sex



Abundance (Local, Commune)



Extrinsic Factors

Location

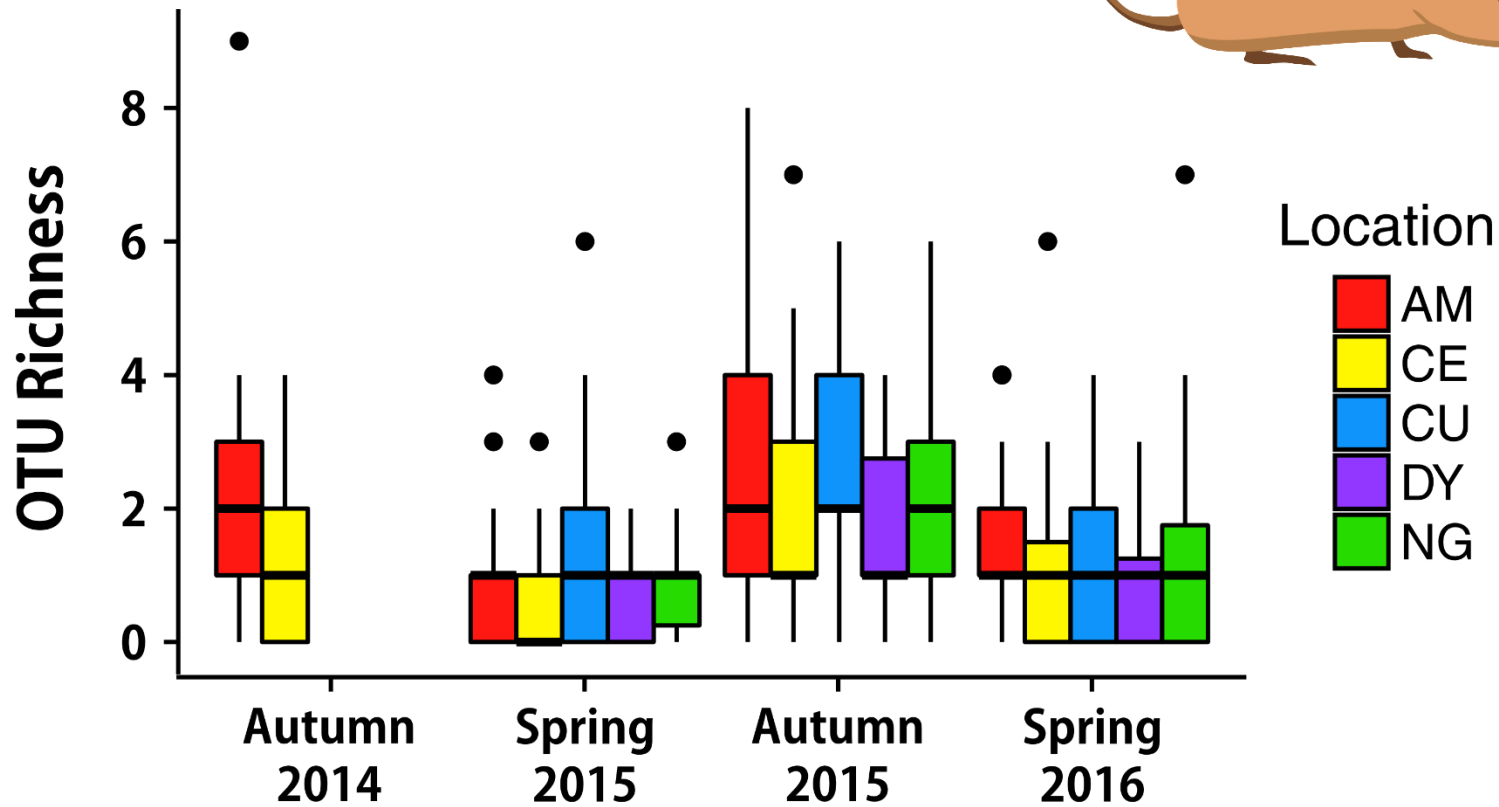
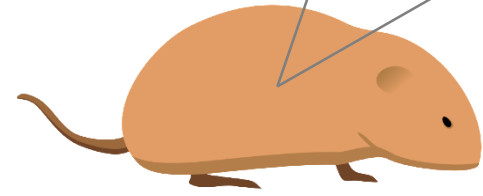
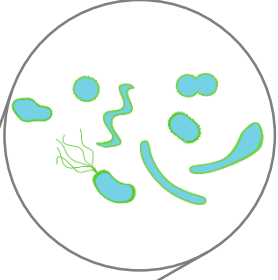


Date (Season, Year)



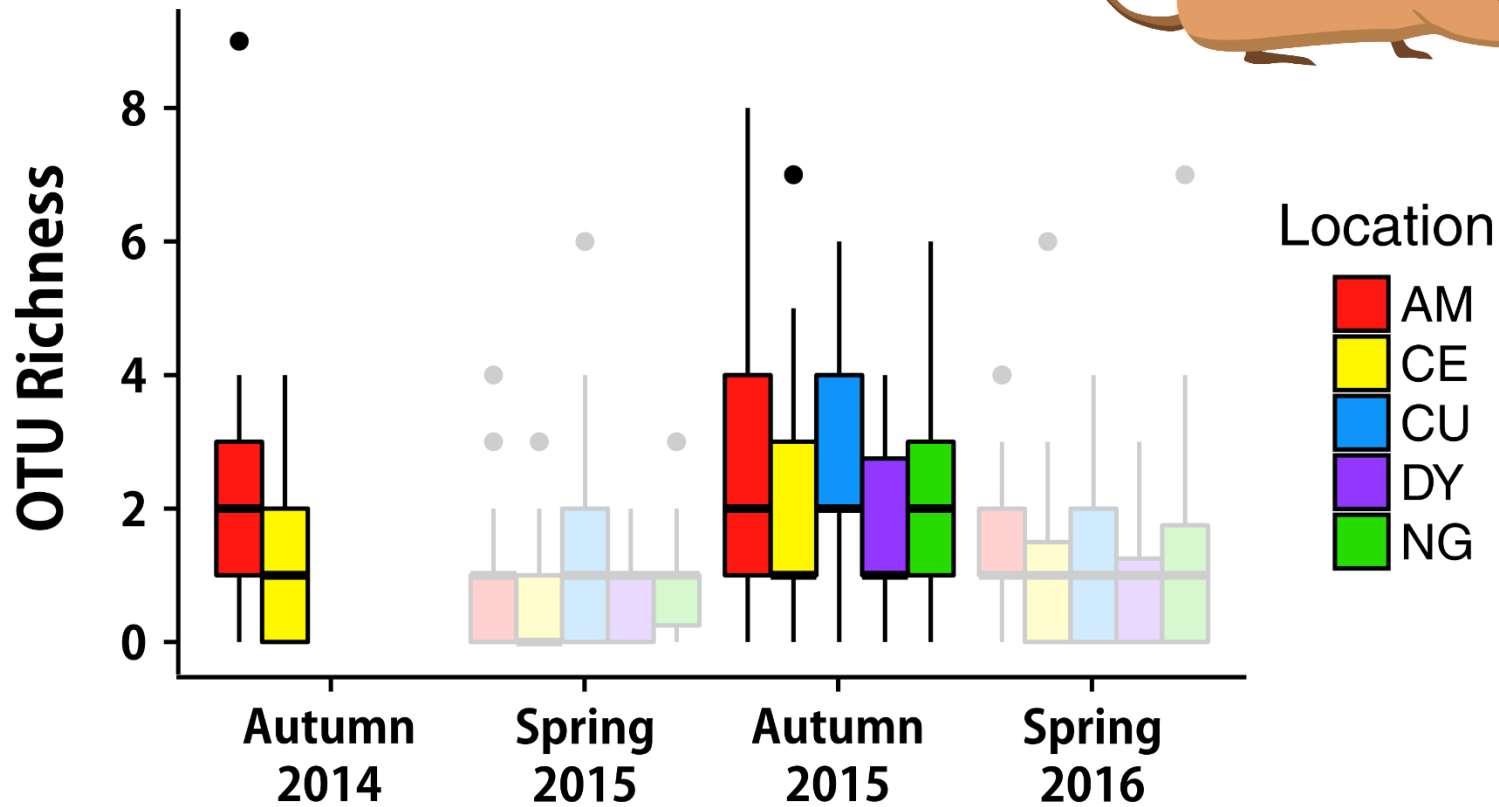
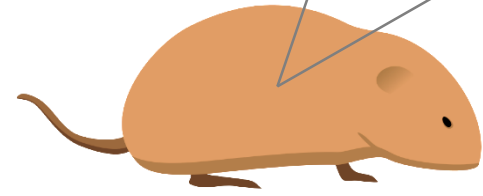
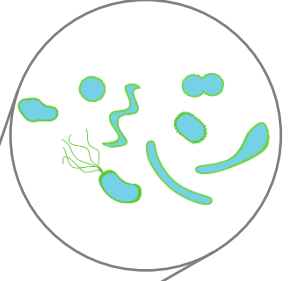
2014 2015 2016

Infracommunity richness



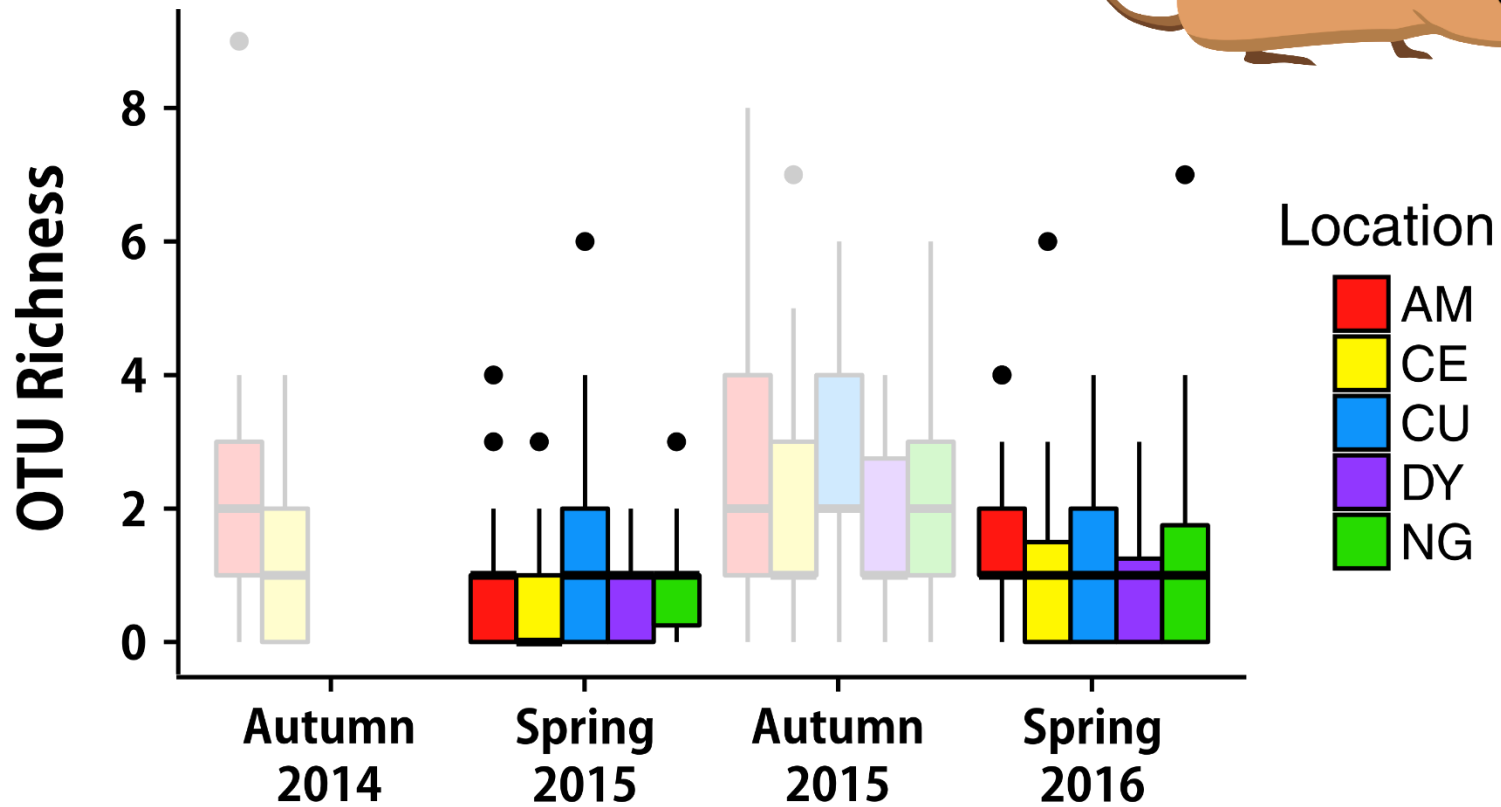
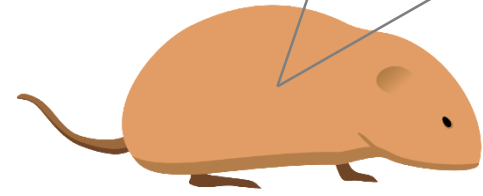
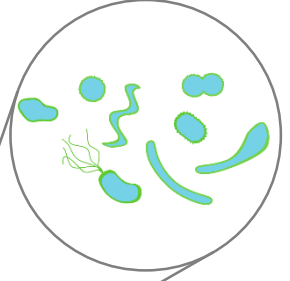
Zero-inflated Poisson Regression, AIC model selection

Infracommunity richness

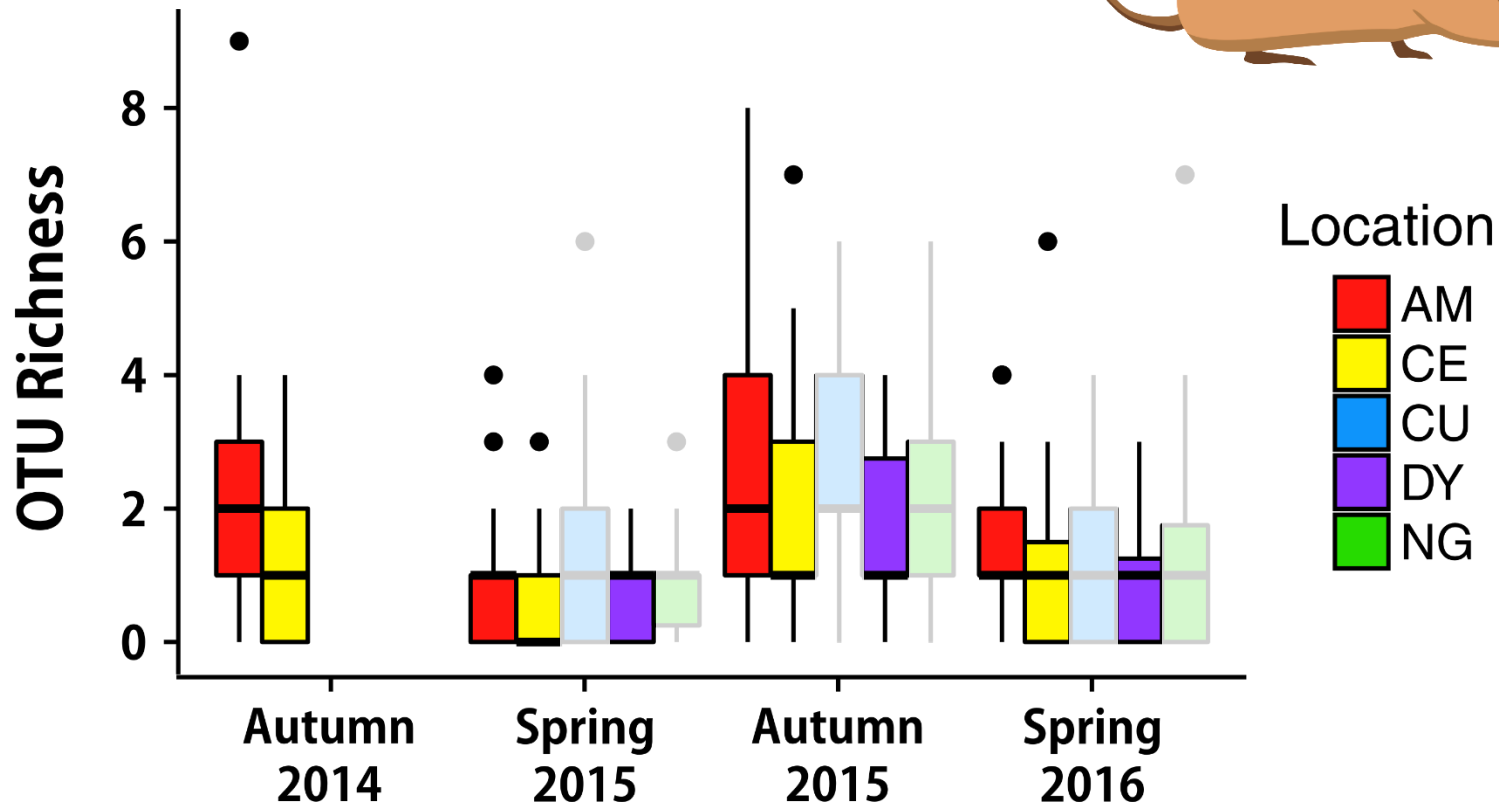
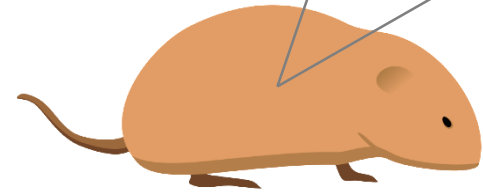
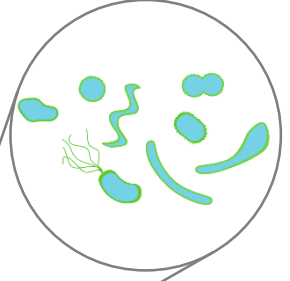


Zero-inflated Poisson Regression, AIC model selection

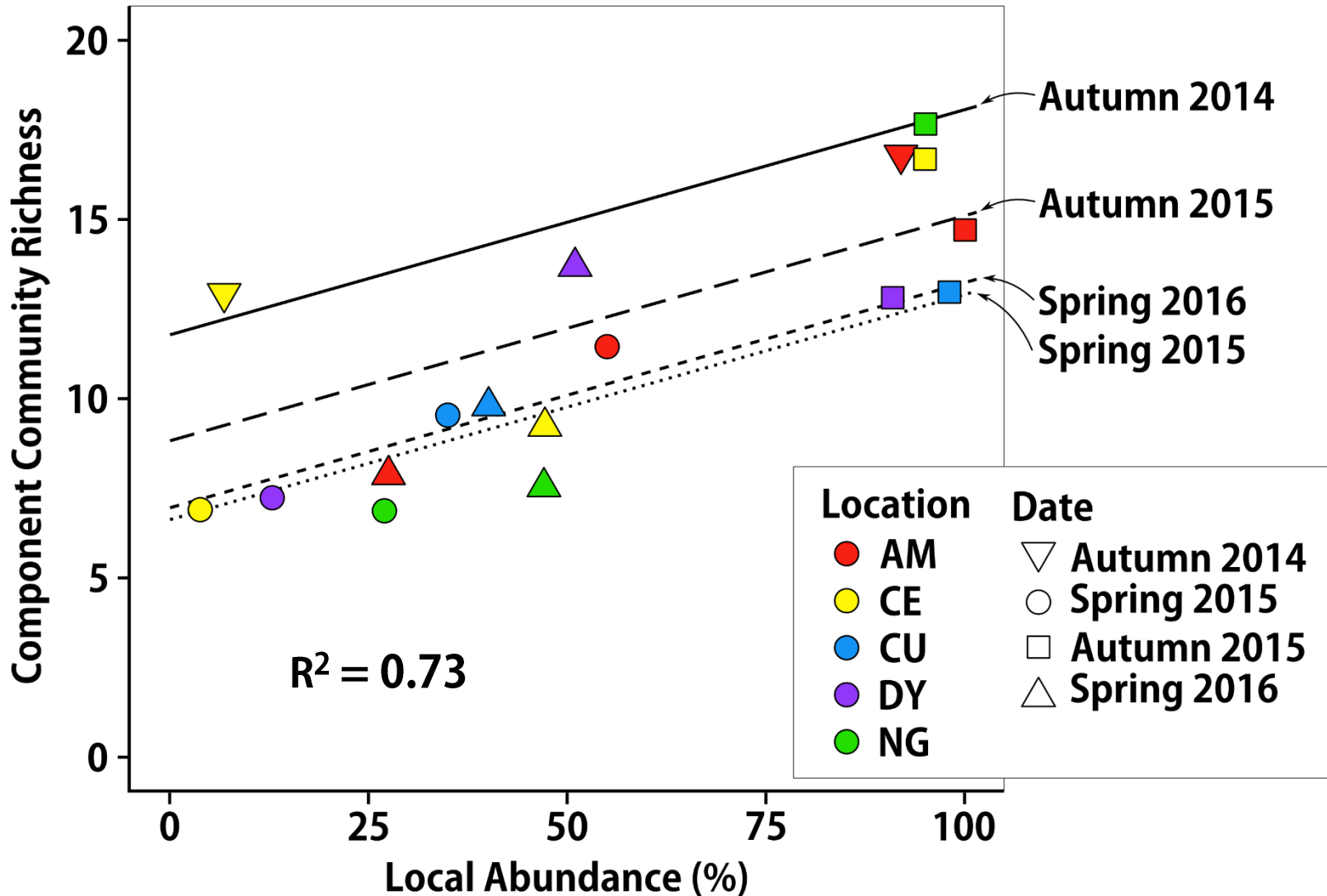
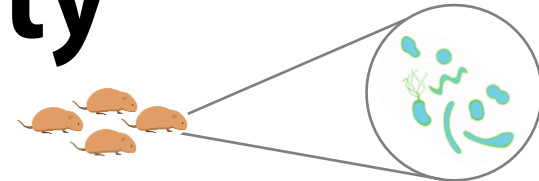
Infracommunity richness



Infracommunity richness

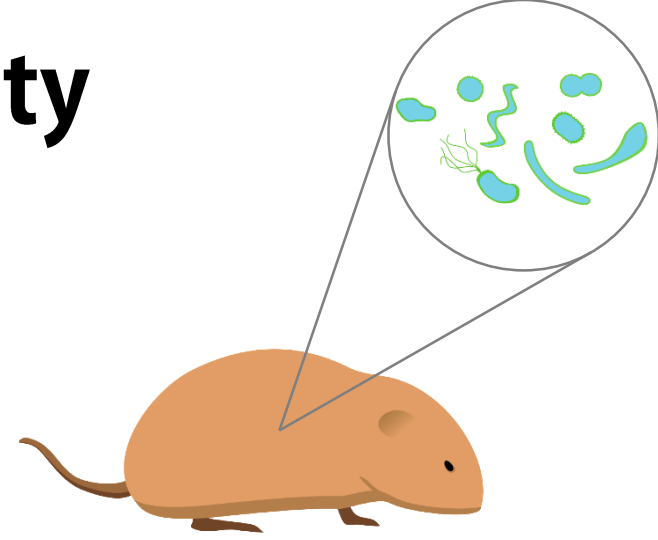
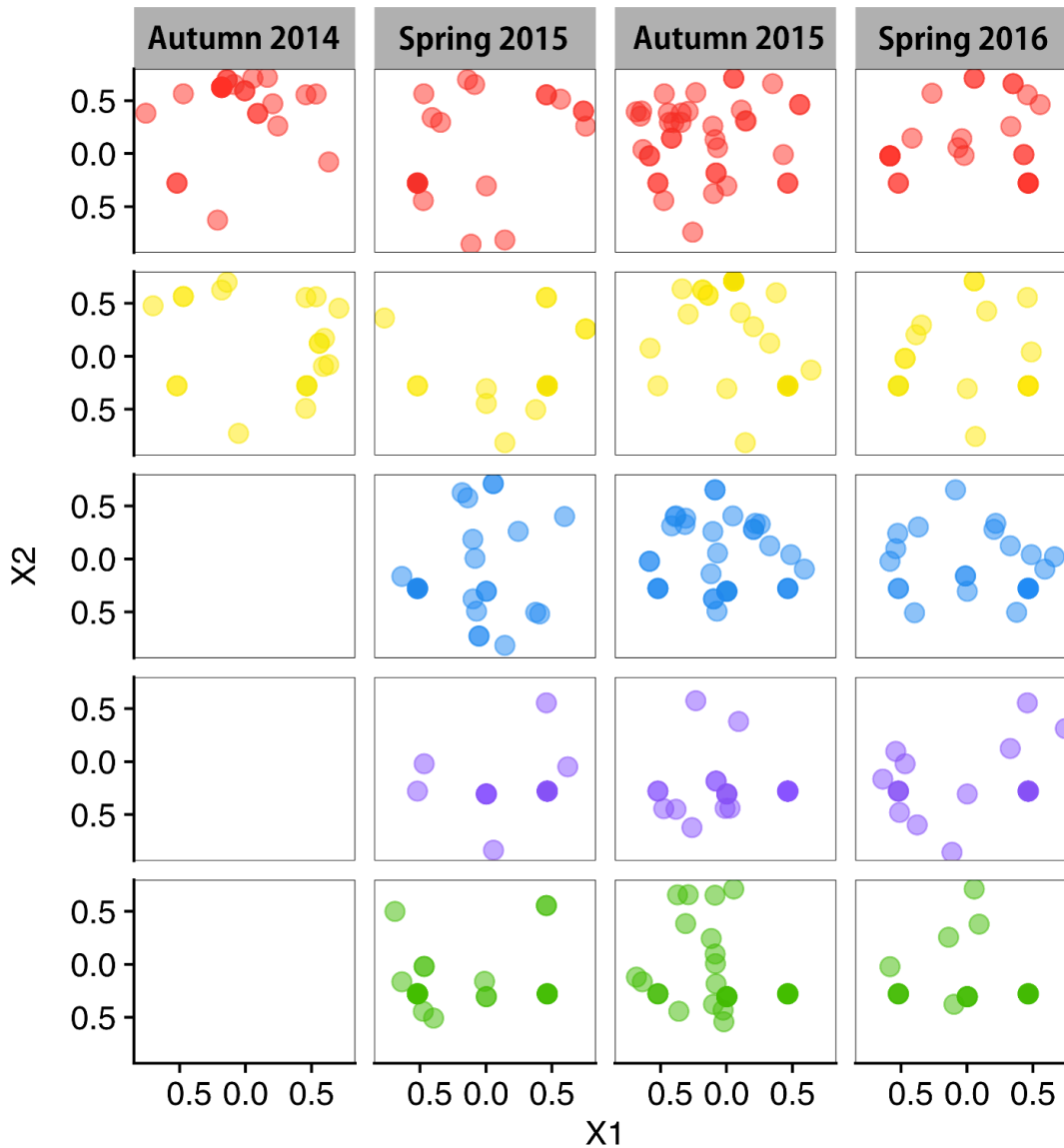


Component Community richness



GLM, AIC model selection

Infracommunity Similarity



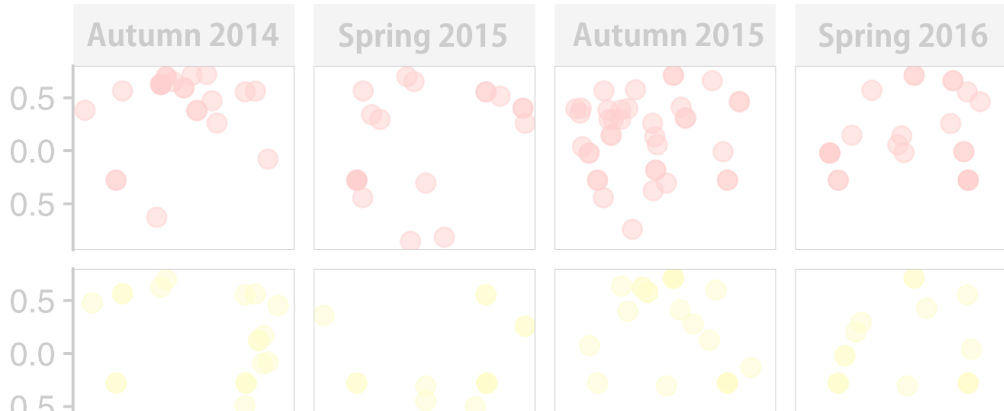
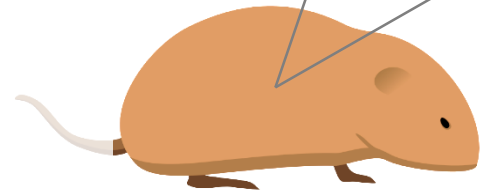
Location

- AM
- CE
- CU
- DY
- NG

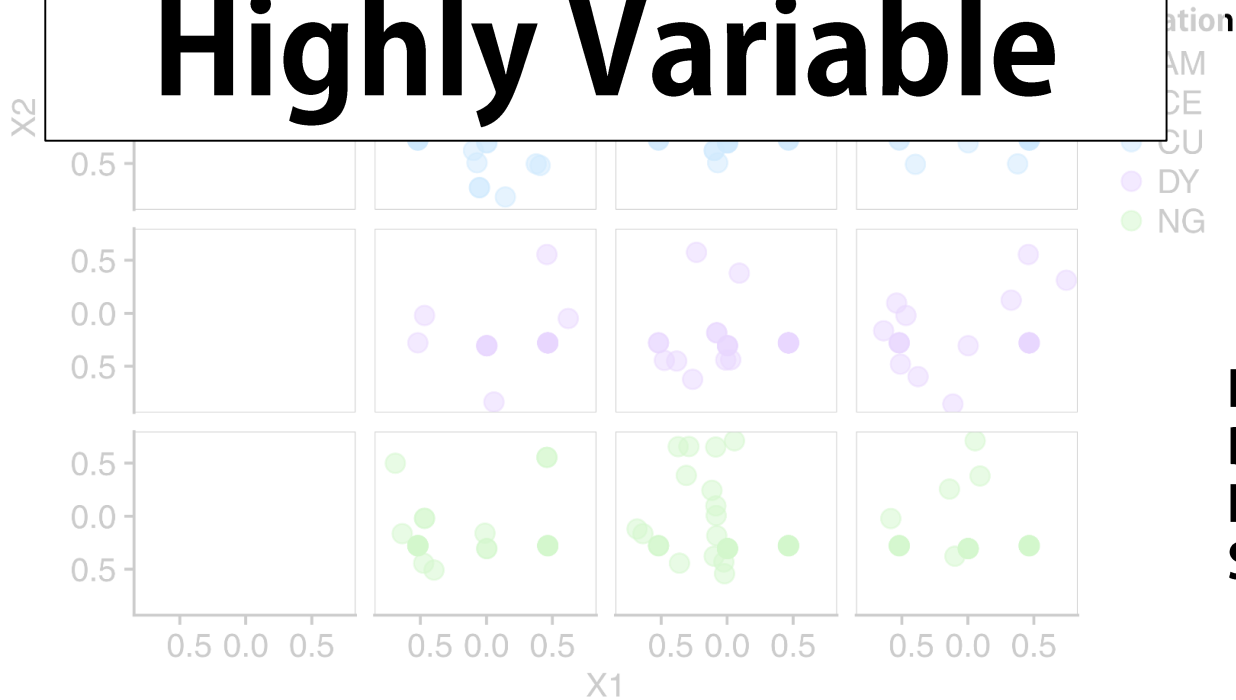
PERMANOVA

Location - 3%
Date - 3%
Local abundance - 2%
Sex - 1%

Infracommunity Similarity



Highly Variable



PERMANOVA

Location - 3%

Date - 3%

Local abundance - 2%

Sex - 1%

Component Community Similarity

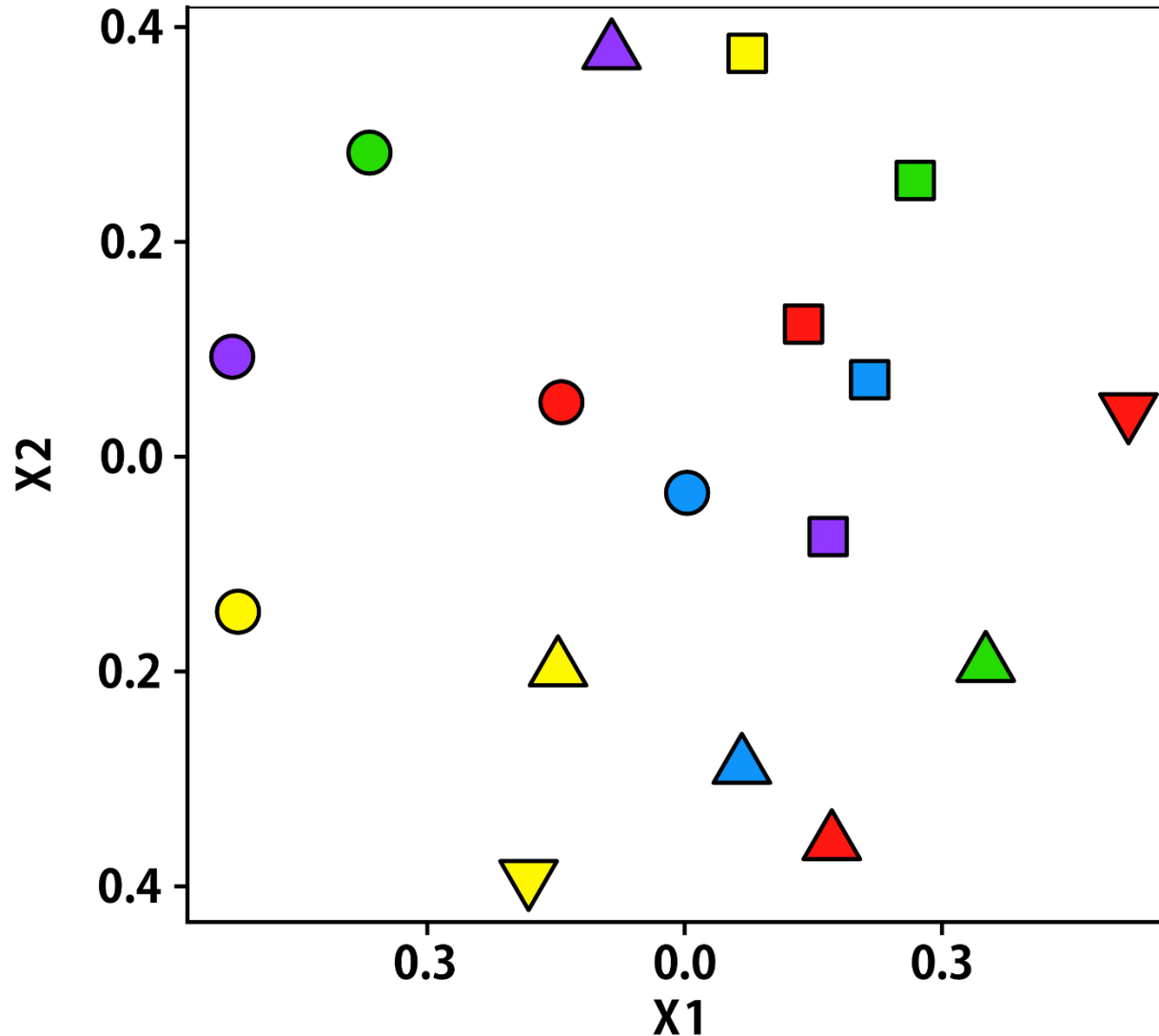


Date

- ▽ Autumn 2014
- Spring 2015
- Autumn 2015
- △ Spring 2016

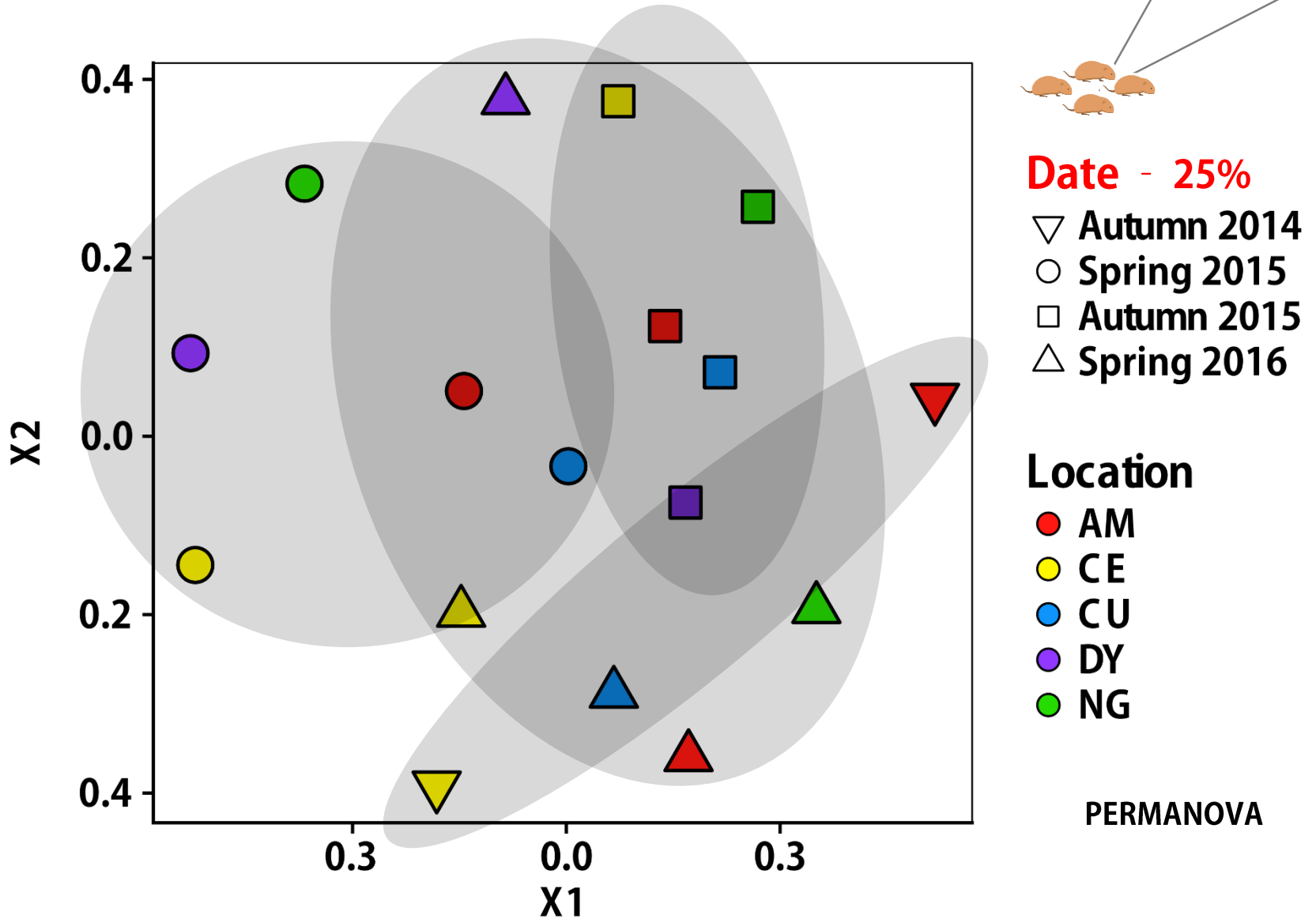
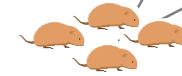
Location

- AM
- CE
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- DY
- NG

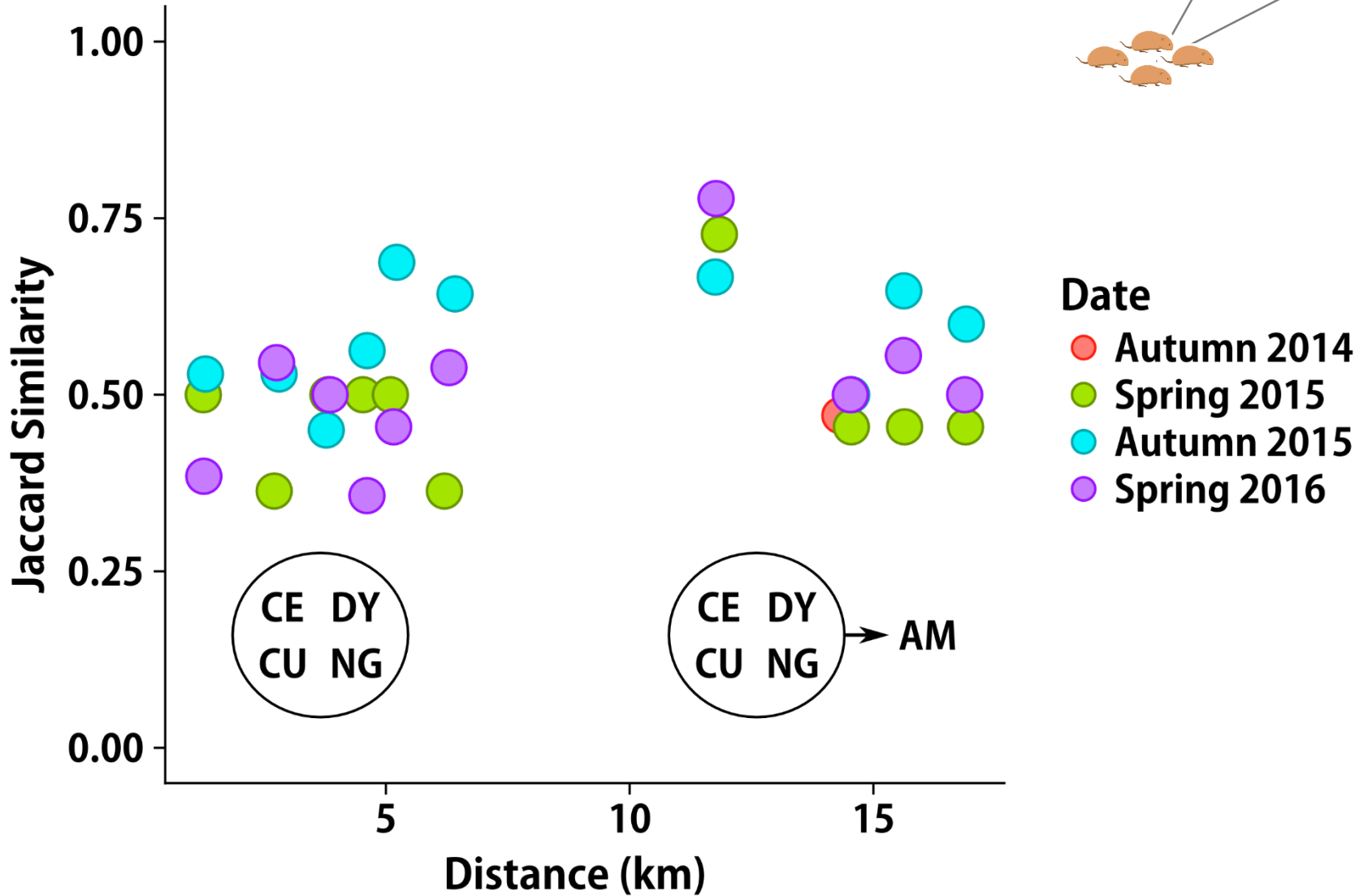
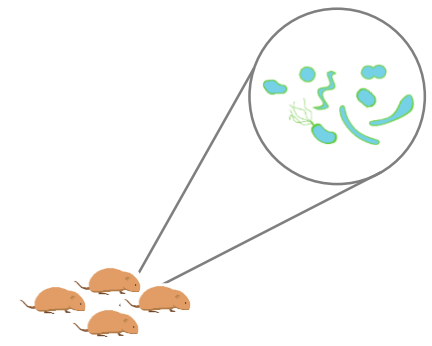


PERMANOVA

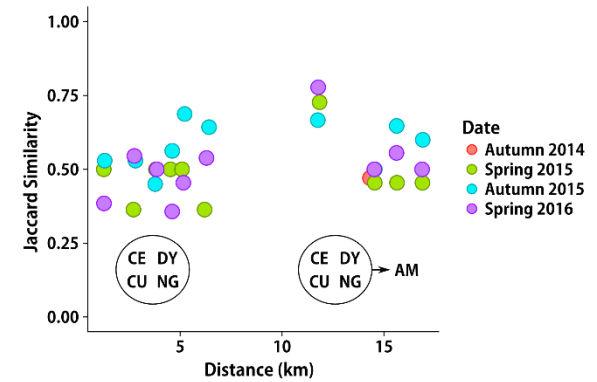
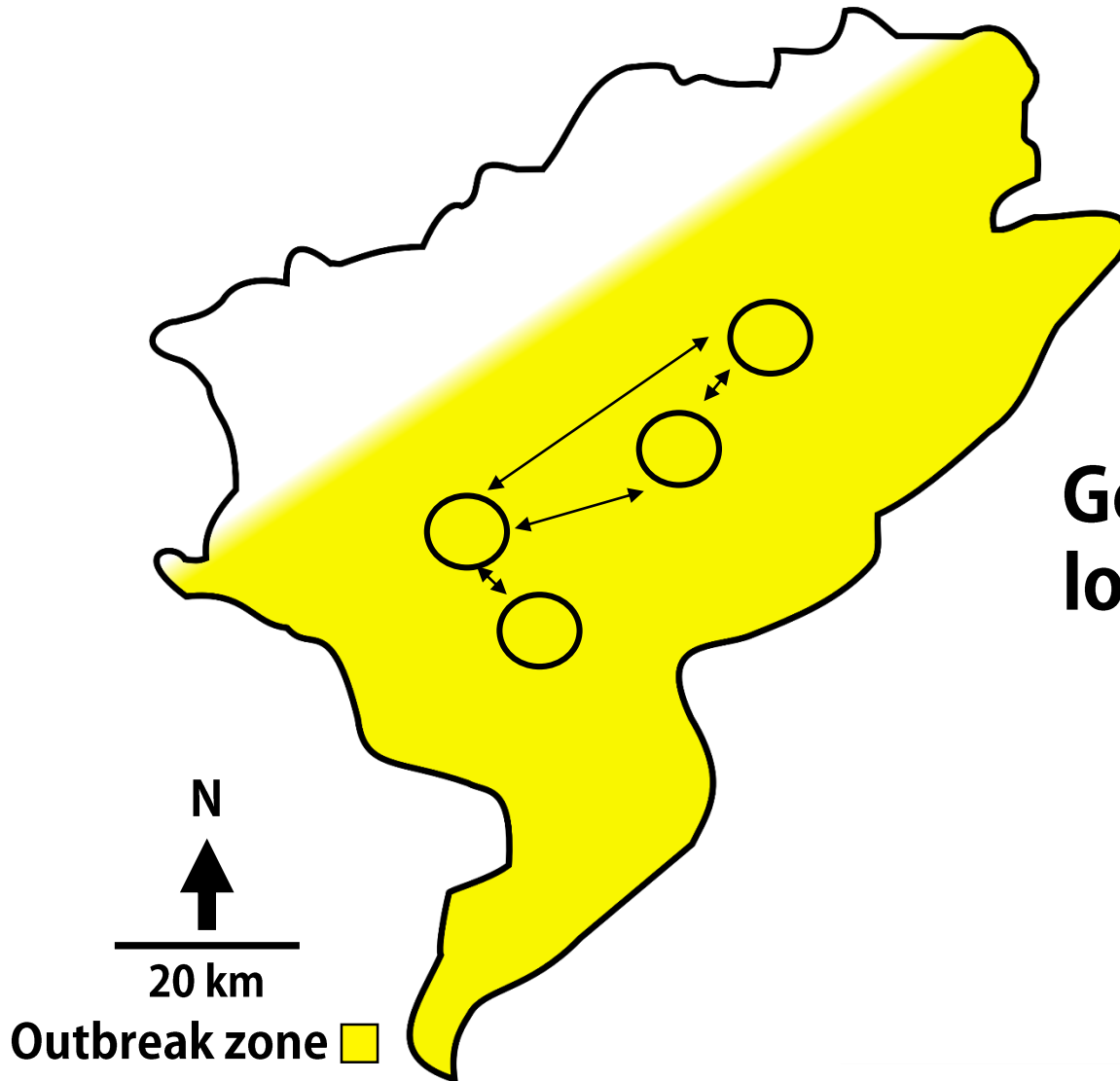
Component Community Similarity



Geographic Distance



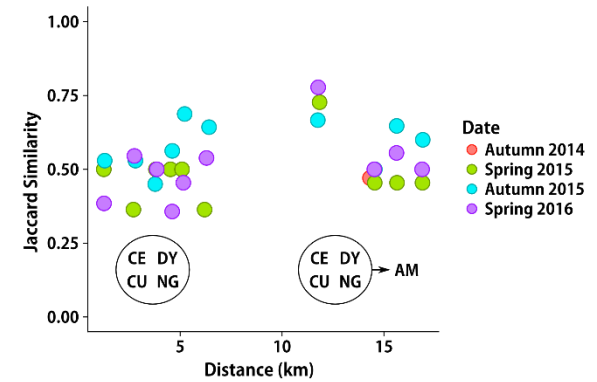
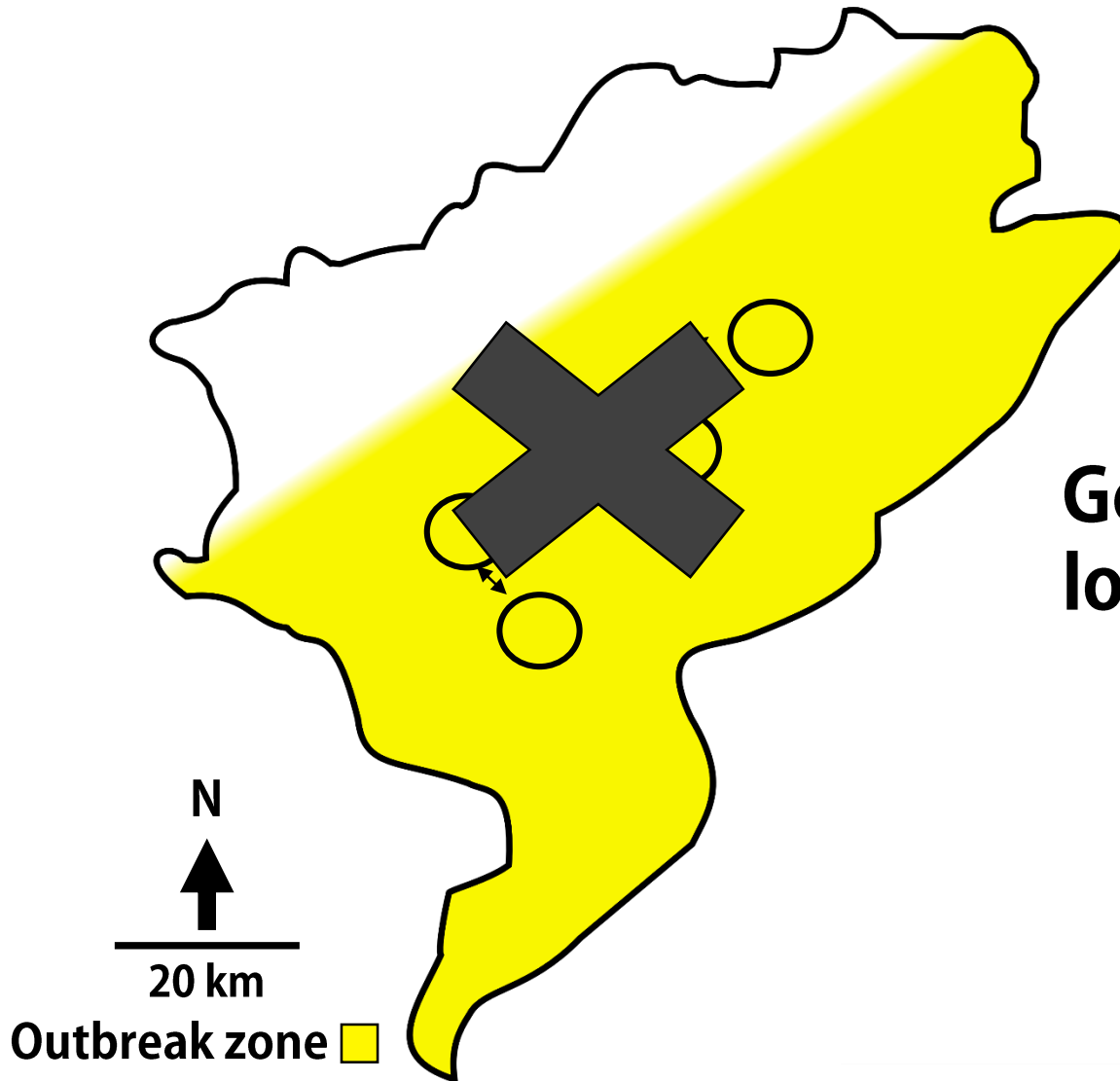
Geographic Distance



Gene flow low at low density

(Berthier et al 2005, 2006)

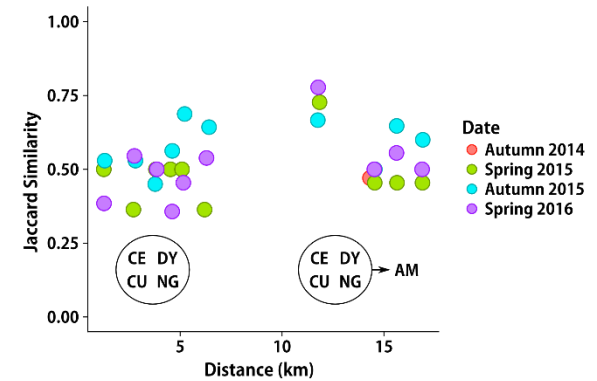
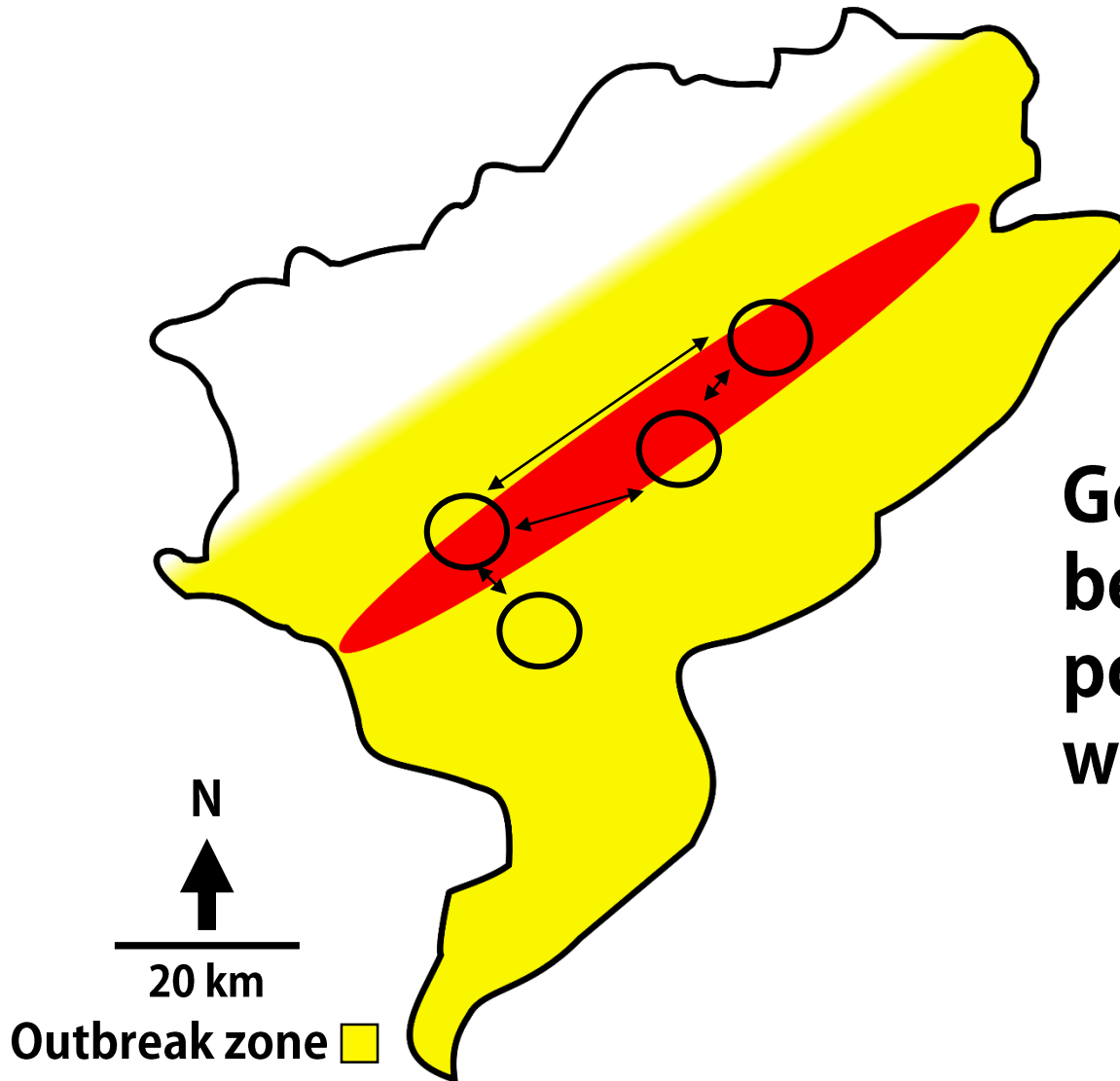
Geographic Distance



Gene flow low at low density

(Berthier et al 2005, 2006)

Geographic Distance



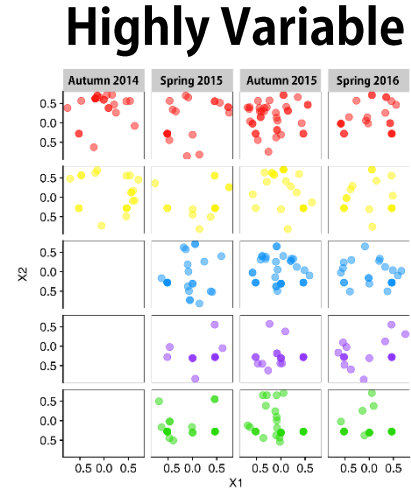
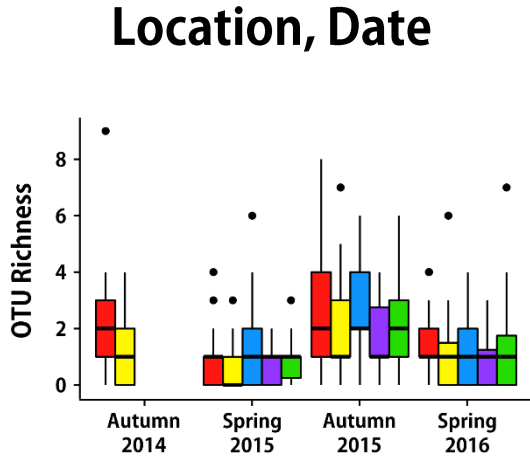
Gene flow high between peak populations, decays with distance

(Berthier et al 2005, 2006)

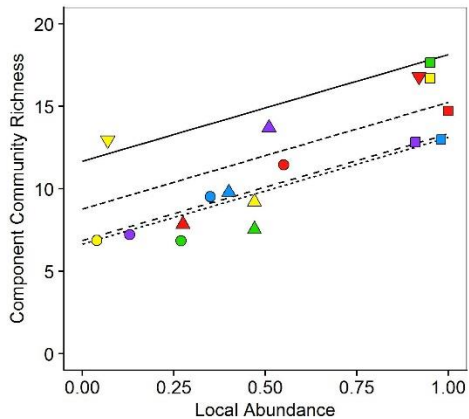
Summary

Richness

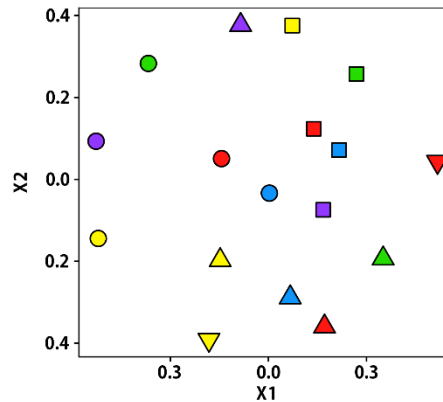
Community Similarity



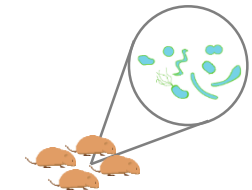
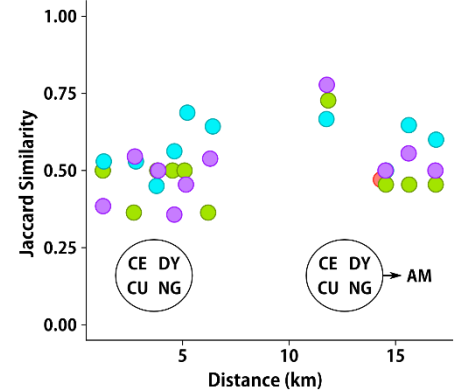
Local Abundance, Date



Date



Geographic Distance



Thanks for all the help!

- Amaël Dupaix
- Aurélie Guislain-Vitek
- Aurélien Levret
- Bérangère Foscarin
- Caroline Tatard
- Dominique Rieffel
- Eve Afonso
- Geoffroy Couval
- Herminie Piernavieja
- Javier Fernandez-de-Simon
- Jean-Baptiste Pons
- Jean-Francois Cosson
- José Gonzalo Zapata Carbonell
- Julie Montas
- Lexa Villette
- Marilyne Fontanier
- Maxime Galan
- Nathalie Charbonnel
- Nicolas Bassin
- Patrick Giraudoux
- Thibault Moulin
- Virgile Baudrot
- Vincent Driget



INRA
SCIENCE & IMPACT

ZA **Zone Atelier**
LTER FRANCE ARC JURASSIEN

CHRONO ENVIRONNEMENT

UMR CBGP

Merci!



RÉGION
BOURGOGNE
FRANCHE
COMTÉ



Future Directions - Decline

