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**25 SEPT 2019**  
11h00 – 11h40

Salle 201, Bâtiment PS2, CIRAD-UMR AMAP,  
Boulevard de la Lironde

## Testing and interpreting the shared space-environment fraction in variation partitioning analyses of ecological data

*presented by*

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### ABSTRACT

Variation partitioning analyses combined with spatial predictors (Moran's eigenvector maps, MEM) are commonly used in ecology to test the fractions of species abundance variation purely explained by environment and space. However, while these pure fractions can be tested using a classical residuals permutation procedure, no specific method has been developed to test the shared space-environment fraction (SSEF). Yet, the SSEF is expected to encompass a major driver of community assembly, that is, an induced spatial dependence effect (ISD; i.e. the reflection of a spatially structured habitat filter on a species distribution). A reliable test of this fraction is therefore crucial to properly test the presence of an ISD on ecological data. To bridge the gap, we propose to test the SSEF through spatially-constrained null models: torus-translations, and Moran spectral randomisations. We investigated the type I error rate and statistical power of our method based on two real environmental datasets and simulations of tree distributions. Ten types of tree distribution displaying contrasted aggregation properties were simulated, and their abundances were sampled in 153 regularly-distributed  $20 \times 20$  m quadrats. The SSEF was tested for 1000 simulated tree distributions either unrelated to the environment, or filtered by environmental variables displaying contrasting spatial structures. The method proposed provided a correct type I error rate ( $< 0.05$ ). The statistical power was high ( $> 0.9$ ) when abundances were filtered by an environmental variable structured at broad scale. However, the spatial resolution allowed by the sampling design limited the power of the method when using a fine-scale filtering variable. This highlighted that an ISD can be properly detected providing that the spatial pattern of the filtering process is correctly captured by the sampling design of the study. An R function to apply the SSEF testing method is provided and detailed in a tutorial.

### KEY WORDS

Environmental filtering, determinants of plant community assembly, spatially structured environmental variable.

### Invited and animated by:

Type:

Dr. Claire Fortunel (UMR AMAP)

Oral language:

Research results

Language of PPT:

english / français

