

# Os dois lados da mesma moeda:

Como uma rivalidade teórica nos ajuda a entender os padrões em comunidades ecológicas

---

Karlo Guidoni

08 de Abril de 2022

Fundação Brasileira para o Desenvolvimento Sustentável

Use R!

Daniel Borcard  
François Gillet  
Pierre Legendre

# Numerical Ecology with R

*Second Edition*

 Springer

# Preface

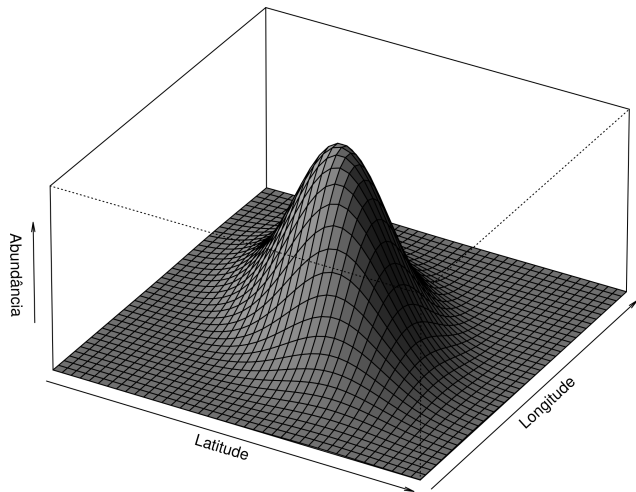
Ecology is sexy. Teaching ecology is therefore the art of presenting a fascinating topic to well-predisposed audiences. It is not easy: the complexities of modern ecological science go well beyond the introductory chapters taught in high schools or the marvellous movies about ecosystems presented on TV. But well-predisposed audiences are ready to make the effort. *Numerical* ecology is another story. For some unclear reasons, a majority of ecology-oriented people are strangely reluctant when it comes to quantifying nature and using mathematical tools to help understand it. As if nature was inherently non-mathematical, which it is certainly not: mathematics is the common language of all sciences. Teachers of biostatistics and numerical ecology thus have to overcome this reluctance: before even beginning to teach the subject itself, they must convince their audience of the interest and necessity of it.

Tentando entender os padrões em comunidades ecológicas:

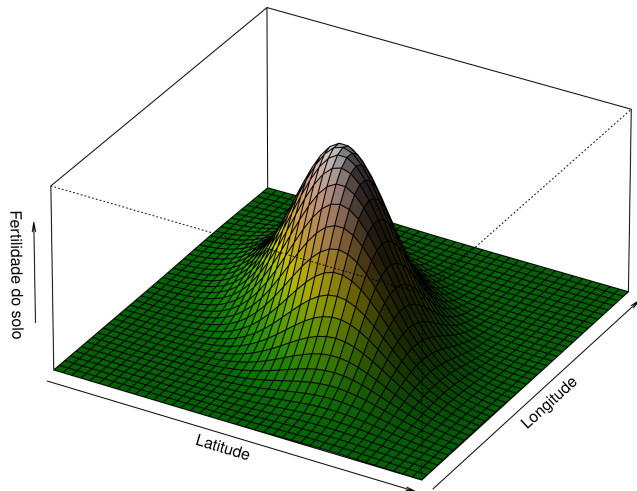
- UM PROBLEMA
- UMA SUGESTÃO
- UMA RUPTURA?
- UMA SOLUÇÃO?
- UM FINAL

## UM PROBLEMA

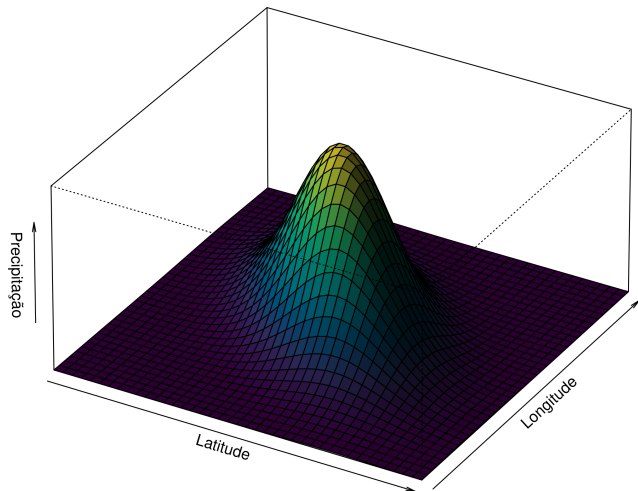
---



Distribuição espacial da abundância de uma espécie



Distribuição espacial da fertilidade do solo



Distribuição espacial da precipitação



Como separar esses efeitos?

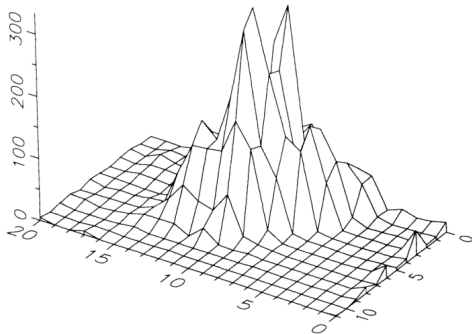


FIG. 1. Perspective plot of Hengeveld's (1979) summer collection of the carabid *Dyschirius globosus* on a reclaimed polder. Separation distance between intersection points on the sampling grid is 40 m.

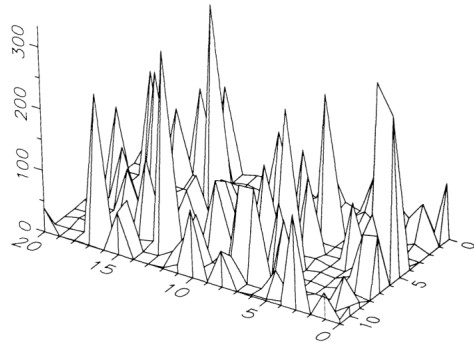


FIG. 2. Perspective plot of Hengeveld's (1979) carabid beetle data, which were presented in Fig. 1; here they have been rearranged randomly over the same sampling space.

<sup>1</sup>Rossi et al. 1992, *Ecological Monographs*

As estatísticas para os dois mapas anteriores são as mesmas

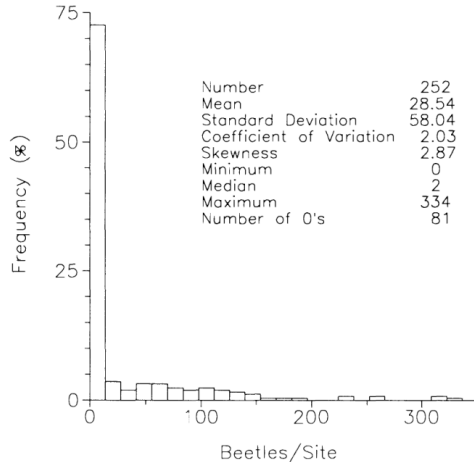


FIG. 3. Frequency histogram and some basic summary statistics for Hengeveld's (1979) data, which were presented in both Figs. 1 and 2.

**UMA SUGESTÃO**

---

Incorpore ao estudo aquilo que pode te ajudar a contar sua história<sup>2</sup>

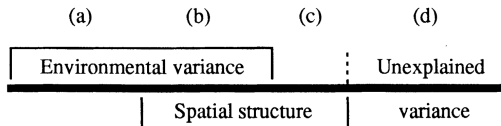


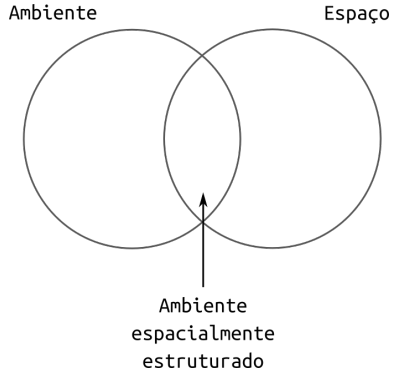
FIG. 2. Variation partitioning of a species data table, showing that fraction (b) is the intersection of the environmental and spatial components of the species variation.

Em outras palavras: abrace o problema!<sup>3</sup>

<sup>2</sup>Borcard *et al.* 1992, *Ecology*

<sup>3</sup>Legendre 1993, *Ecology*

## Pensando de forma operacional



Mas ainda precisávamos de uma teoria para o espaço

## UMA RUPTURA

---

O que está enraizado em nossas mentes há mais de um século<sup>4</sup>

## Nicho:

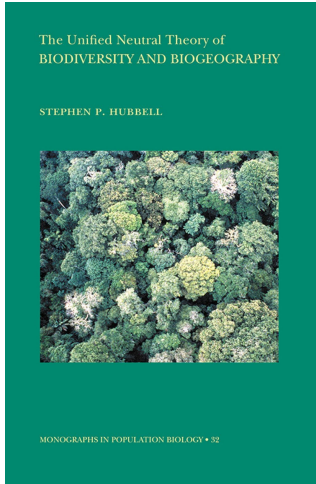
- requerimentos ambientais
- relações intra e interespecíficas



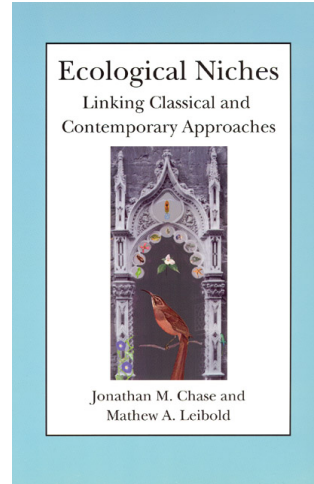
---

<sup>4</sup>Grinell 1917, *The Auk*





Hubbell 2001



Chase and Leibold 2003

Hubbell (2001) has recently challenged ecologists by claiming that the niche concept will have to be completely rethought from first principles. As an alternative, Hubbell champions a neutralist theory of biodiversity and relative species abundance, which claims that understanding differences among species with regard to their niches is not necessary and that many broad and general ecological patterns can be understood by assuming that all species are, in essence, identical in their ecological niches. However, it is well known that species do indeed differ in many important aspects, and so Hubbell's assumption cannot be strictly true. Nevertheless, the apparent success and predictive ability of Hubbell's ideas place the centrality of the niche concept in ecology at serious risk. What we hope is that this book will do just what Hubbell asked. Specifically, we will place the concept of the niche into a less ambiguous framework and try to disentangle a number of complicated processes that have caused confusion and dissatisfaction. In doing so, we hope to help answer a number of unresolved questions and to reestablish the central position of the niche concept in ecology and evolutionary biology.

Chase and Leibold 2003

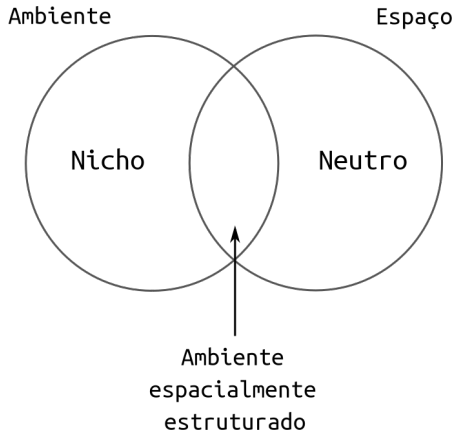
Hubbell (2001) recentemente desafiou ecólogos alegando que o conceito de nicho terá que ser completamente repensado a partir do primeiro princípio.

[...] todas espécies são, em essência, idênticas em seus nichos ecológicos.

[...] as ideias de Hubbell colocam a centralidade do conceito de nicho na ecologia em sério risco.

**UMA SOLUÇÃO**

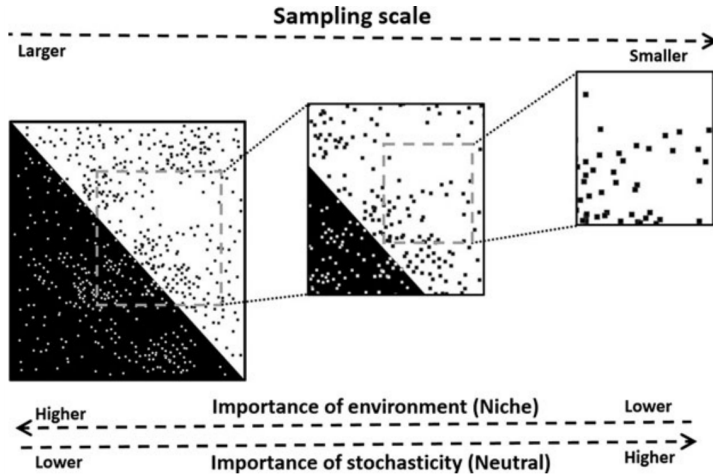
---



## Múltiplas hipóteses:

1. A composição de espécies é uniforme ao longo do espaço (interações preponderam)
2. A composição de espécies flutua aleatoriamente, mas com padrão espacial (dispersão prepondera)
3. A composição de espécies é relacionada ao ambiente (controle ambiental prepondera)

<sup>5</sup>Legendre *et al.* 2005, *Ecological Monographs*



<sup>6</sup>Chase 2014 - Spatial scale resolves the niche versus neutral theory debate, *JVS*

**UM FINAL**

---

Felizmente, não existe!

E ainda podemos (e devemos) explorar:

- Diversidade funcional
- Diversidade filogenética
- Estudos em múltiplas escalas espaciais
- Estudos em múltiplas escalas temporais



*“O gerenciamento adequado dos ecossistemas [...] exige que entendamos os processos pelos quais a diversidade é criada e mantida. Se a diversidade for inteiramente o resultado de processos aleatórios contemporâneos e históricos, podemos pegar os recursos em qualquer lugar sem efeitos adversos, desde que não os esgotemos. Caso contrário, temos que preservar a organização espacial ou as relações espécie-ambiente necessárias para a natureza recriar e manter a diversidade.”*

---

<sup>7</sup>Legendre et al. 2005, *Ecological Monographs*

**Perguntas?**

`karloguidoni2@gmail.com`