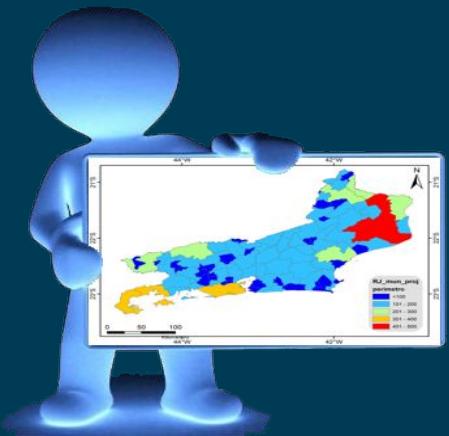


Tópicos Especiais em RGV II

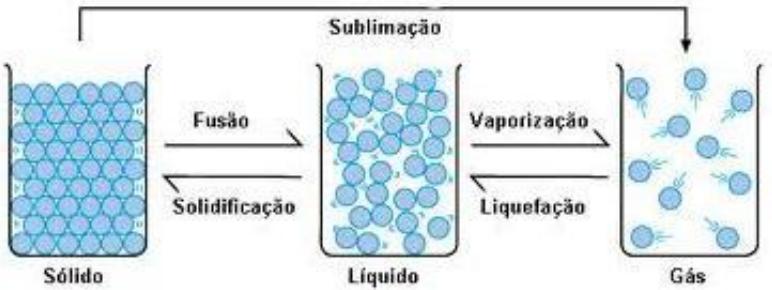
Modelagem de adequabilidade ambiental



Diogo S. B. Rocha

O que são Modelos?

Uma simplificação com um propósito !

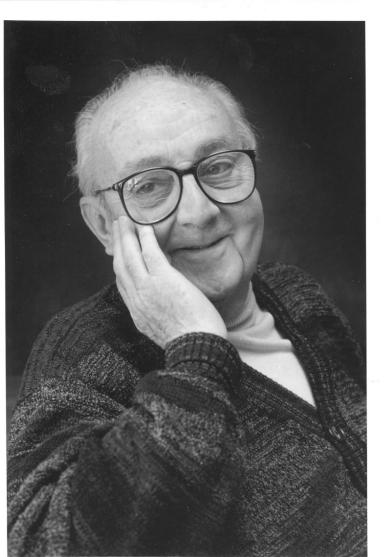


$$f(x) = ax + b$$

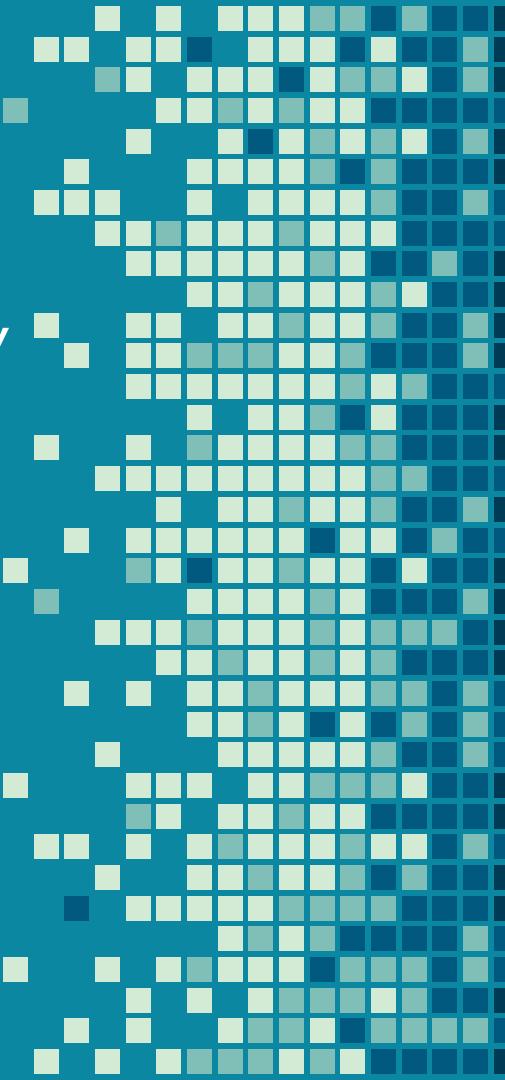


“

*Todos os modelos estão errados,
mas alguns são **úteis***



George E. P. Box
18 October 1919 – 28 March 2013



Relação entre altitude e temperatura

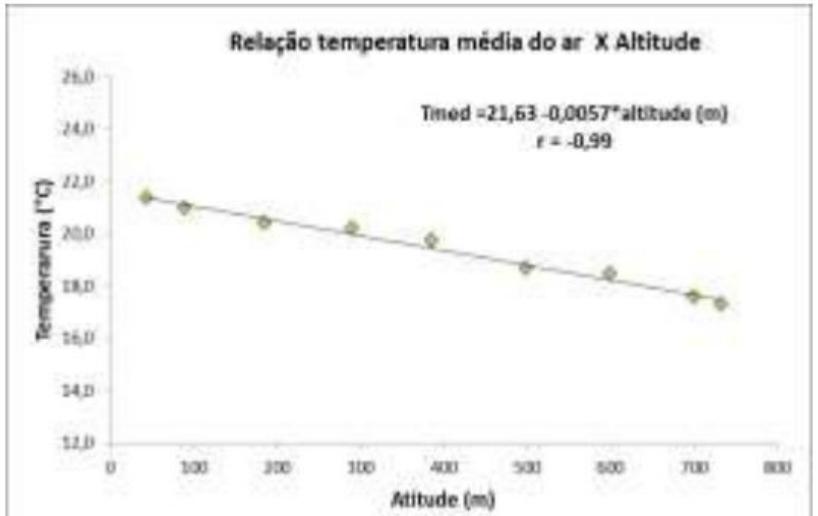
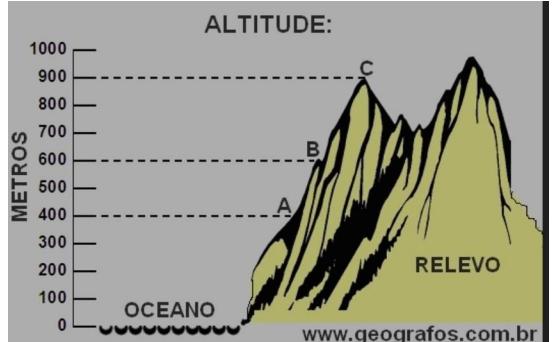
$$T = T_0 + ah$$

Temperatura

Temperatura de referência

Altitude

Variação da temperatura



Santos, D. D., de Moraes, S. L., & Galvani, E. (2016). Variação da temperatura do ar média, mínima e máxima no perfil topoclimático da Trilha Caminhos do Mar (SP). *REVISTA EQUADOR*, 5(5), 01-19.

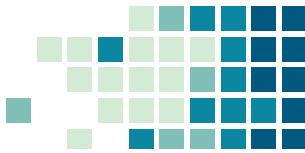
Modelagem de Adequabilidade Ambiental



1.

Distribuição geográfica





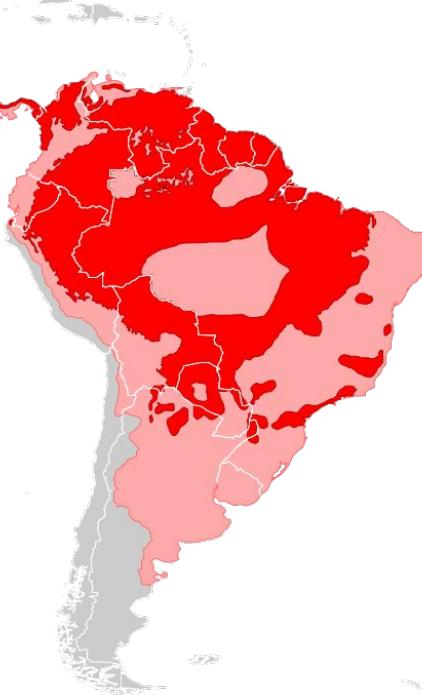
Distribuição de espécies



Panthera onca



■ Atual ■ Original



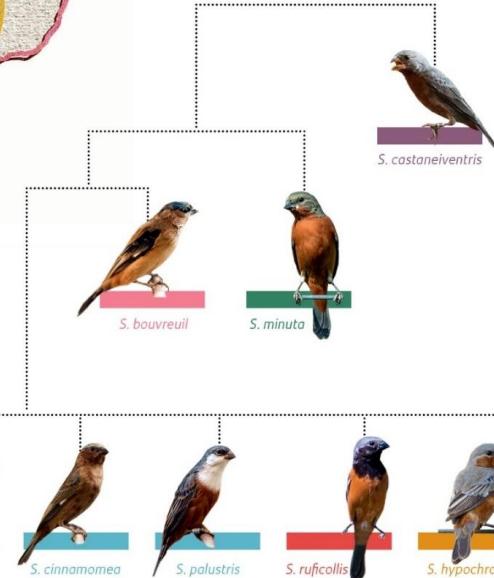
Hábitat dos caboclinhos

As espécies mais antigas vivem no norte da América do Sul e as mais recentes se espalharam pelo centro-sul

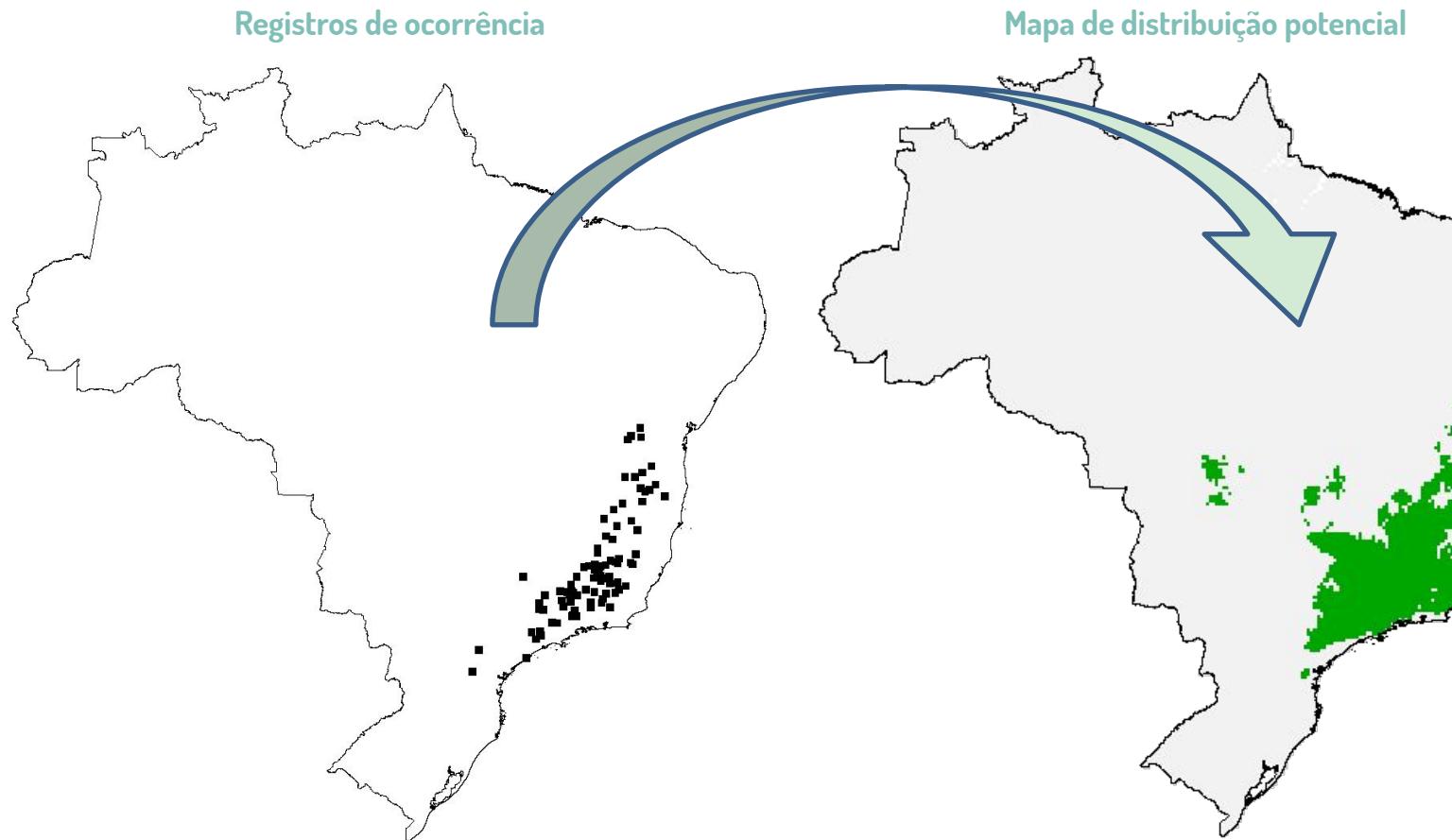
FONTE CAMPAGNA E SILVEIRA
FOTOS CESAR MEDOLACO
INFOGRÁFICO ANA PAULA CAMPOS
ILUSTRAÇÃO SANDRO CASTELLI



As relações filogenéticas entre as 11 espécies do gênero *Sporophila*. A espécie que primeiro divergiu das demais é a *S. castaneiventris*



Distribuição de espécies



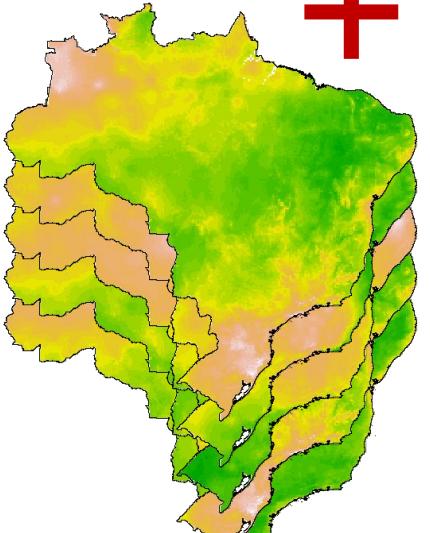
Introdução Modelagem

Registros de ocorrência



Dados de entrada

Variáveis preditoras



Precipitação

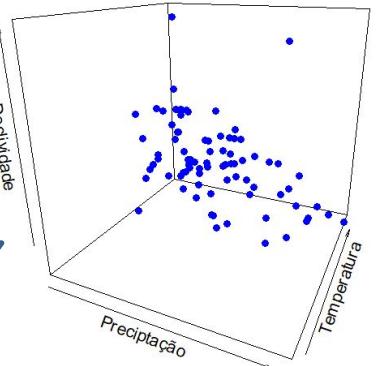
Temperatura

Topografia

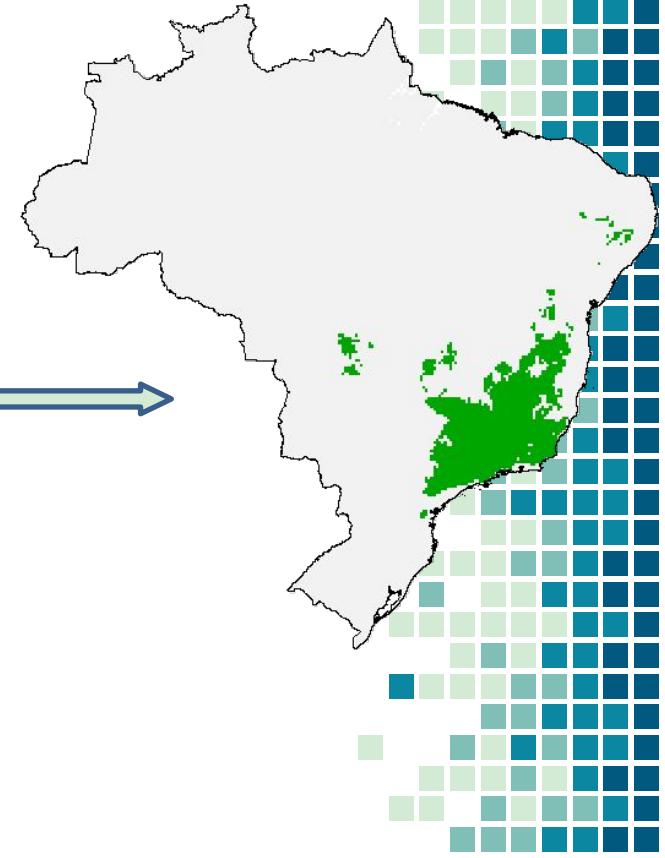
Variável X

Variável Y

Algoritmos de modelagem
(Bioclim, GLM, GAM, ANN, MAXEnt, etc.)



Mapa de distribuição potencial

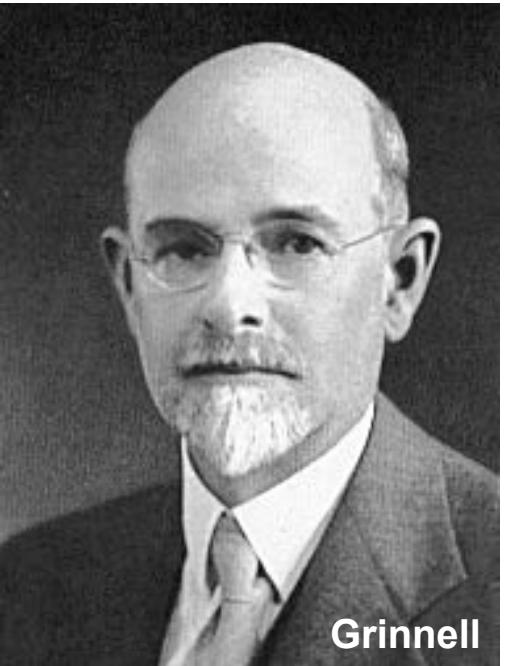


2.

Conceitos de Nicho



O termo *nicho* apareceu primeiramente nos trabalhos de Grinnell (1917, 1924) cujo foco está na distribuição geográfica dos indivíduos de uma espécie como uma resposta às variáveis ambientais (temperatura, precipitação, elevação etc.).



THE NICHE-RELATIONSHIPS OF THE CALIFORNIA THRASHER.¹

BY JOSEPH GRINNELL.

THE California Thrasher (*Toxostoma redivivum*) is one of the several distinct bird types which characterize the so-called "Californian Fauna." Its range is notably restricted, even more so than that of the Wren-Tit. Only at the south does the California Thrasher occur beyond the limits of the state of California, and in that direction only as far as the San Pedro Martir Mountains and

¹ Contribution from the Museum of Vertebrate Zoölogy of the University of California.

Grinnell

Elton (1927) muda o foco e coloca o nicho como uma resposta da interação entre espécies.



ECOLOGY LETTERS
Ecology Letters, (2010) 13: 1310–1324 doi: 10.1111/j.1461-0248.2010.01515.x

REVIEW AND SYNTHESIS

Niche conservatism as an emerging principle in ecology and conservation biology

Abstract
The diversity of life is ultimately generated by evolution, and much attention has focused on the rapid evolution of ecological traits. Yet, the tendency for many ecological traits to

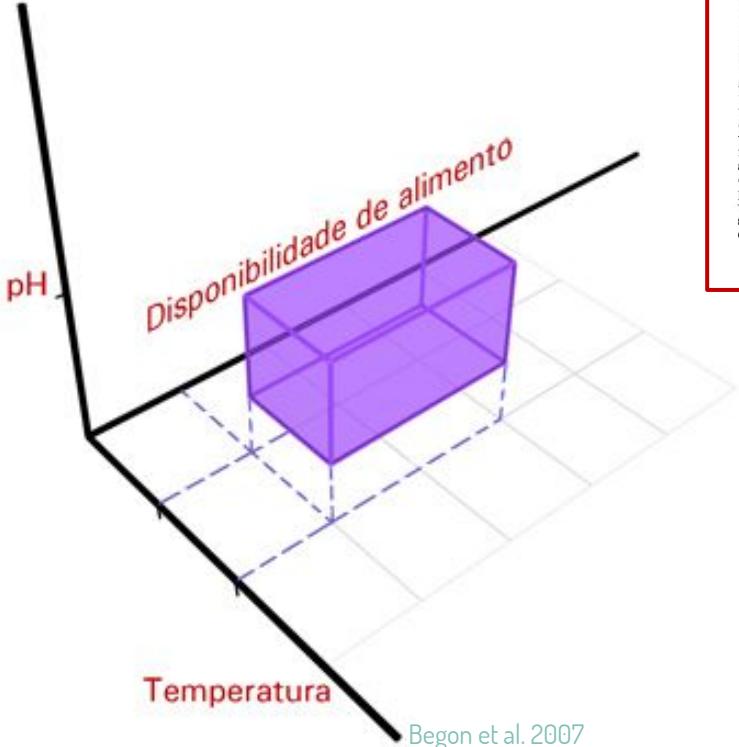
Ecology Letters, (2007) 10: 1115–1123 doi: 10.1111/j.1461-0248.2007.01107.x

IDEA AND PERSPECTIVE

Grinnellian and Eltonian niches and geographic distributions of species

Abstract
In the recent past, availability of large data sets of species presences has increased by orders of magnitude. This, together with developments in geographical information systems and statistical methods, has enabled scientists to calculate, for thousands of species, the environmental conditions of their distributional areas. The profiles thus obtained are obviously related to niche concepts in the Grinnell tradition, and separated from those in Elton's tradition. I argue that it is useful to define Grinnellian and Eltonian niches on the basis of the types of variables used to calculate them, the natural spatial scale at which they can be measured, and the dispersal of the individuals over the environment. I use set theory notation and analogies derived from population ecology theory to obtain formal definitions of areas of distribution and several types of niches. This brings clarity to several practical and fundamental questions in macroecology and biogeography.

Hutchinson (1957) define o termo *nicho* como a soma de todos os fatores ambientais (bióticos e abióticos) que agem em um determinado organismo, definido como um hipervolume com n dimensões.



Begon et al. 2007

Concluding Remarks

G. EVELYN HUTCHINSON
Yale University, New Haven, Connecticut

This concluding survey¹ of the problems considered in the Symposium naturally falls into three sections. In the first brief section certain of the areas in which there is considerable difference in outlook are discussed with a view to ascertaining the nature of the differences in the points of view of workers in different parts of the field; no aspect of the Symposium has been more important than the reduction of areas of dispute. In the second section a rather detailed analysis of one particular problem is given, partly because the question, namely, the nature of the ecological niche and the validity of the principle of niche specificity has raised and continues to raise difficulties, and partly because discussion of this problem gives an opportunity to refer to new work of potential importance not otherwise considered in the Symposium. The third section deals with possible directions for future research.

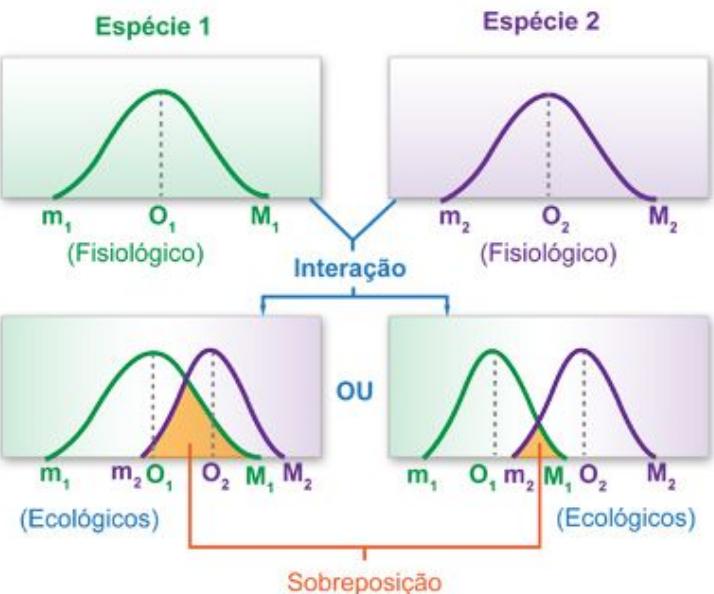
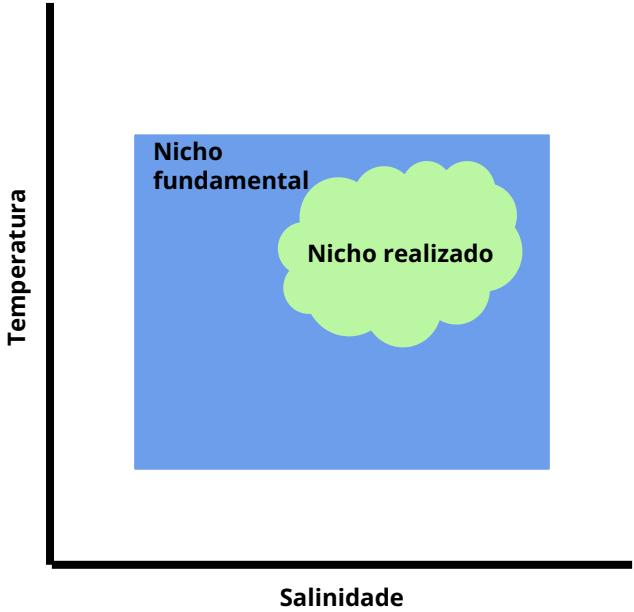
THE DEMOGRAPHIC SYMPOSIUM AS A
HETEROGENEOUS UNSTABLE
POPULATION

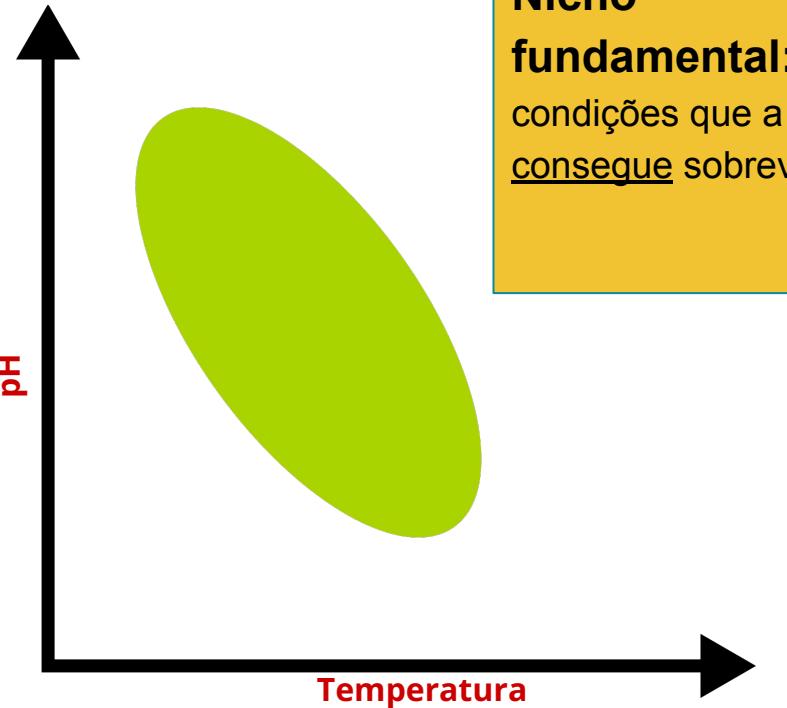
The human demographer by virtue of his position as a slow breeding participant observer, and also because he is usually called on to predict for practical purposes what will happen in the immediate future, is inevitably interested in what may be called the microdemography of man. The significant quantities are mainly second and third derivatives, rates of change of natality and mortality and the rates of change of such rates. These latter to the animal demographer might appear as random fluctuations which he can hardly hope to analyse in his experiments. What the animal demographer is mainly concerned with is the macrodemographic problem of the integral curve and its first derivative. He is accustomed to dealing with innumerable cases where the latter is negative, a situation that is so rare in human populations that it seems to be definitely pathological to the human demographer. Only when anthropology and archaeology enter the field of human demography does something comparable to animal demography, with its broad,

if sometimes insufficiently supported, conclusions

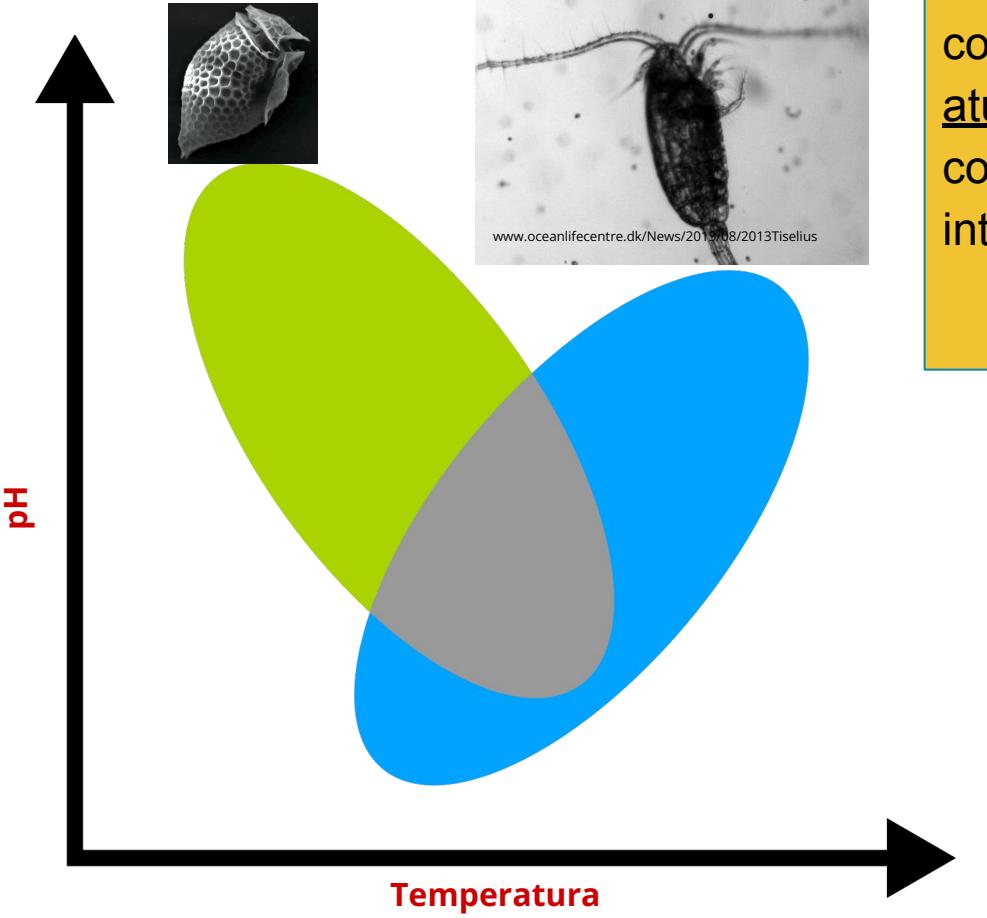
Terminologias de Hutchinson

- **Nicho Fundamental:** conjunto de ótimos fisiológicos.
- **Nicho Realizado:** conjunto de ótimos ecológicos.



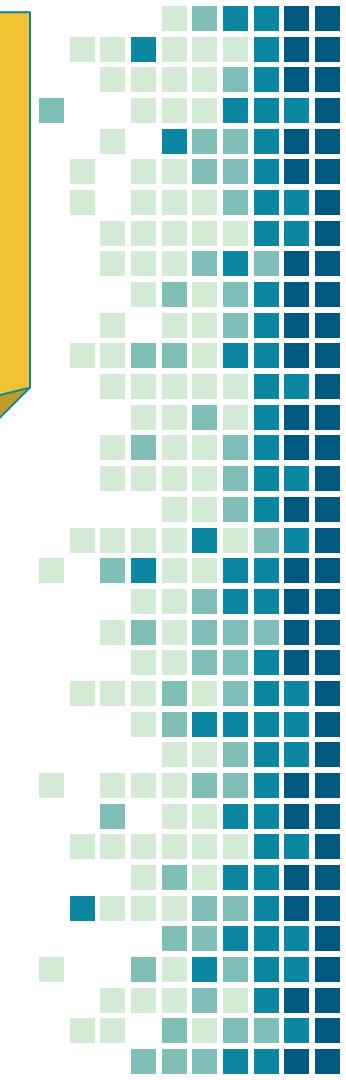


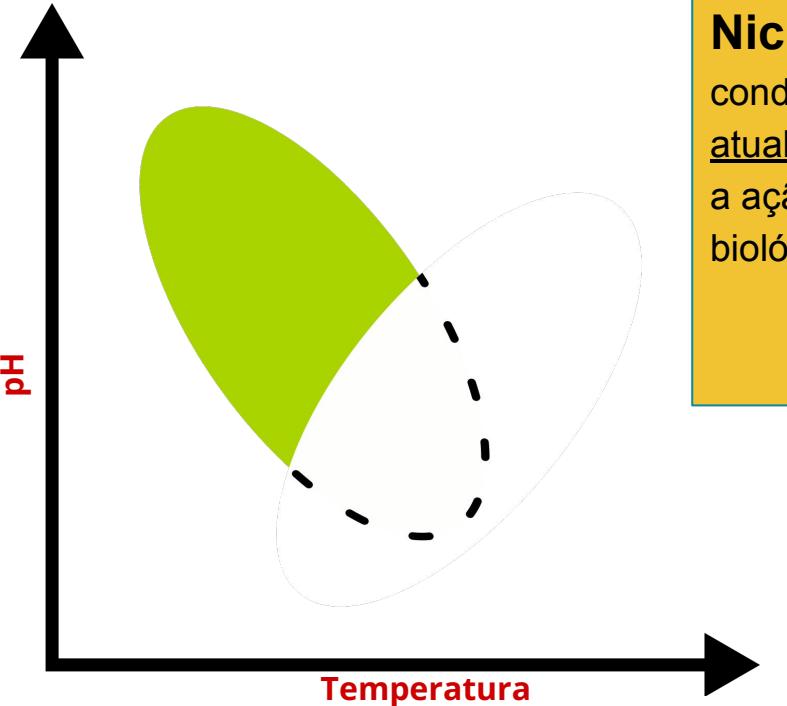
Nicho fundamental:
condições que a espécie
consegue sobreviver



Nicho realizado:

condições que a espécie atualmente vive,
considerando a ação das
interações biológicas





Nicho realizado:

condições que a espécie atualmente vive, considerando a ação das interações biológicas

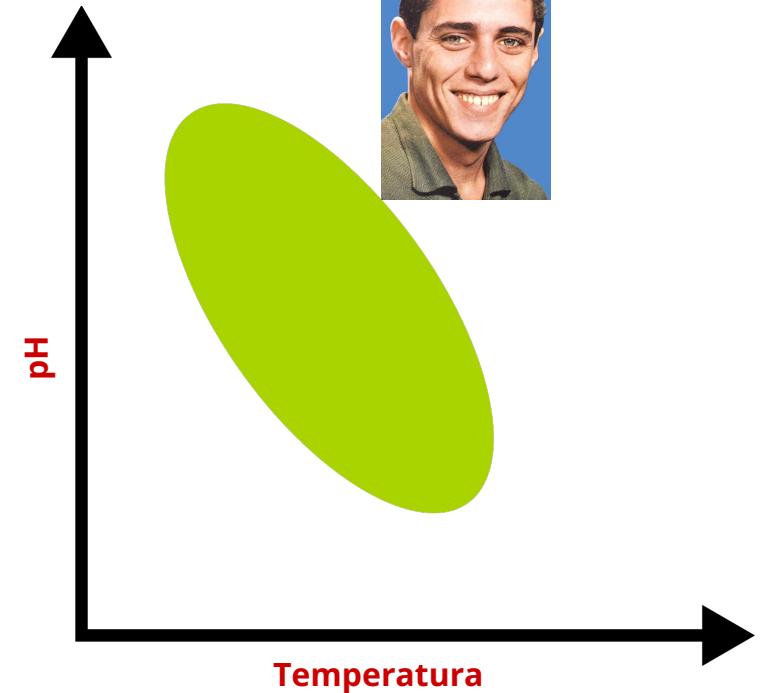
Nicho Fundamental

vs.

Nicho Realizado

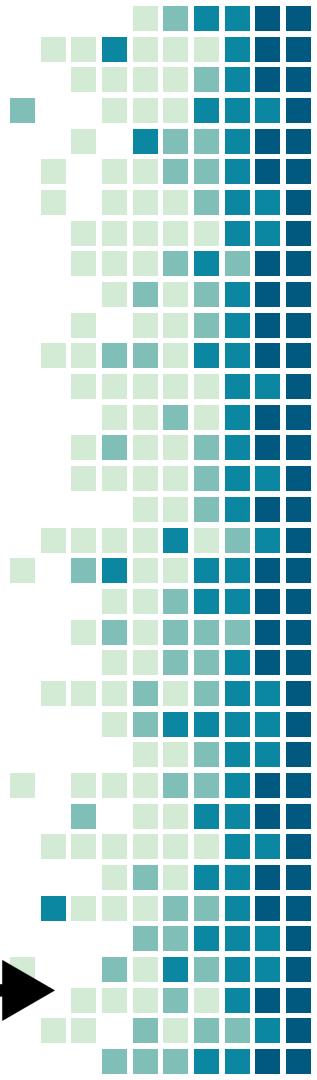
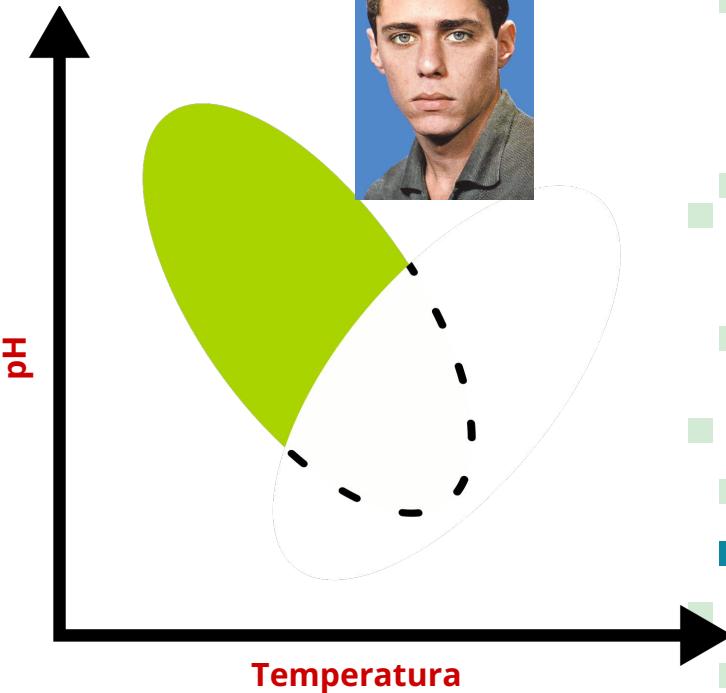
Fatores abióticos

Salinidade, pH, temperatura,
nutrientes, luz



Fatores bióticos

Predação, competição



Conceito de nicho em Ecologia

Duas classes principais:

1. O nicho Grinnelliano é importante para compreender a distribuição geográfica das espécies em escala global/continental
2. O nicho Eltoniano foca nas interações bióticas e dinâmica de consumo dos recursos, que na maior parte das vezes ocorre em escala local

Ecology Letters, (2007) 10: 1115–1123 doi: 10.1111/j.1461-0248.2007.01107.x

IDEA AND PERSPECTIVE

Grinnellian and Eltonian niches and geographic distributions of species

Jorge Soberón*

Biodiversity Research Center
and Museum of Natural History,
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1345 Jayhawk Blvd, Lawrence,
KS 66045, USA

*Correspondence: E-mail:
jsoberon@ku.edu

Abstract

In the recent past, availability of large data sets of species presences has increased by orders of magnitude. This, together with developments in geographical information systems and statistical methods, has enabled scientists to calculate, for thousands of species, the environmental conditions of their distributional areas. The profiles thus obtained are obviously related to niche concepts in the Grinnell tradition, and separated from those in Elton's tradition. I argue that it is useful to define Grinnellian and Eltonian niches on the basis of the types of variables used to calculate them, the natural spatial scale at which they can be measured, and the dispersal of the individuals over the environment. I use set theory notation and analogies derived from population ecology theory to obtain formal definitions of areas of distribution and several types of niches. This brings clarity to several practical and fundamental questions in macroecology and biogeography.

(Soberón 2007)

GLOBAL

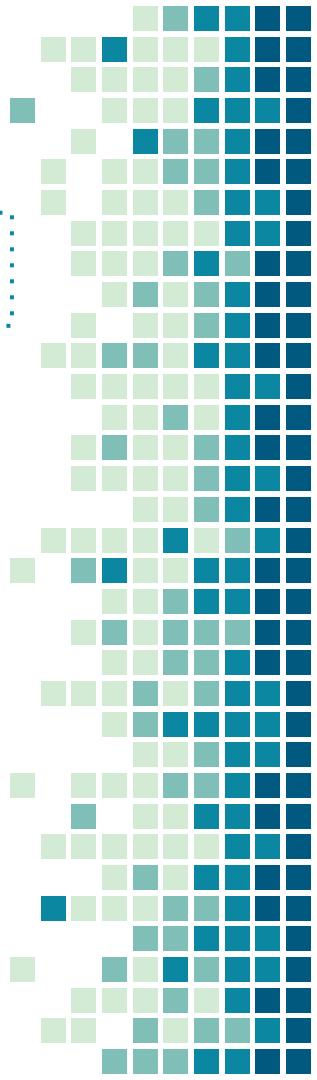
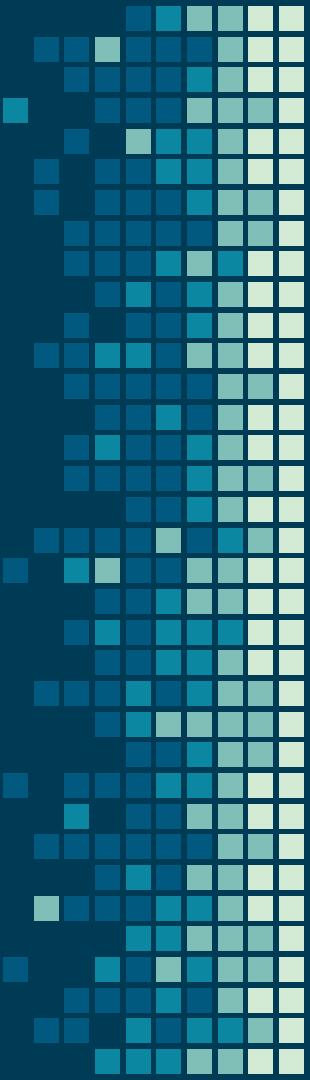
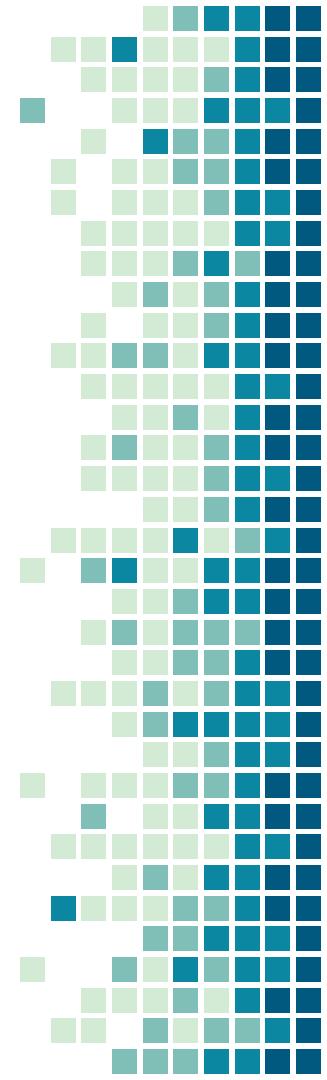
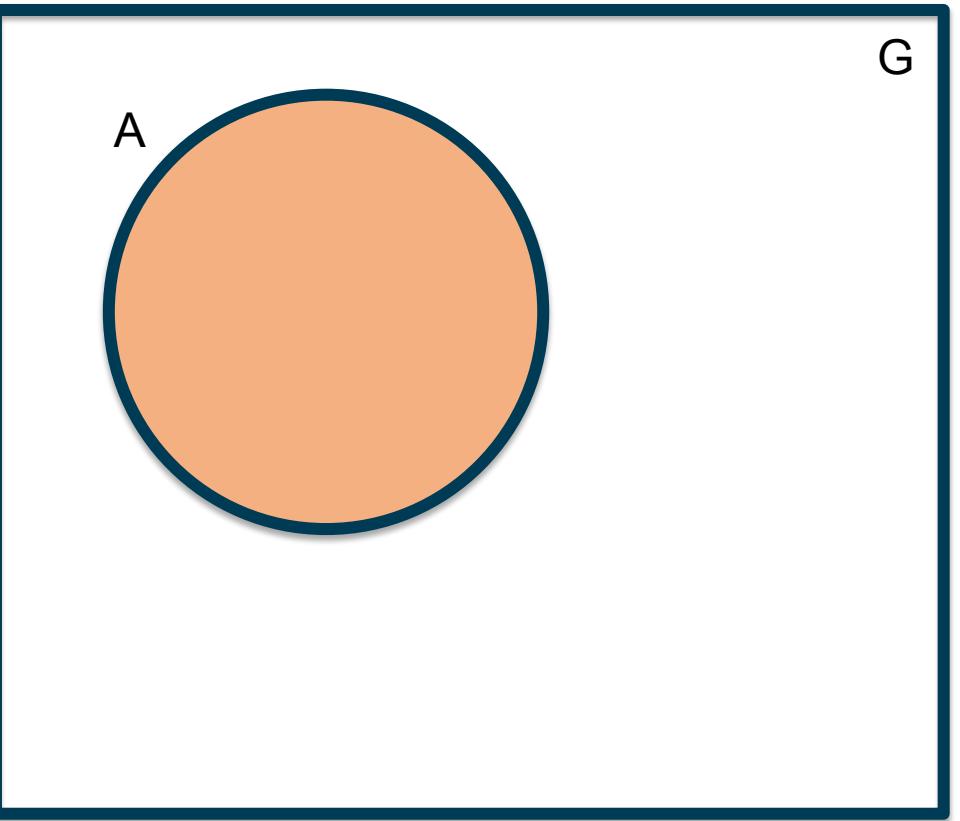
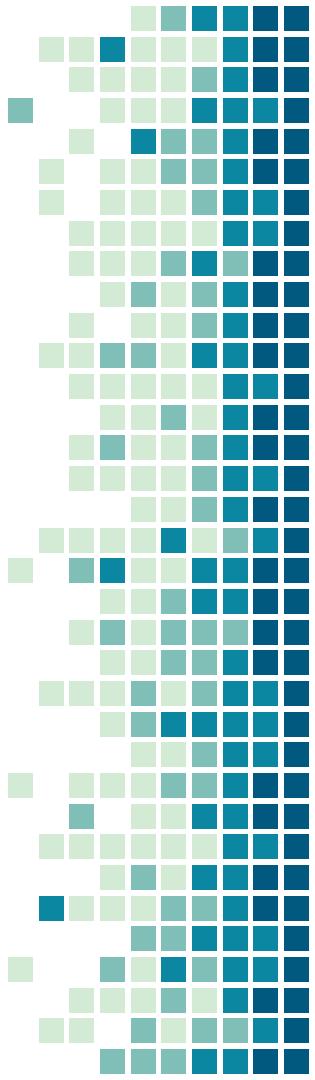
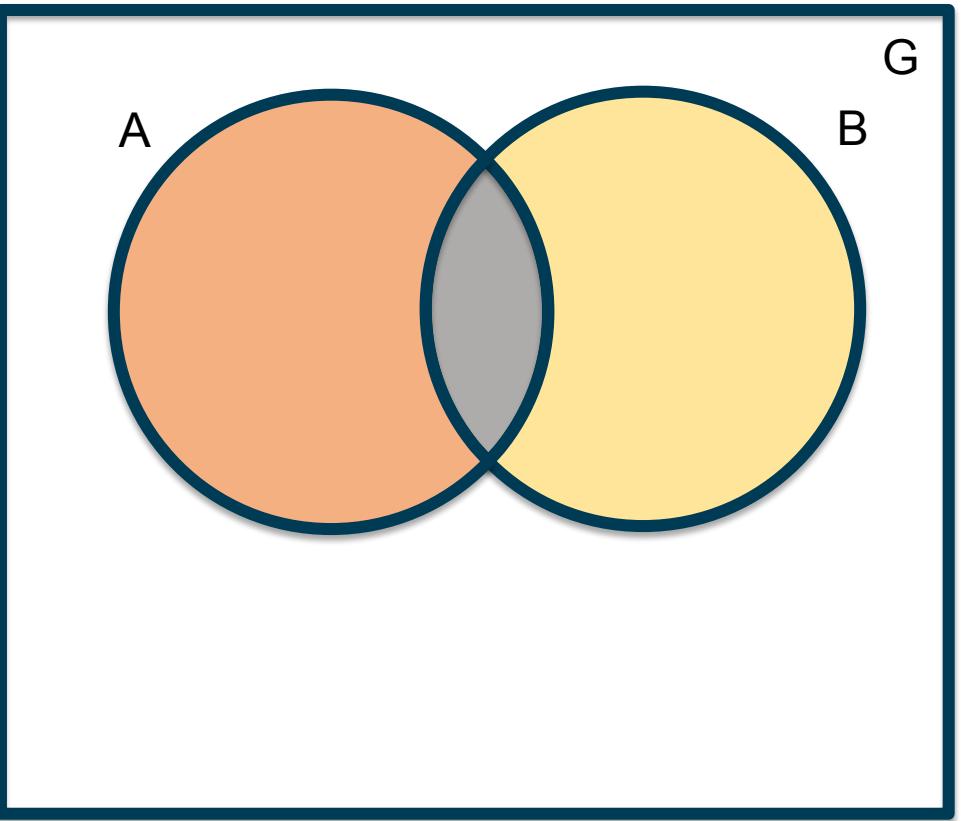


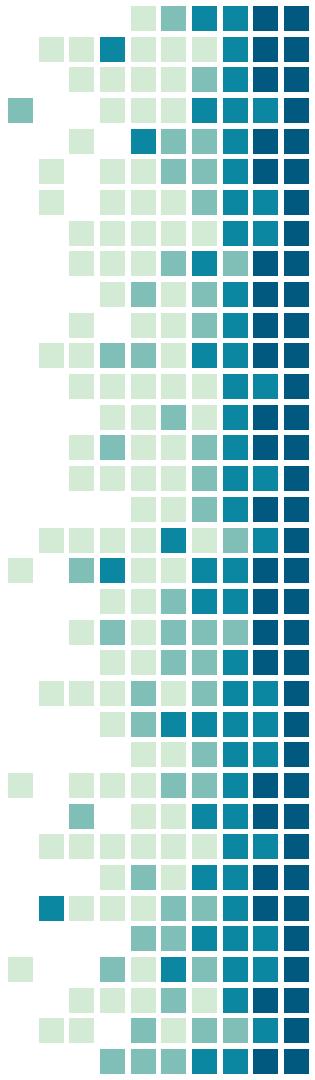
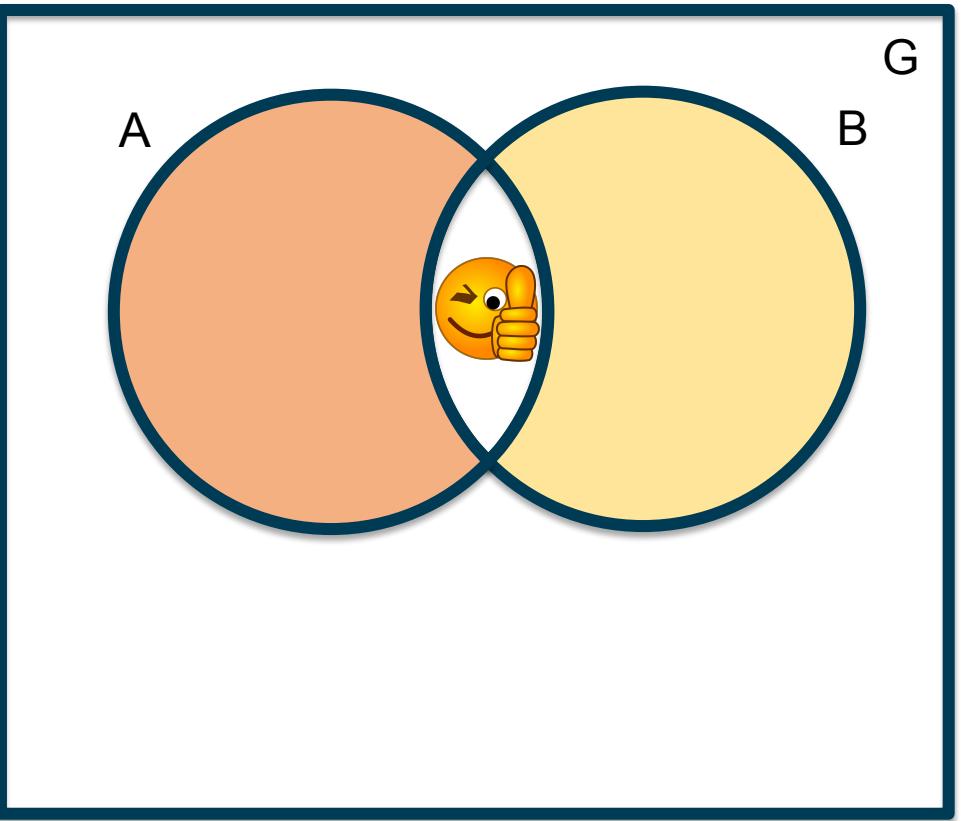


Diagrama BAM: Fatores que influenciam a distribuição das espécies









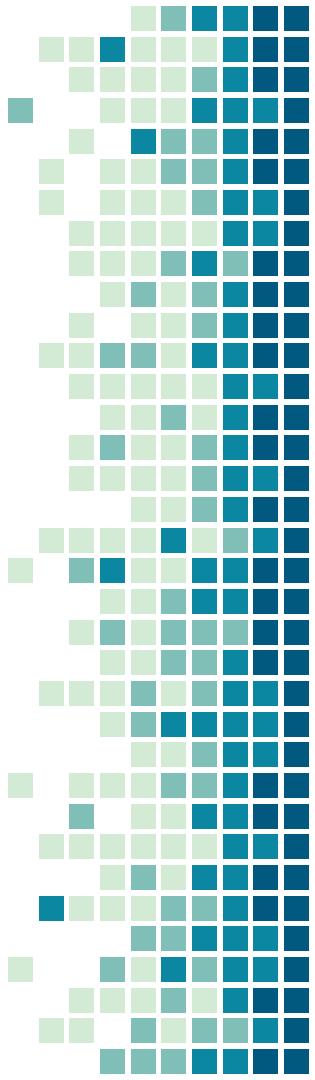
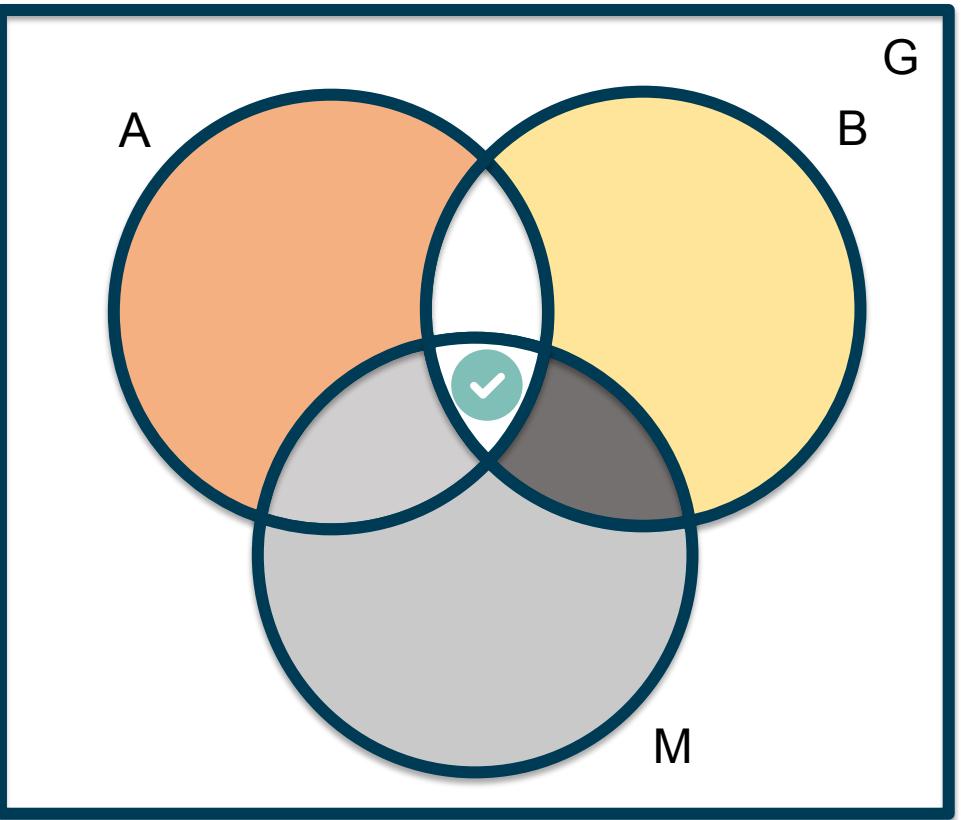


Diagrama BAM (Peterson et al. 2011): Fatores que influenciam a distribuição

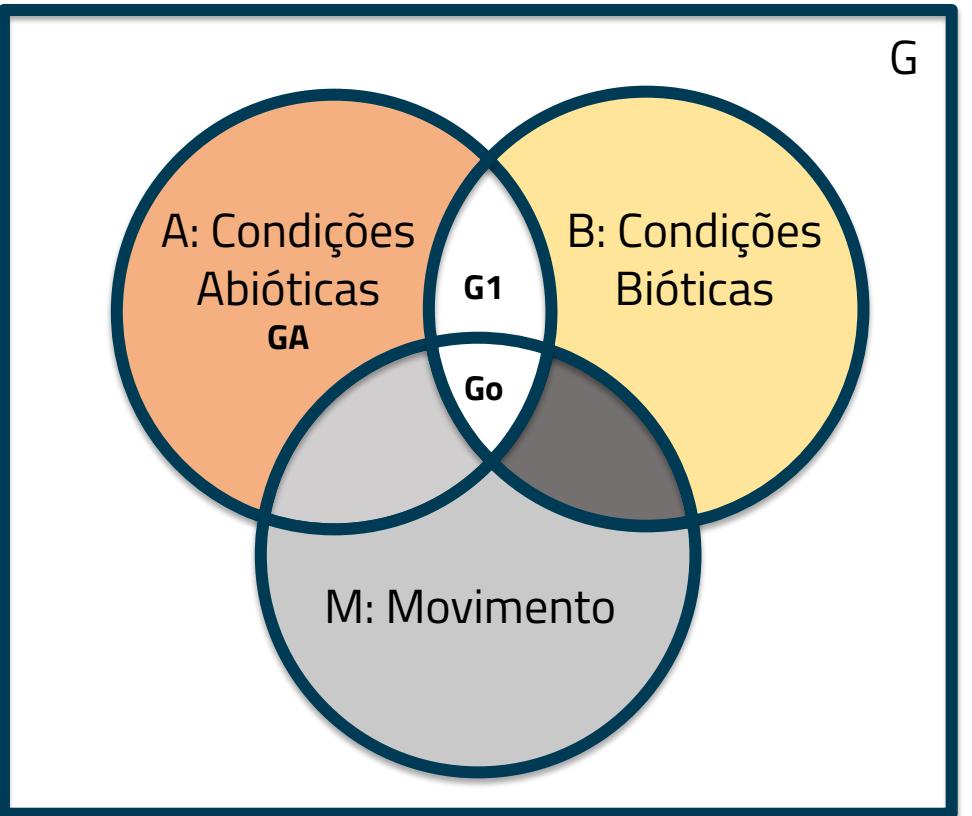
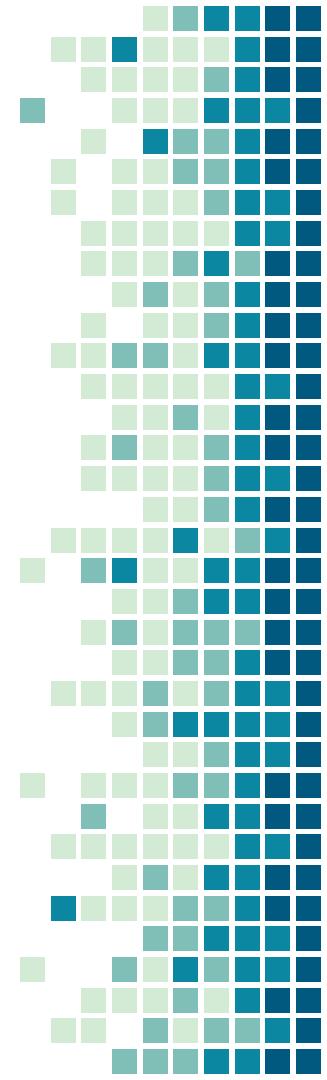
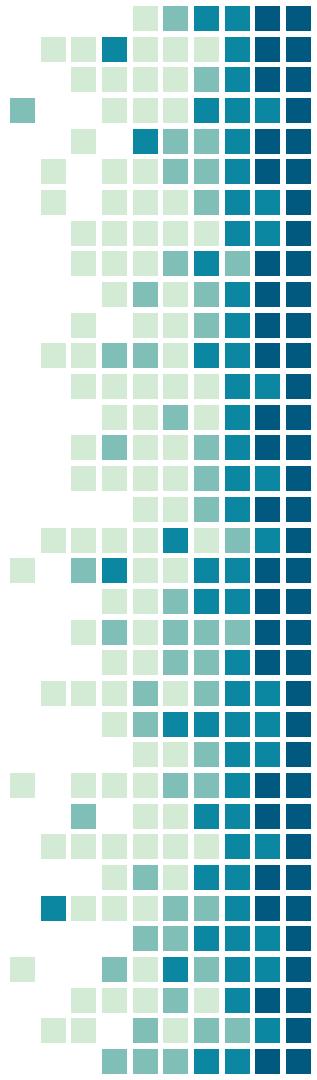
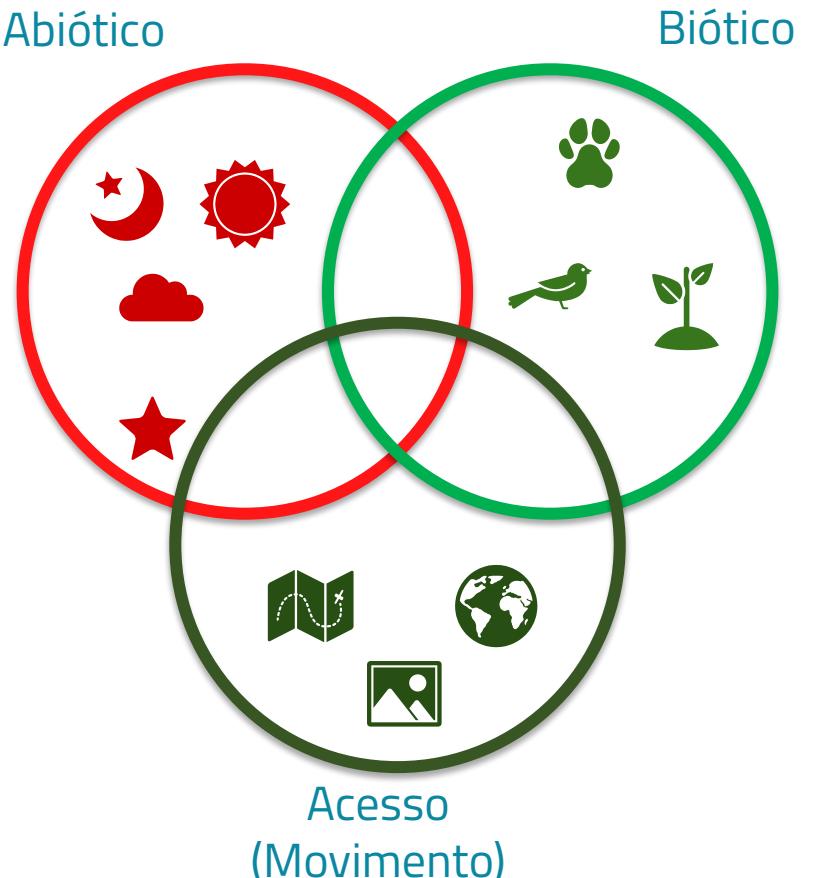


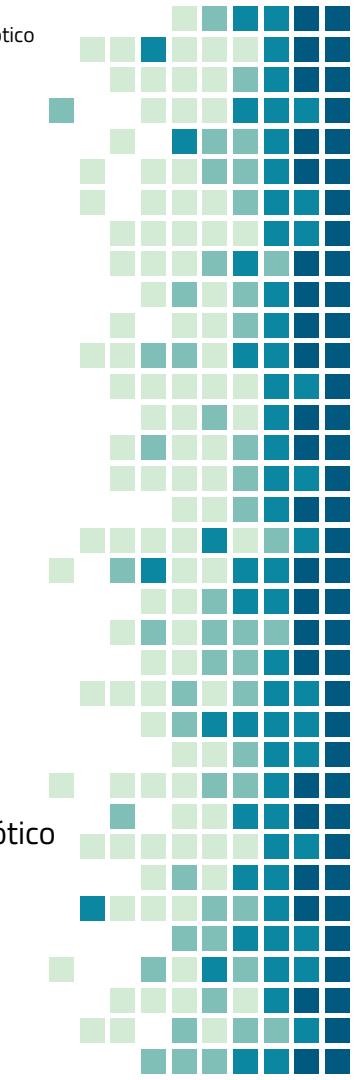
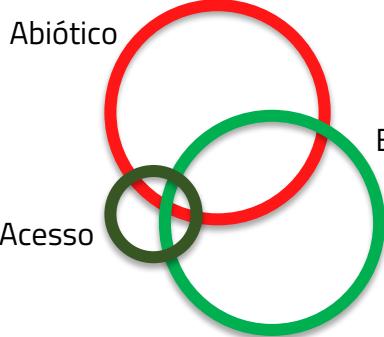
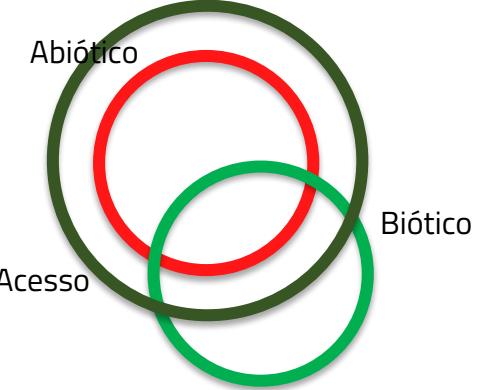
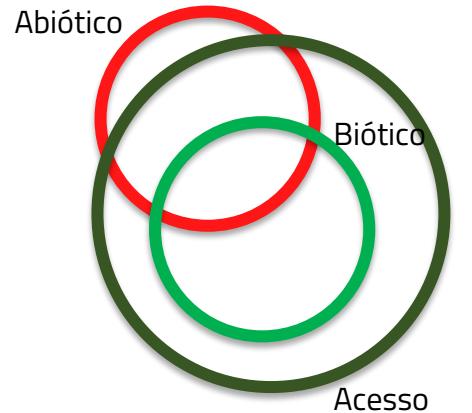
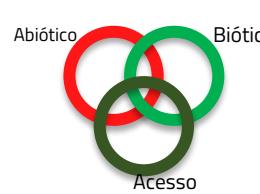
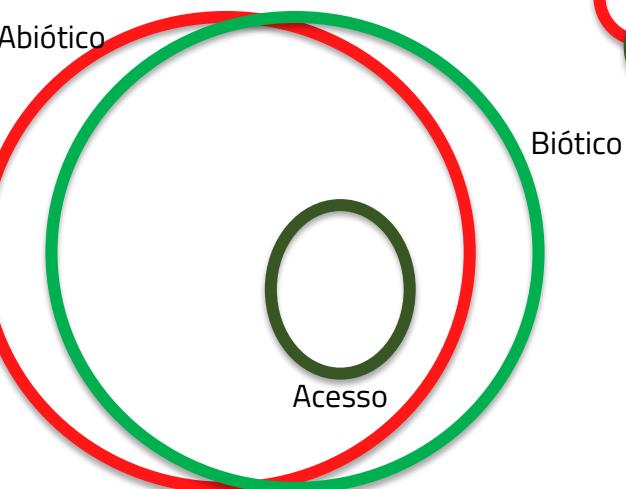
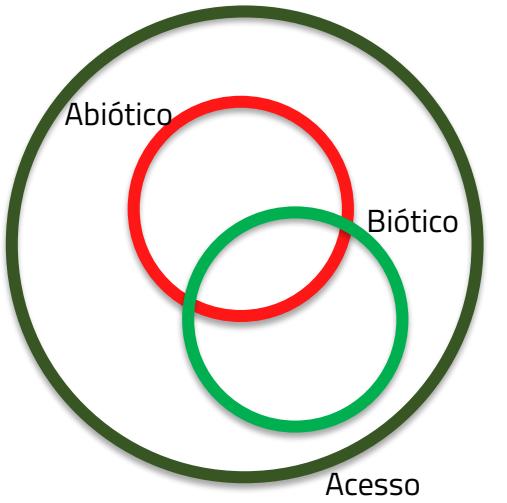
Diagrama representando as interações entre os fatores bióticos (**B**), abióticos (**A**) e de movimento (**M**) que condicionam a ocorrência de uma espécie em um determinado local. **G** representa o espaço geográfico em que a espécie está inserida, **Go** = área efetivamente ocupada; **G1** = área de distribuição potencial e **GA** = toda a área abiótica que a espécie tem condição de ocupar.



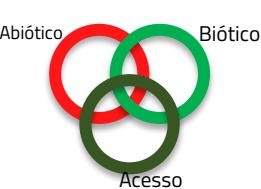
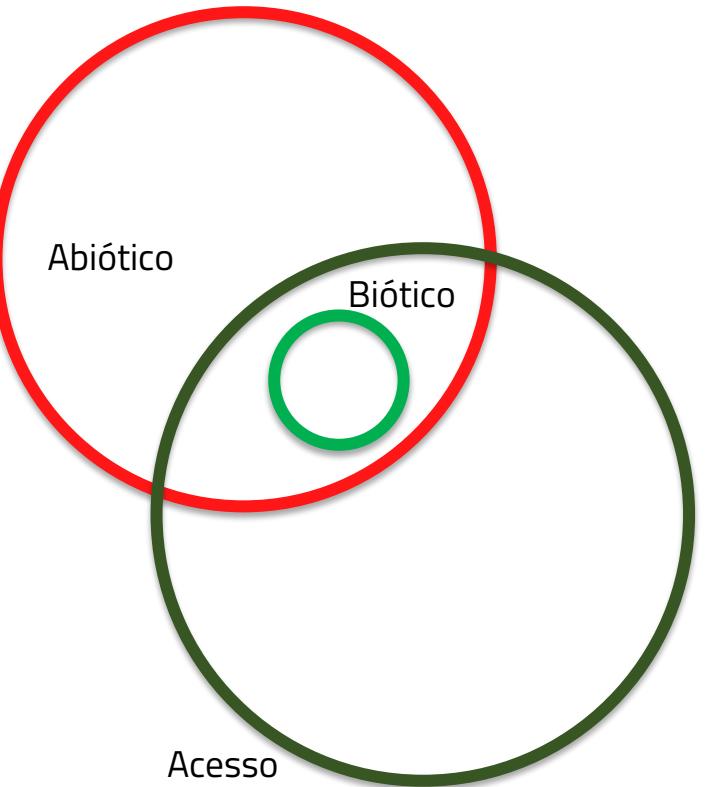
Configuração clássica do Diagrama BAM



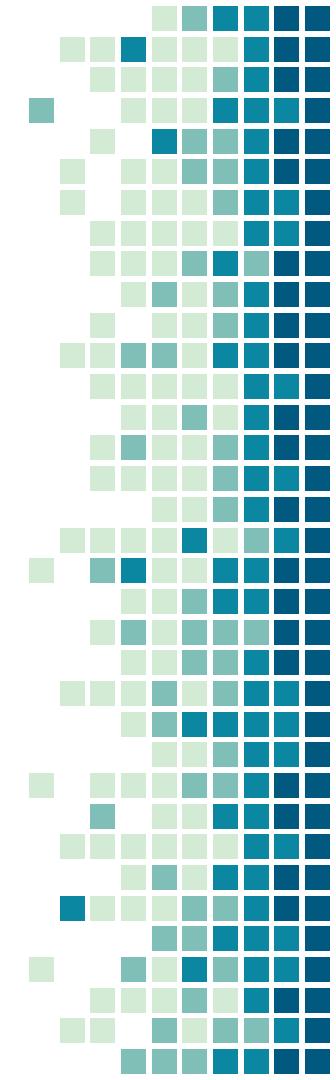
Configurações possíveis do Diagramma BAM



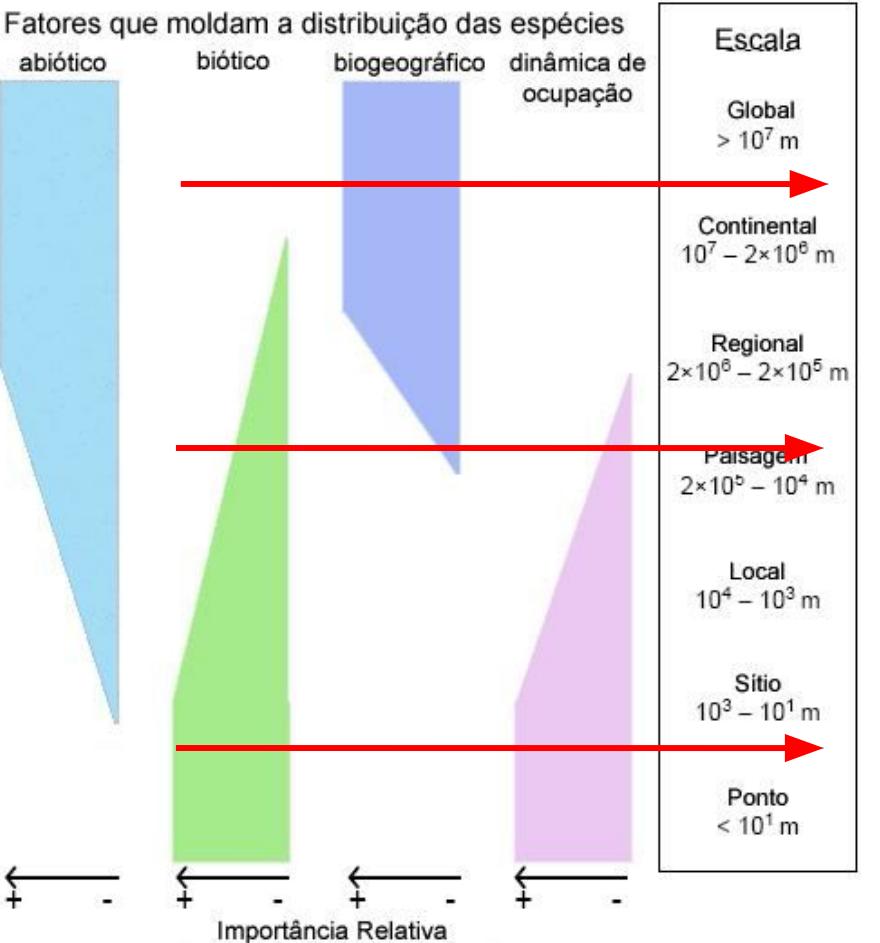
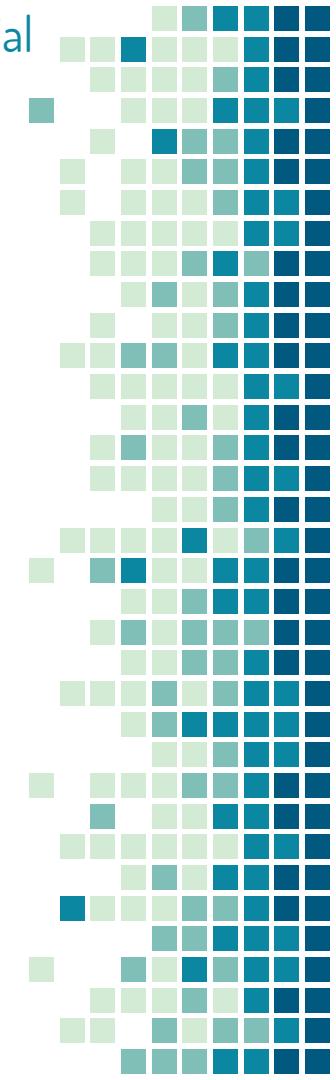
Configurações possíveis do Diagrama BAM



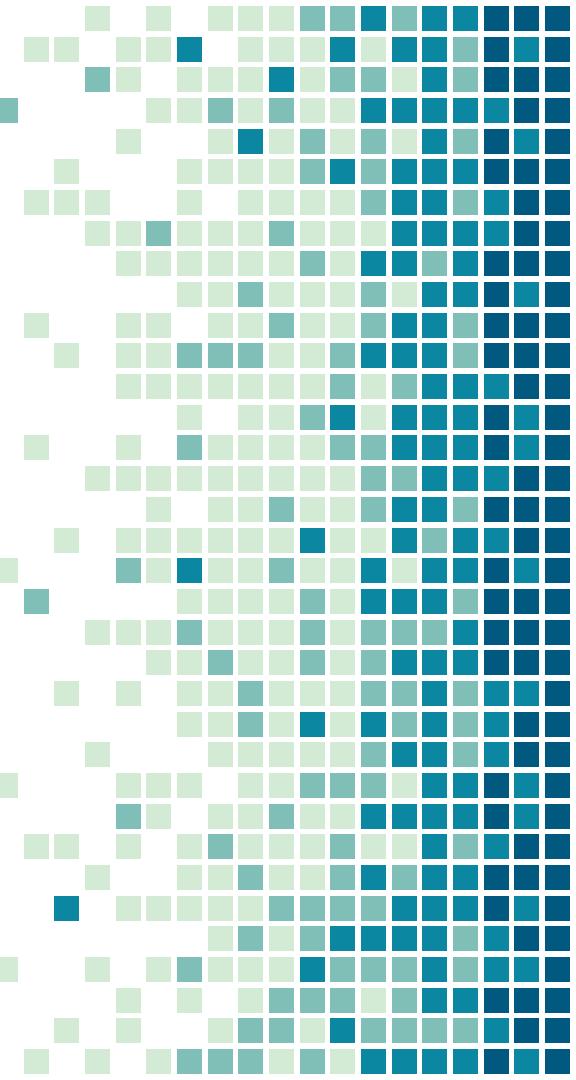
“Ruído Eltoniano”
Os fatores bióticos
influenciam em
pequena escala



Importância dos fatores que afetam a distribuição das espécies através da escala espacial



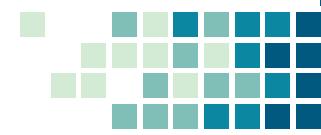
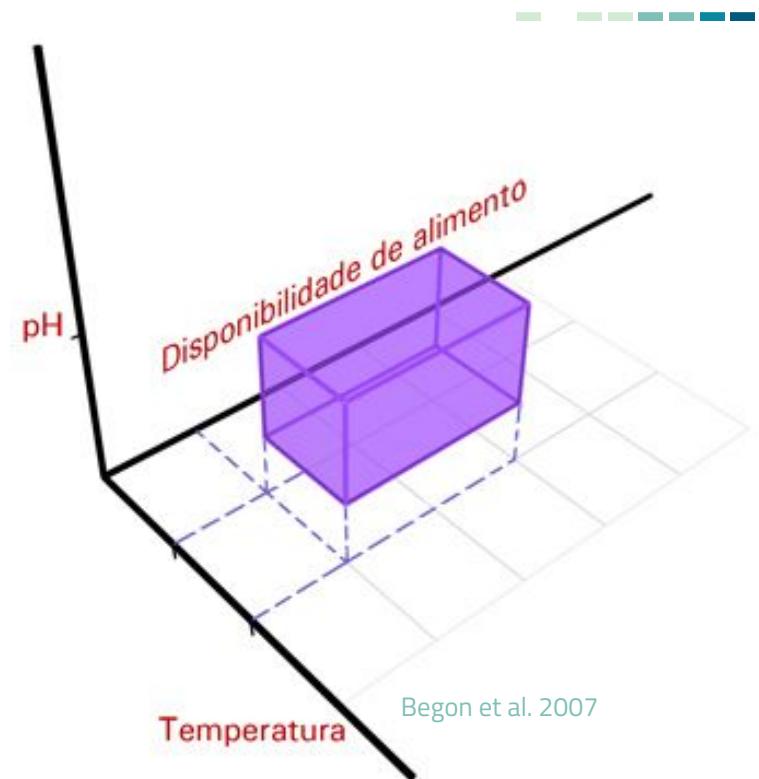
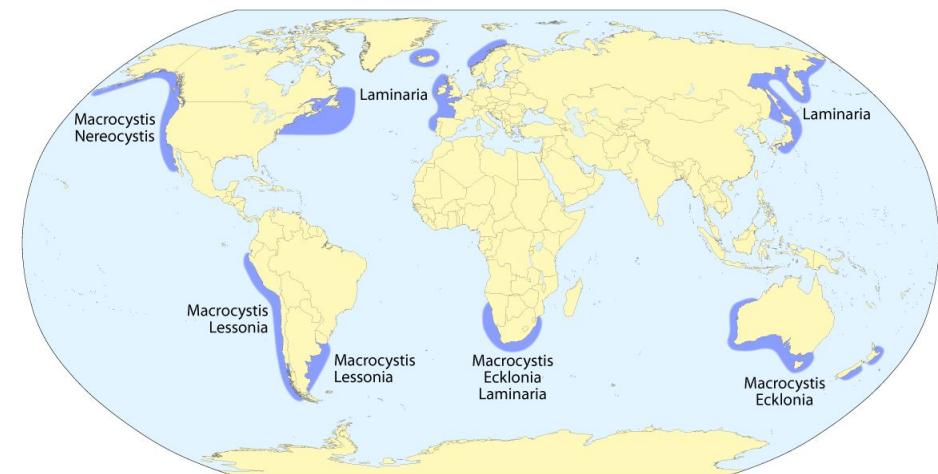
3. Espaço Geográfico e Espaço Ambiental

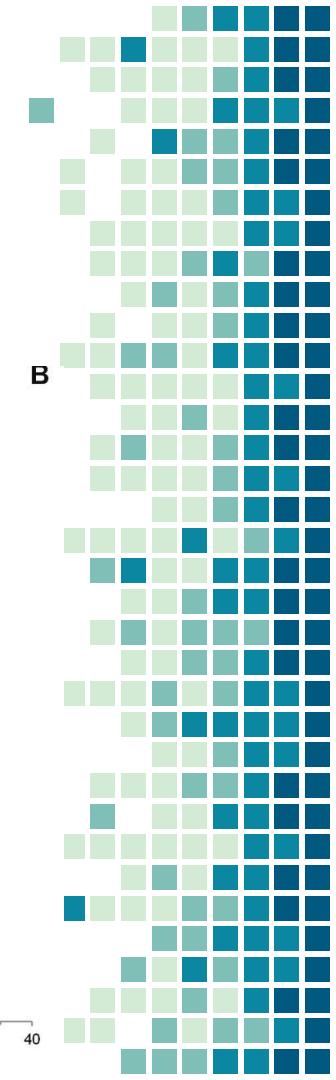
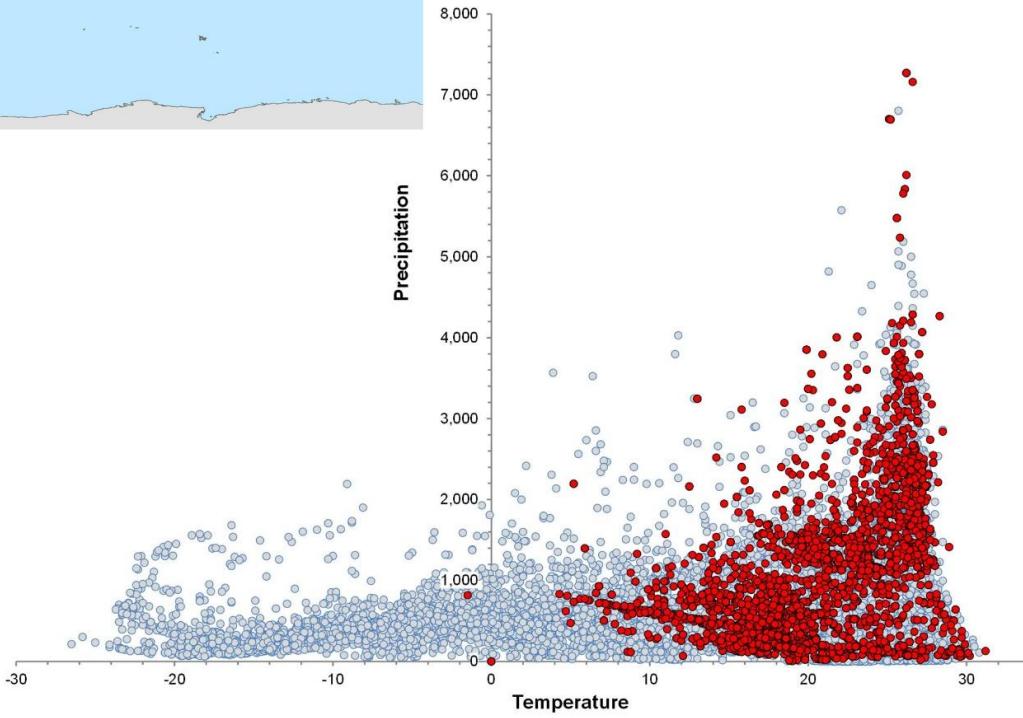
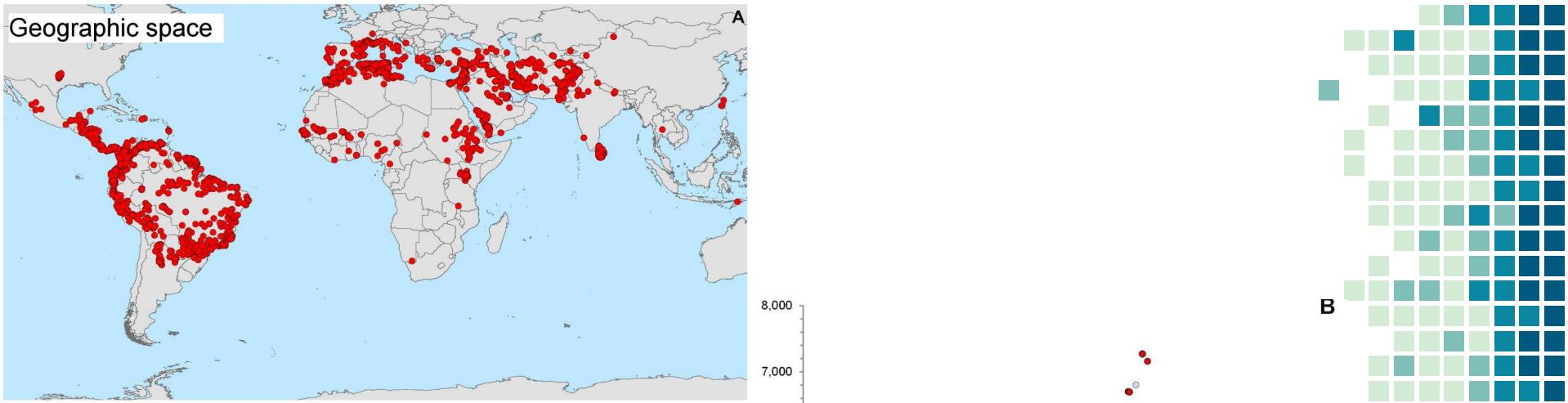


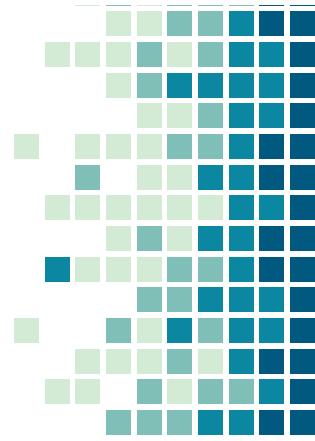
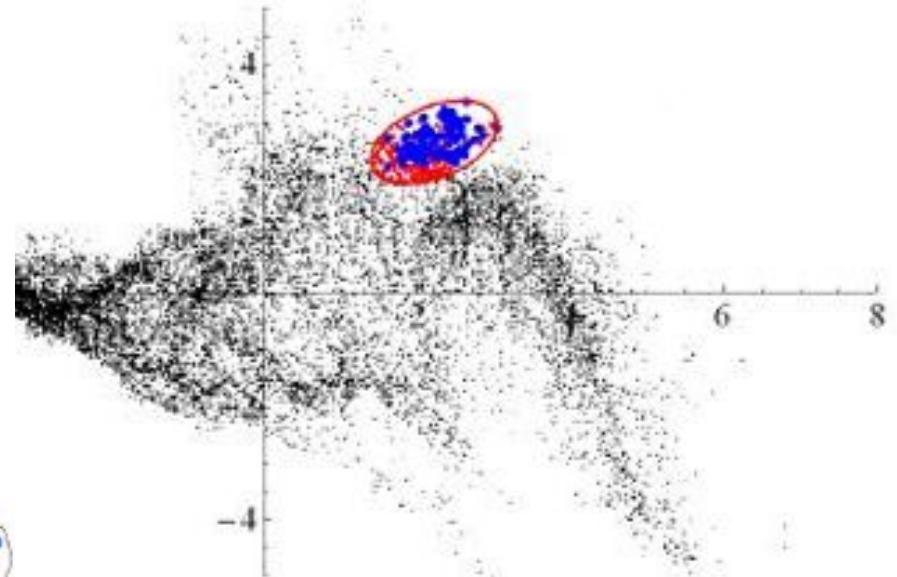
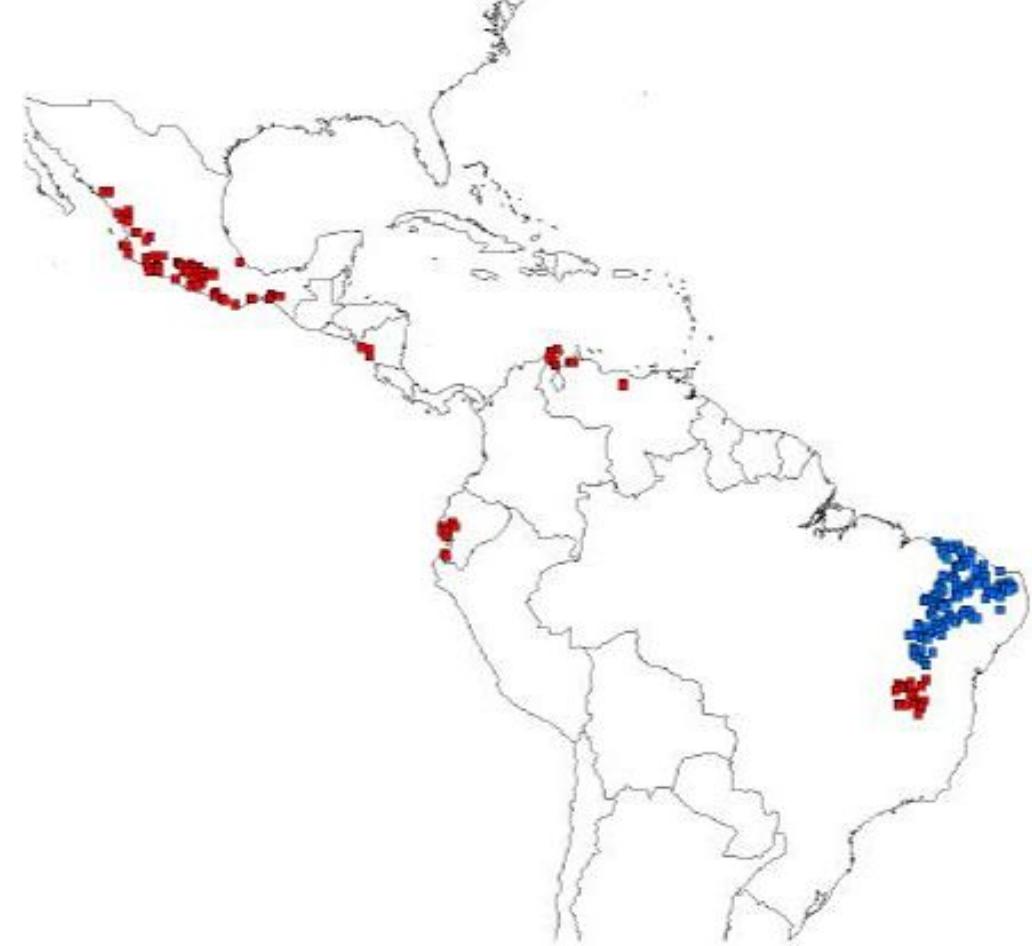


Distribuição no espaço geográfico

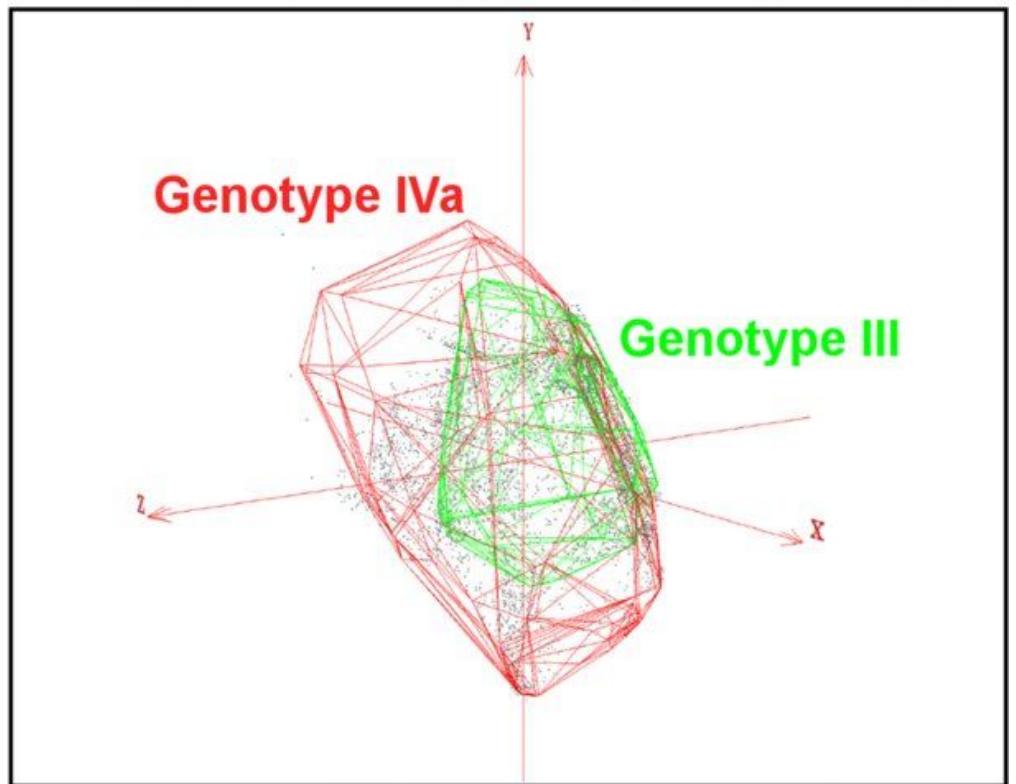
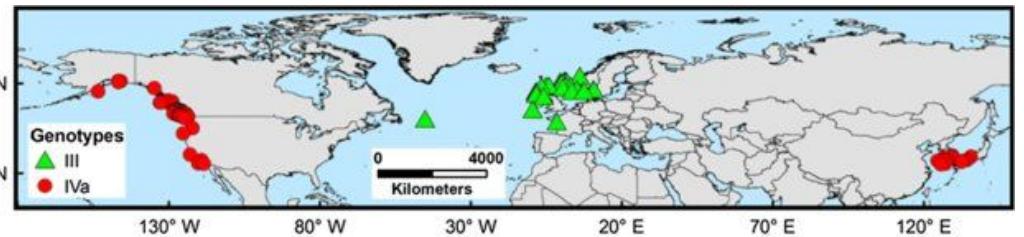
x Distribuição no espaço ambiental







Soberón, J., & Townsend Peterson, A. (2011). Ecological niche shifts and environmental space anisotropy: a cautionary note.
Revista Mexicana de Biodiversidad, 82(4), 1348-1355.



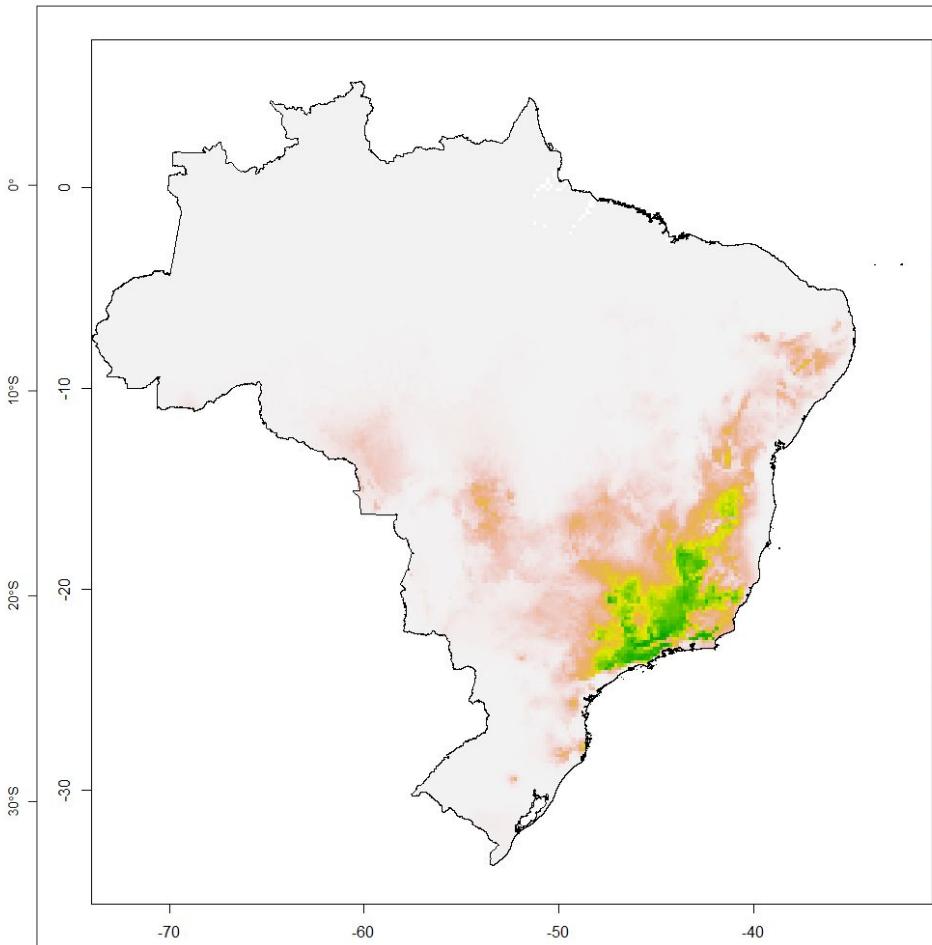
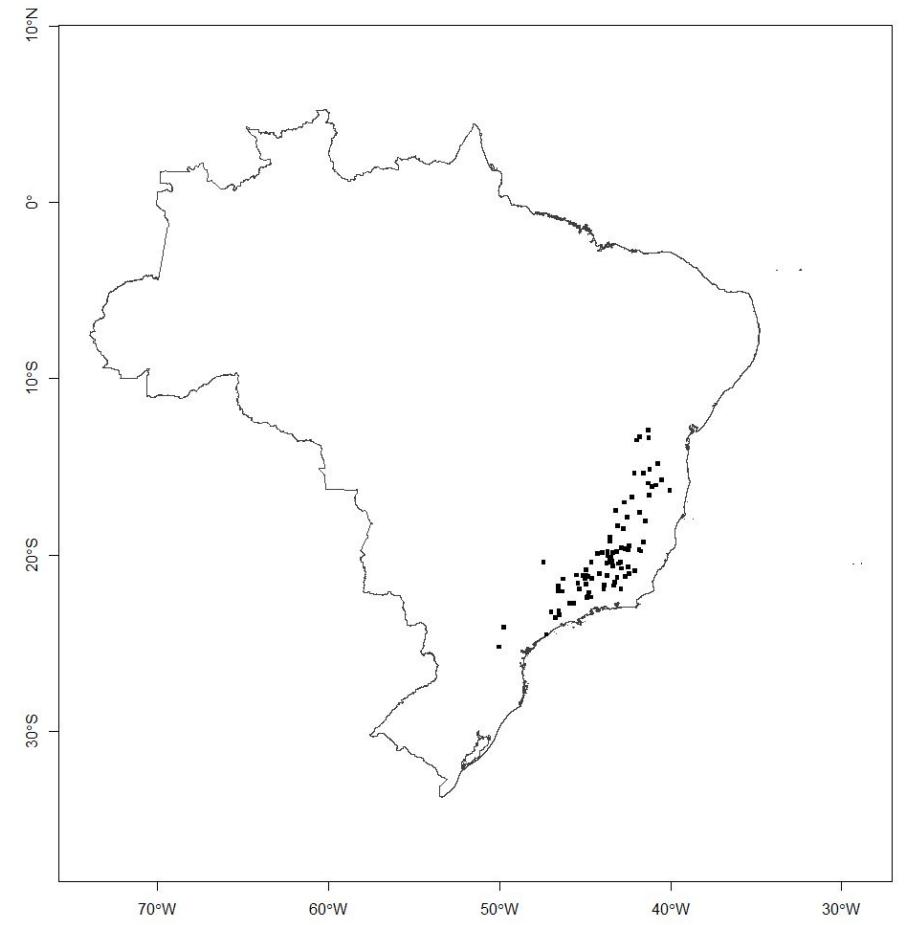
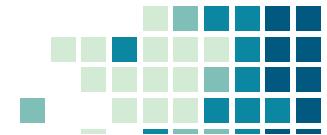
Escobar, L. E., Escobar-Dodero, J., & Phelps, N. B. (2018). Infectious disease in fish: global risk of viral hemorrhagic septicemia virus. *Reviews in Fish Biology and Fisheries*, 28(3), 637-655.

4.

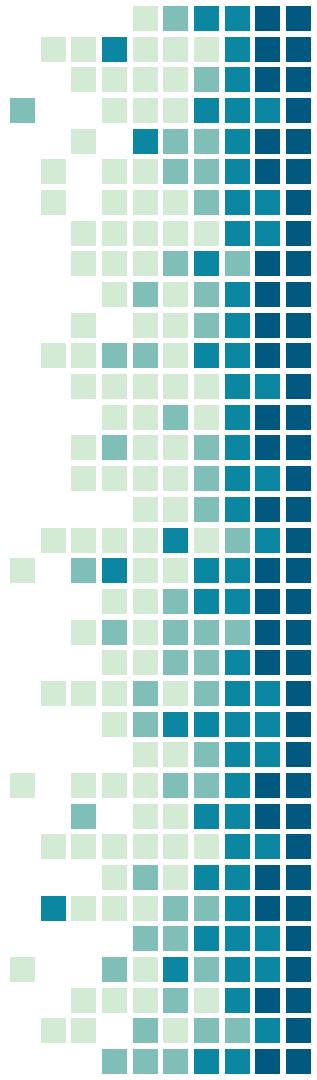
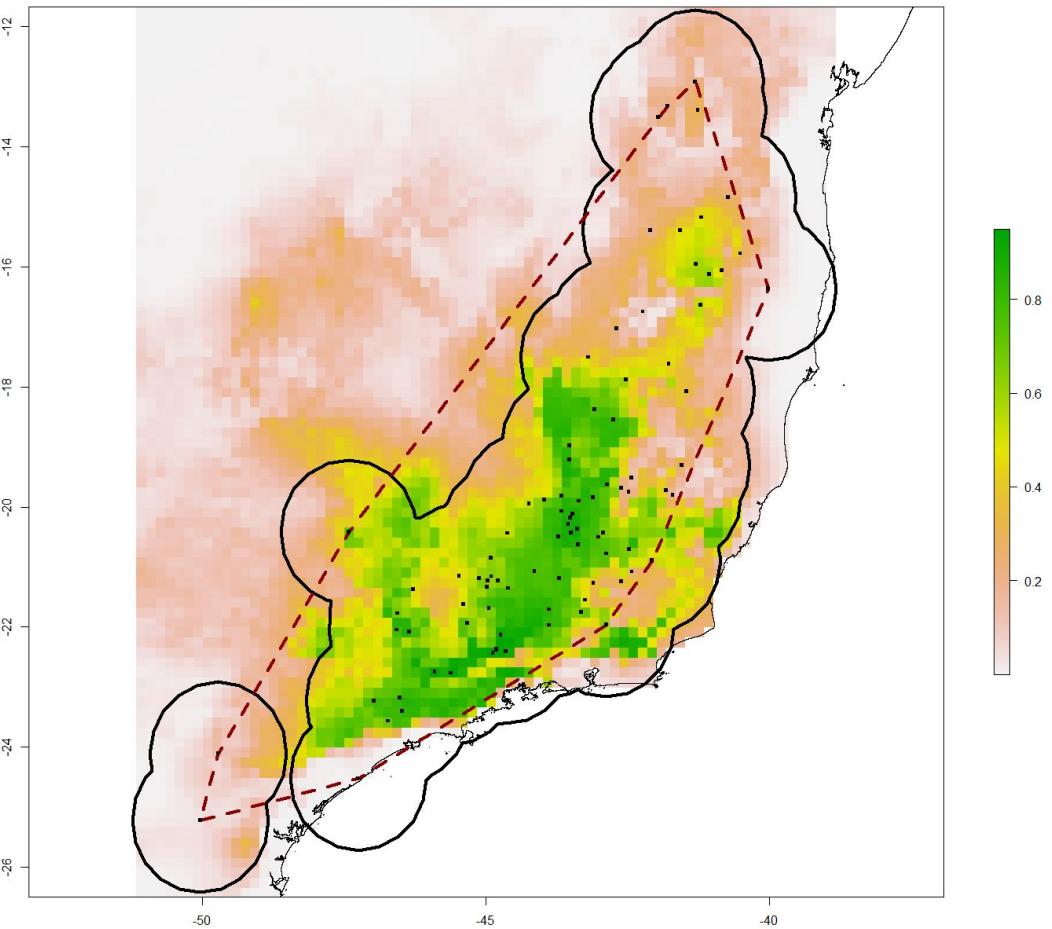
Distribuição potencial: abordagens



Distribuição de espécies



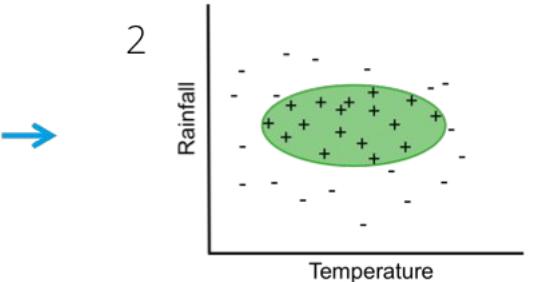
Distribuição de espécies



Environmental space models



Geographical space



Environmental space



Geographical space

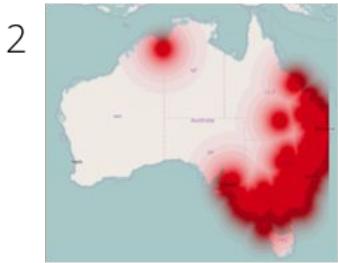


Geographical space models



Geographical space

No environmental variables



Geographical space

5. Mapa conceitual



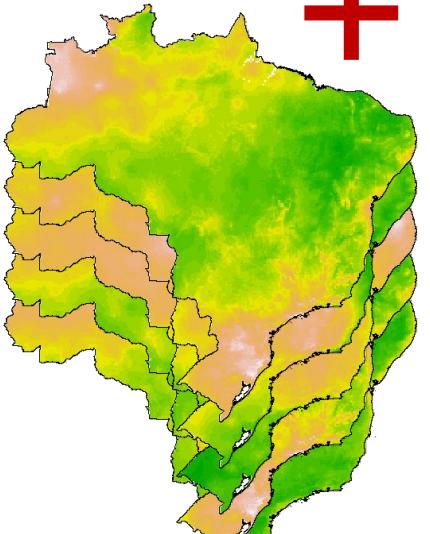
Modelagem

Registros de ocorrência



Dados de entrada

Variáveis preditoras



Precipitação

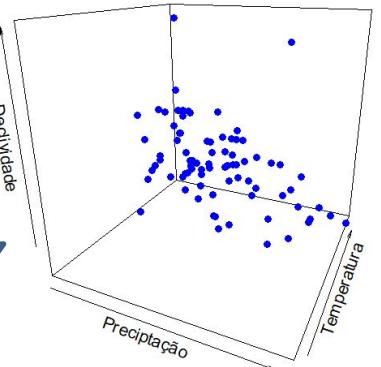
Temperatura

Topografia

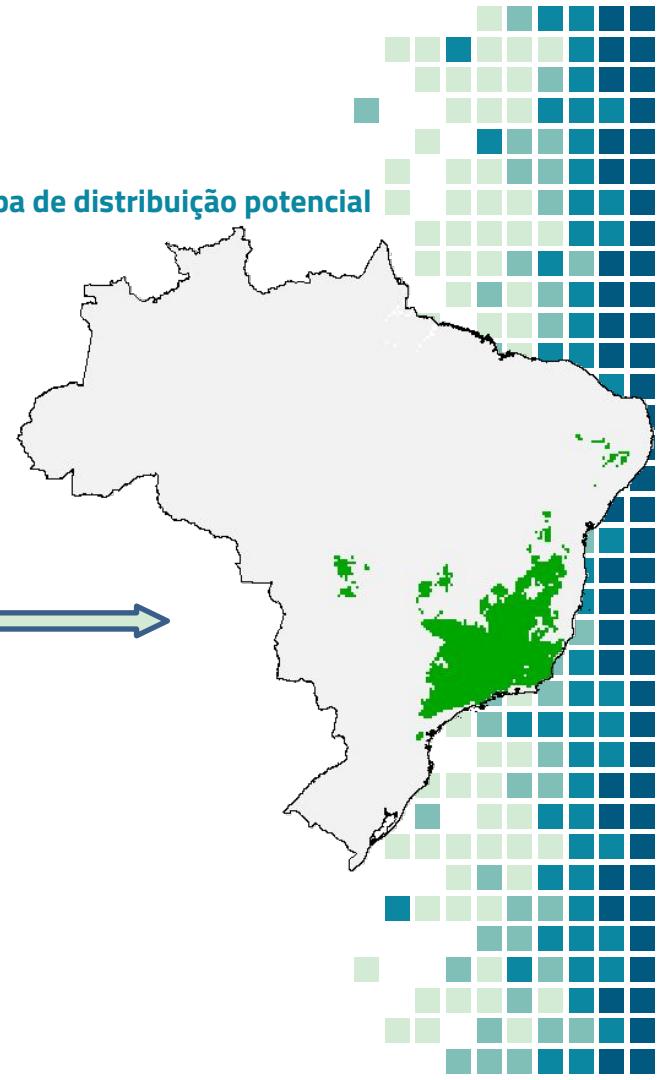
Variável X

Variável Y

Algoritmos de modelagem
(Bioclim, GLM, GAM, ANN, MAXEnt, etc.)

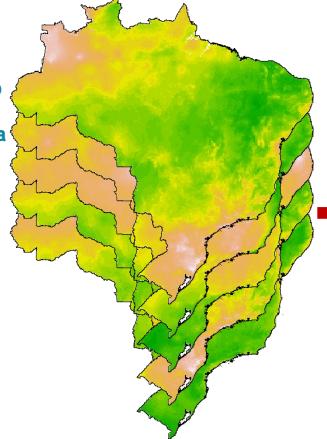


Mapa de distribuição potencial



Modelagem de nicho ecológico no espaço

Região Nativa



Precipitação

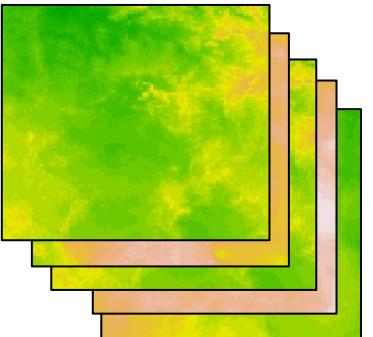
Temperatura

Topografia

Varivábel X

Varivábel Y

Região Alternativa



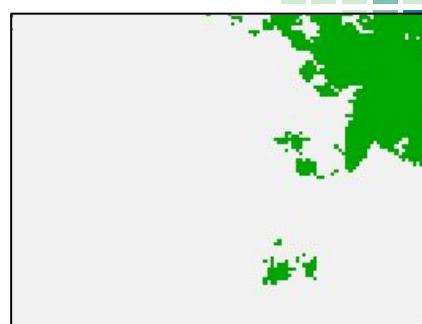
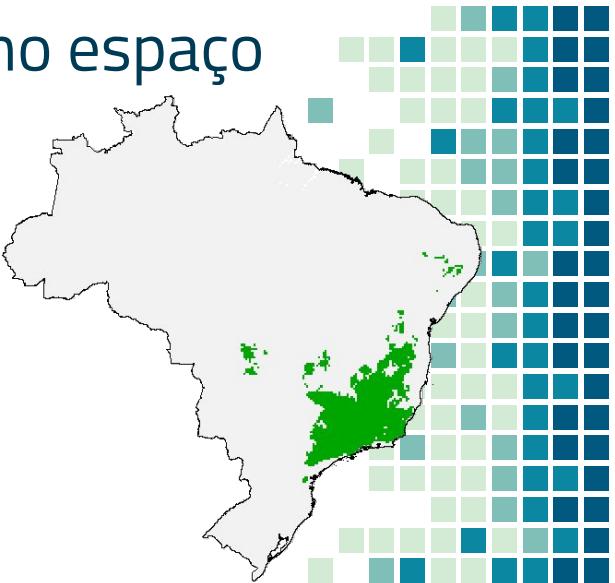
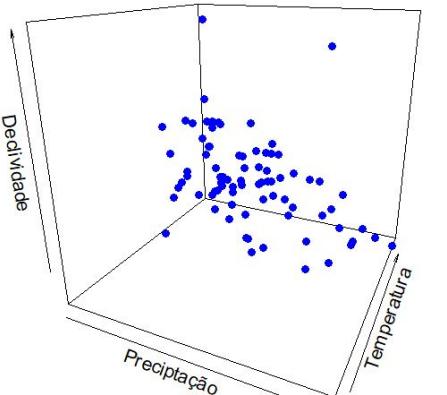
Precipitação

Temperatura

Topografia

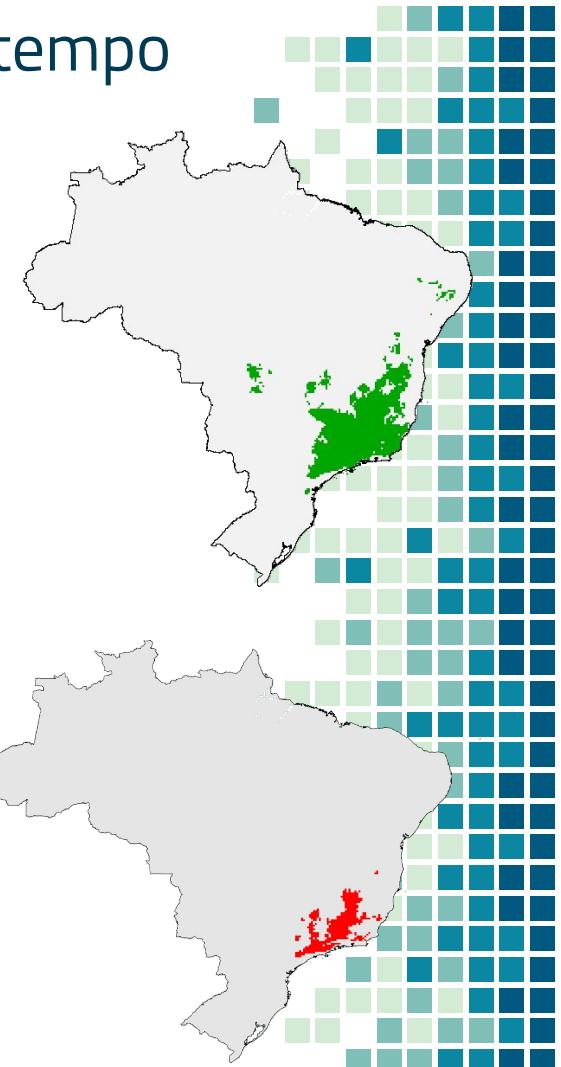
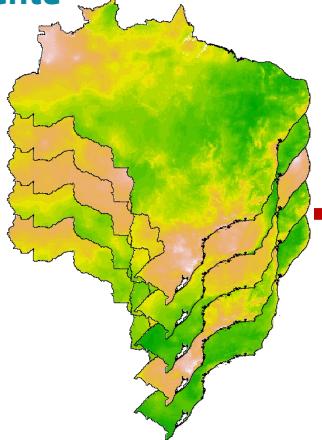
Varivável X

Varivável Y



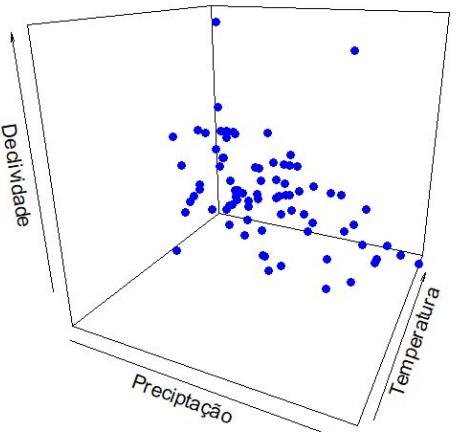
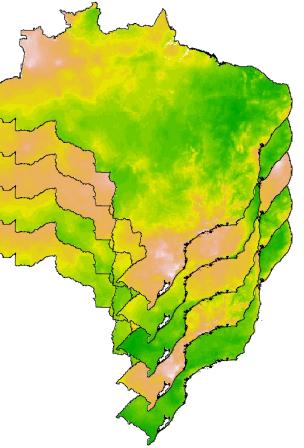
Modelagem de nicho ecológico no tempo

Presente



Cenário Climático alternativo
(e.g. Passado, Futuro)

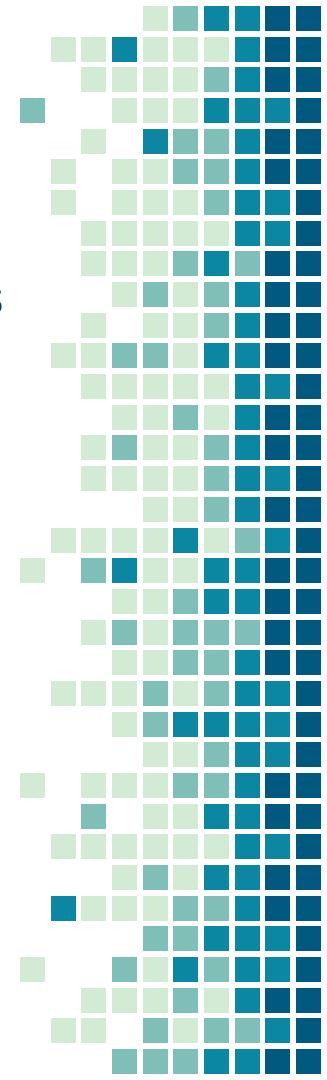
- Precipitação
- Temperatura
- Topografia
- Variável X
- Variável Y



6. Premissas



Premissas básicas da modelagem de nicho

- 
- 1) Equilíbrio: Uma relação de equilíbrio entre a espécie e as condições ambientais que ocupam. É dita que uma espécie está em equilíbrio com as características físicas do ambiente em que ocorrem quando a espécie ocupa todas as áreas **possíveis** de serem ocupadas.
 - 2) Suficiência amostral: A amostragem do espaço geográfico (registros de ocorrência da espécie) deve carregar uma boa amostra do espaço ambiental ocupado pela espécie.
 - 3) Conservação do nicho: a propensão das espécies em manter as características referente ao nicho que ocupa ao longo de uma escala de tempo evolutivo.

Garbage in Garbage OUT

