

# Introdução à modelagem de distribuição de espécies usando a linguagem R

Mastozóólogos Organizados em uma Conferência Online (MOCÓ)

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## Resumo

A ampla disponibilidade de dados sobre a biodiversidade e variáveis ambientais propiciam o uso de análises espaciais, dentre elas, os Modelos de Distribuição de Espécies (ou do inglês *Species Distribution Modeling* — SDM). Nessa oficina, oferecerei uma introdução teórica e prática à técnica de SDM utilizando a linguagem R. Primeiramente, apresentarei brevemente os principais conceitos da teoria de nicho ecológico (Grinnell, Elton e Hutchinson) e da teoria de SDMs (espaço geográfico (G), espaço ambiental (E) e diagrama Biótico-Abiótico-Movimentação (BAM)). Seguida à parte teórica, apresentarei as principais bases de dados (ocorrências e variáveis ambientais), tipos de algoritmos (BIOCLIM, Mahalanobis, Gower, GLM, GAM, Random Forest, SVM e MaxEnt), avaliação dos modelos (ROC, AUC e TSS), limites de corte (*thresholds*) e consenso de modelos (*ensemble*). A parte prática será focada na construção dos modelos através da linguagem R, onde abordarei: (1) introdução à linguagem R, (2) obtenção e seleção de dados de ocorrências e variáveis ambientais, (3) ajuste e predição dos modelos, (4) métricas de avaliação, (5) consenso dos modelos (*ensemble*) e (6) composição dos mapas.

## Carga horária

06 horas

## Repositório do GitHub

<https://github.com/mauriciovancine/workshop-r-sdm>

## Pré-requisitos

É desejável, mas não obrigatório, o conhecimento em linguagem R (tidyverse), geoprocessamento e conceitos de estatística básica e inferencial.

## Ministrante

Maurício Vancine é Bacharel em Ecologia, Mestre em Zoologia e Doutorando em Ecologia, Evolução e Biodiversidade pela UNESP de Rio Claro. Possui experiência em Ecologia Espacial, Ecologia da Paisagem, Modelos de Distribuição de Espécies e Ecologia de Anfíbios. Mais informações: <https://mauriciovancine.github.io/>.

## **Conteúdo**

### **1 Apresentação (10 min)**

1. Apresentações
2. Oficina
3. Material
4. Slides
5. Conferindo os computadores

### **2 Teoria de nicho ecológico e distribuição de espécies (90 min)**

1. Visão geral dos Modelos de Distribuição de Espécies
2. Nicho ecológico e distribuição de espécies
3. Outros tipos de modelos
4. Padronização para criação dos modelos
  - 4.1. Conceituação
  - 4.2. Preparação dos dados
  - 4.3. Ajuste dos modelos
  - 4.4. Avaliação dos modelos
  - 4.5. Predições no tempo e no espaço

### **3 Funcionamento da linguagem R (20 min)**

1. Linguagem R
2. RStudio
3. Console
4. Scripts
5. Operadores
6. Objetos
7. Funções
8. Pacotes
9. Ajuda
10. Diretório de trabalho
11. tidyverse (pipe - %>%)

### **4 Dados de entrada (ocorrências e variáveis) (60 min)**

1. Dados geoespaciais
2. Dados de ocorrências
3. Bases de dados de ocorrências
4. Download de dados de ocorrência
5. Limpeza de dados de ocorrência
6. Dados ambientais
7. Base de dados ambientais
8. Download de dados ambientais
9. Colinearidade de dados ambientais

### **5 Ajuste dos modelos (30 min)**

1. Tipos de métodos ou algoritmos

2. Somente-presença (BIOCLIM, DOMAIN e Mahalanobis)
3. Presença-(pseudo)ausência (GLM, GAM, Random Forest e SVM)
4. Presença-background (MaxEnt)
5. Outros métodos ou algoritmos

## 6 Avaliação dos modelos (30 min)

1. Partição dos dados (treino e teste)
2. Limiar de corte dos modelos
3. Matriz de confusão
4. Métricas de avaliação

## 7 Predição e consenso dos modelos (30 min)

1. Predição dos modelos
2. Consenso dos modelos
3. Consenso por frequência
4. Consenso por média
5. Consenso por média ponderada
6. Incertezas

## 8 Composição de mapas (20 min)

1. Composição de mapas
2. Mapas estáticos
3. Mapas interativos

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