University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Species Distribution Modeling in R

1 Credit

MEES ***
Semester?

Course Objectives / Overview

This seminar will introduce graduate students to species distribution modeling with R. Species distribution modeling (SDM), also known as climate envelope-modeling, habitat modeling, and ecological niche-modeling, is now widely used in ecology to estimate and map habitat suitability and species distributions. This course will cover all aspects of species distribution modeling, including data preparation, model fitting and evaluation, and projecting models to new place and/or times, with an emphasis on applications to conservation, biogeography, and global change. The primary goal of the course is to provide students with the skills necessary to use techniques of species distribution modeling in their own research.

Expected Learning Outcomes

1. Understanding of the drivers of species distributions, niche theory, and model assumptions
2. Ability to acquire and prepare species occurrence data for SDMs
3. Ability to acquire and prepare environmental data for SDMs
4. Ability to fit, interpret, and evaluate SDMs using different statistical algorithms
5. Understanding of ensemble modeling and model averaging
6. Projection and interpretation of SDMs across space and through time

Course Assessment / Grading

Students will be assessed through homework assignments and a final project.

INSTRUCTOR DETAILS:
Matt Fitzpatrick
mfitzpatrick@umces.edu
(301) 689-7131

CLASS MEETING DETAILS:
Dates:
Times:
Originating Site:
IVN bridge number:
(*******)
Phone call in number:
(***)
Room phone number:
(*****)

CURRICULUM FULLFILMENT:
MEES *** fulfills a *** (PD, ISG, etc) MEES requirement. OR elective etc

Prerequisites
Ecology
Basic R programming
Introductory Statistics

Teaching Assistant
N/A

Tentative Weekly Course Schedule

Week 1: Background
- von Humboldt – Essay on plant geography
- Gleason – Individualistic plant concept

Week 2: Niche theory
- Grinnell – Niche relations of the California thrasher
- Hutchinson – Concluding remarks

Week 3: Niche theory II
- Chase & Leibold – Ecological niche Ch. 1
- Hubbell – Unified theory of biodiversity Ch. 1

Week 4: Data: Environmental
- Hijmans – High resolution climate data

Week 5: Data: Occurrences
- Barbet-Massin – Choosing pseudo absence points
- Can GBIF data predict large scale patterns?

Week 6: Algorithms 1: Envelopes
- Guisan – Offering more than simple habitat models

Week 7: Algorithms 2: Regression
- Elith – How do they differ? WHY do they differ?
- Elith – Novel methods improve species distribution predictions

Week 8: Algorithms 3: Machine learning
- Elith – Statistical explanation of maxent for ecologists
- Brieman – Random forests

Week 9: Model evaluation
- Hirzel – Evaluating presence only distribution models
- Franklin – Mapping species distributions

Week 10: Projecting models in space and time
- Quantifying the niche through time

Week 11: Model Ensembles & averaging
- Araujo – Ensembling species distribution models
- Thuiller – biomod2 – ensemble modelling of species distribution models

Week 12: Practical uses
- Identification of unsampled populations using SDM

Week 13: Integrating genetics/intraspecific variation
- Yannic et al. – Past and future genetic diversity in Caribou
- Mapping local adaptation of Arabidopsis

Week 14: Other ways of predicting distributions
Vaclavik – Invasive species distribution modelling

Week 15: Other ways of predicting distributions: Community level models
Maguire et al – Controlled comparison of SDM and CLM
Ferrier et al – Spatial modeling at the community level

Required textbooks, reading and/or software or computer needs

TBD

Course Communication

Google Drive, email.

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved of various academic and research-related policies by which all students and faculty must abide.

Please visit http://www.umces.edu/consolidated-usm-and-umces-policies-and-procedures for a full list of campus-wide academic policies.

Course-Specific Policies and Expectations

[Separate from the campus-wide policies linked earlier, you may want to outline any additional course policies of which students need to be aware. Also include late work policy, etc.]