This is a video transcript of Module 1 of the Online Open Course in Species Distribution Modelling. To access the full suite of videos click here.

Online Open Course - Species Distribution Modelling

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Module 1 Introduction in Species Distribution Modelling

Welcome to the first module of this online open course about species distribution modelling. In this module, we will give you an introduction to what species distribution modelling is and the steps involved in calibrating and mapping these models.

Let's start with first asking why it is important to understand where species occur. There are many different answers to this question. For a start, it is fundamental to our understanding of the biology and the natural history of a species. But there are also many different applications of species distribution models: they can help to identify areas that should be prioritized for conservation, for example for endangered species that are vulnerable to extinction. They can be of value in evaluating the potential of an invasive species to settle in particular areas. They can also help determine potential routes of infections and diseases, which makes them important for public health and safety as well. Another application is to combine them with future projections of changes of the natural environment. This means they can be used to predict how biodiversity will be affected by impacts such as climate change or changes in land use. So there are many important reasons for why we want to know where particular species can occur, but how do we predict species distributions?

Developing a species distribution model begins with observations of species occurrences: these are places where we know a species has been found. These occurrences are mostly point-based and come from sources such as museum records and observations of experts in the field. However, if you look up a distribution map of a species, it often shows a range rather than dots on a map. So, how do we go from specific places where individuals of a species have been observed to producing a map that gives an estimate of the distribution of that species? This is where species distribution models come into play.

There are two approaches that you can take in estimating species distributions. You can either use a mechanistic model, which specifically incorporates known species' tolerances to environmental conditions, such as the maximum temperature in which a species can survive. This requires detailed data on the physiological response of species to environmental factors, but this data is often not available. The second approach is the correlative approach, which is mostly used in species distribution models, and is also the focus of this course. This approach is used when we don't have the detailed information about species' tolerances to particular environmental variables. The correlative approach is based on the assumption that the current distribution of a species is a good indicator of its ecological requirements.

To calibrate a correlative species distribution model we need two types of input data: species occurrences, and measurements of a suite of environmental variables, such as temperature and rainfall. These two types of data are then put into an algorithm to find associations between the known occurrences of a species and the environmental conditions at those sites, so we can identify the environmental conditions that are suitable for a species to survive. In other words, they describe relationships between species distributions and environmental variables. So we know something about where species occur and something about the environmental conditions of those places. The next thing we need to understand is how the algorithm uses this data. The algorithm uses these two types of information to estimate the probability of a species occurring in a place as some function of the environmental conditions of that place.

Once we built the model, we can then project the predicted species distribution geographically on a map. For every point in the landscape, the model estimates the probability of a species occurring there. This can either be displayed as a binary outcome, that means as a presence/absence map, or as a probability on a scale from 0 to 1, with for example darker coloured areas representing a higher likelihood that a species can occur in that place. It is important to note that these maps do not show actual occurrences of a species, but highlight areas that have similar environmental conditions to areas where we have already found the species, and thus it is an estimation of where a species can occur. This does not necessarily mean that a species actually exists in the area.

So this was a short introduction into species distribution modelling. In other modules of this course, we will have a look at each of these components of a species distribution model. Module 2 will explain the ecological theory behind these models. Then, module 3 will cover how to get and interpret the input data. Module 4 will give an overview of the different models that are available and how to choose which model best suits your data and the question that you are trying to answer. We explain the different methods that you can use to build species distribution models in more detail in three different modules: presence only models in module 5, statistical regression models in module 6, and machine learning models in module 7. How to evaluate the outcome of a model is dealt with in module 8. We will focus on one implementation in particular in module 9: the effects of climate change on species distributions. In the last module of this course we introduce the BCCVL, the Biodiversity and Climate Change Virtual Laboratory. This is a tool that lets you run species distribution models including climate change projections in a few easy steps. In that last module, we will illustrate how to use the BCCVL with a few case studies.

Thank you for watching module 1, I hope to see you soon in module 2.

Attribution

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