Lecture 6: Unified Ecology

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> **i** BCB743
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> **This material must be reviewed by BCB743 students in Week 1 of Quantitative Ecology.**

> **i** BDC334 Lecture Transcript
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> **Please see the BDC334 Lecture Transcript for the main content of all lectures.**

> This Lecture Is Accompanied by the Following Lab
>
> - Lab 4. Species Distribution Patterns

> Reading Required for This Lab
>
> - Matthews and Whittaker (2015)
> - Shade et al. (2018)

This lecture is incomplete – other sections in this lecture series has the material you want; for example, see Lab 4.

Univariate diversity measures such as Simpson and Shannon diversity have already been prepared from species tables, and we have also calculated measures of β-diversity that looked at pairwise comparisons and offered insight into community structure across a landscape and hinted at the processes that might have resulted in these structures. These ways of expressing biodiversity only gets us so far in understanding the structure of communities.

A much deeper insight into the processes responsible for community formation can be obtained by looking at how the species patterns are distributed across sites. This is the focus of this lecture.

Let's shine the spotlight to additional views on ecological structures and the ecological processes that structure the communities—sometimes we will see reference to 'community or species formation processes' to offer mechanistic views on how species come to be arranged into communities (the aforementioned turnover and nestedness-resultant β-diversity are examples of other formation processes). Let's develop views that are based on all the information contained in the species tables, i.e. abundance, the number of sites, and the diversity of the biota. This deeper view is not necessarily captured if we limit our toolkit to the various univariate and pairwise descriptors of biodiversity.

You will already be familiar with the paper by Shade et al. (2018). Several kinds of ecological patterns are mentioned in the paper, and they can be derived from a species table with abundance data (but *not* presence-absence data!). The patterns that can be derived from such a table include (see Figure 1 below), and they are as follows:

- Species-abundance distribution
- Occupancy-abundance curves
- Species-area curves
- Rarefaction curves
- Distance-decay curves
- Elevation gradients

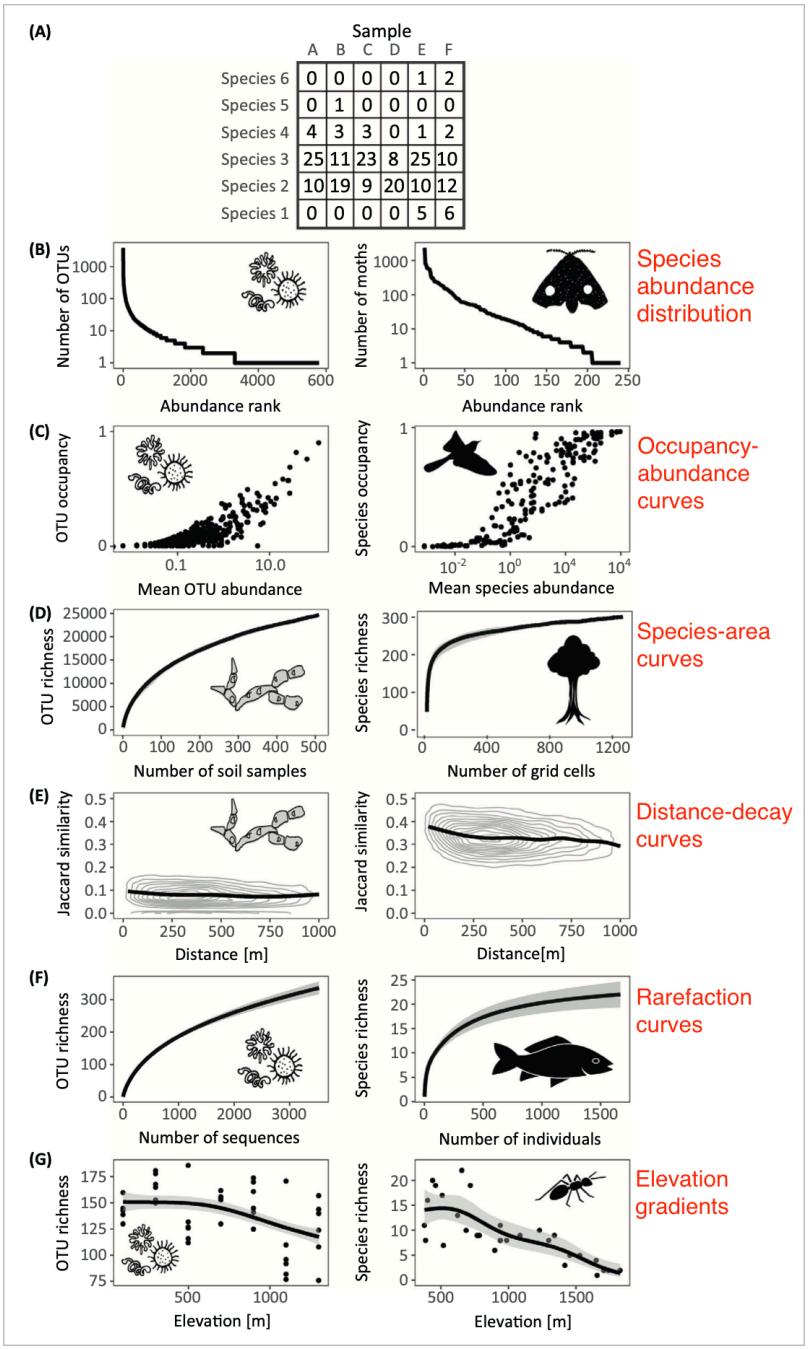

Figure 1: Species distribution curves by Shade et al. (2018). Note that this figure starts with a species table where the species are arranged down the rows and the sites along the variables (columns). I, and also the **vegan** package, require that the **species are down the columns (called variables) and the sites (or samples) are along the rows**. This is the convention that will be used throughout this module.

Bibliography

Shade A, Dunn RR, Blowes SA, Keil P, Bohannan BJ, Herrmann M, Küsel K, Lennon JT, Sanders NJ, Storch D, others (2018) Macroecology to unite all life, large and small. Trends in ecology & evolution 33:731–744.