Which ecological analysis method should I use?

All of the methods mentioned here are described in detail in the “Vocabulary and Concepts” Google doc.

Q: How diverse are my samples?

Alpha diversity metrics measure the diversity of a single sample (or a group of samples). Be aware that different metrics weight rare and common species differently, and therefore have different interpretations. Be aware that many diversity metrics are presented on a logarithmic scale.

Q: How can I compare diversity between samples?

Linear models like t-tests or ANOVAs can be used to compare diversity metrics and look for statistically significant differences.

Q: How do my samples relate to one another?

Distance metrics based on species abundances can tell you how closely two samples are related to one another. Again, these metrics take different things into account, and can have different interpretations or results.

Q: How can I visualize distances between samples?

Clustering and **unconstrained ordination** methods are two common ways of visualizing the relationships among samples based on distance metrics.

Q: Which OTUs/ASVs are differentially abundant between samples or groups?

Differential abundance methods such as ALDEx2 or ANOCOM.

Q: Which OTUs/ASVs are co-occurring?

Proportionality measures can be calculated between all pairs of ASVs or OTUs. Typical correlation methods (e.g. Pearson) are NOT compatible with compositional data, and cannot be used for this task.

Q: How do my environmental variables relate to the abundance of individual OTUs/ASVs?

Regression techniques can be employed to answer this question, including **logistic, linear,** and **multiple linear regression**. In this case, common correlation metrics such as Pearson correlation may be used.

Q: Are my environmental variables influencing the community structure?

There are many statistical ways to answer this question, depending on your needs. **Constrained ordination**, **perMANOVA**, and **Mantel tests** are common methods. It should be mentioned that Mantel tests are cautioned against unless both the explanatory and response variables (environmental variables and community abundances, respectively) can be reasonably expressed as distances.