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Fundamentals of Ecology
Fall 2018

Community ecology - selected topics

topic 1: trophic cascades. And who better than Jim Estes on this subject?

Estes, James A., Charles H. Peterson, and Robert S. Steneck. 2010. Some effects of apex predators in higher-latitude coastal oceans. pp 37-53 in John Terborgh and James A. Estes, editors. Trophic cascades: predators, prey, and the changing dynamics of nature. Island Press, Washington DC.

topic 2: networks. Shalene Jha works on pollinator networks, as well as on other bee- and pollination-related subjects.

Grass, Ingo, Birgit Jauker, Ingolf Steffan-Dewenter, Teja Tschardt and Frank Jauker. 2018. Past and potential future effects of habitat fragmentation on structure and stability of plant-pollinator and host-parasitoid networks. Nature Ecology and Evolution 2:1408–1417.

definitions

modularity - “Networks composed of distinct, densely connected subsystems are called *modular*. In ecology, it has been posited that a modular organization of species interactions would benefit the dynamical stability of communities, even though evidence supporting this hypothesis is mixed.....ecological interaction networks --where species are the nodes and the edges connecting the species stand for interactions (for example, consumption, pollination and competition) --we therefore expect to find that species can be partitioned into distinct ‘groups’, such that the frequency of interaction largely depends on group-membership. Networks with this property are said to be ‘block-structured’: a *modular structure* is a particular block structure, in which a network is divided into subsystems, and within-subsystem interactions are much more frequent than those between subsystems”(Grilli, Jacopo, Tim Rogers, and Stefano Allesina. 2016. Modularity and stability in ecological communities. Nature Communications 7:12031).

nestedness - “A system (usually represented as a matrix) is said to be *nested* when the elements that have a few items in them (locations with few species, species with few interactions) have a subset of the items of elements with more items.... Imagine a series of islands that are ordered by their distance from the mainland. If the mainland has all species, the first island has a subset of mainland's species, the second island has a subset of the first island's species, and so forth, then this system is perfectly nested” (Wikipedia).

topic 3: trait groups and community assembly. Plant ecologists study the assembly and dynamics of plant communities using plant traits that are thought to be particularly relevant. Here is a choice of three papers.

3a. A short introduction to plant traits relevant to community and ecosystem ecology.

Westoby, Mark, and Ian J. Wright. 2006. Land-plant ecology on the basis of functional traits. *Trends in Ecology and Evolution* 21(5):261-268.

3b. A perhaps more difficult, much-cited paper that tries to bring together and reconcile, in the context of relevant plant traits, a set of quite different ways of looking at plant communities.

Lavorel, S. and E. Garnier. 2002. Predicting changes in community composition and ecosystem functioning from plant traits: revisiting the Holy Grail. *Functional Ecology* 16:545-556.

3c. An example of a way in which Caroline Farior has used plant traits to model forest dynamics.

Weng, Ensheng, Caroline E. Farior, Ray Dybzinski, and Stephen W. Pacala. 2017. Predicting vegetation type through physiological and environmental interactions with leaf traits: evergreen and deciduous forests in an earth system modeling framework. *Global Change Biology* 23(6):2482-2498.

definitions

LMA - leaf dry mass /leaf area. High LMA leaves tend to be thick and sclerophyllous (leathery or stiff)

SLA - specific leaf area. leaf area/dry mass.

RGR - relative growth rate. change in size (g)/initial size (g)/unit time
OR $[\log_e(\text{final size}) - \log_e(\text{initial size})]/\text{unit time}$

NPP - net primary productivity. rate at which plants fix carbon via photosynthesis - rate at which they “burn” it in their own growth and metabolism = gross primary productivity (GPP) - plant respiration. always measured per unit time (typically 1 yr). unless referring to the whole planet, measured per unit area (typically ha or km²).

topic 4. useful background information and orientation to field sites. Finally, besides these conceptual topics, I would like to give you some pointers towards going into a field site and getting a sense of its dynamics and other important factors that can affect your research. I hope to talk about this during the first hour. Since the usual ecology textbooks and even review articles often seem to have little to do with what you will probably see in the field (especially in central Texas), I am providing a handout of my own about natural communities.