

ECOLOGY, LECTURE 6: BIOGEOGRAPHY & MACROECOLOGY (1214–1221)

The **trophic structure** of a community is usually a function of both **bottom-up** and **top-down** causal forces. Bottom-up forces may start with changes in the abiotic environment that first affect the autotrophs and then propagate up the chain. Top-down forces (including **trophic cascades**) are important in systems where the predators exert a strong influence on the distribution and abundance of their prey items, which in turn have a strong influence on their prey, down to the autotrophs. Note that in top-down systems, an *increase* in secondary consumer biomass can lead to a *decrease* in primary consumer biomass and an *increase* in plant biomass. Can you see why?

Dominant species are those that are numerically abundant or that have a disproportionately high biomass. **Keystone species** are those that exert a profound influence on community structure, often in spite of their lack of numerical dominance. Keystone species are usually associated with communities in which top-down forces are important (e.g., *Pisaster* starfish in intertidal communities and *Enhydra* sea otters in kelp forests). **Foundation species** include **facilitators** and **ecosystem engineers** (according to the terminology of your text). You should be able to recount examples of each of these types. Keystone species, facilitators, and ecosystem engineers can all have profound influences on community structure and species diversity.

All communities experience **disturbance**, and the intensity and frequency of disturbances are known to impact community structure. **Succession** refers to the non-seasonal, directional and continuous pattern of colonization and extinction on a site by species populations. Successional processes are traditionally studied at the landscape scale, but note that the pattern of community change on (and in) the corpse of a fallen tree is also a type of succession. The pattern of community change on (and in) a dead human body is also a type of succession, and indeed, the turnover of species populations in a corpse can help identify the time of death of the body and may be important in forensic science.

Please know the difference between **primary** and **secondary succession**. Note that the three mechanisms of **facilitation**, **inhibition**, and **tolerance** are not mutually exclusive in the successional process, and they may occur simultaneously in a species rich system. According to the **intermediate disturbance hypothesis**, moderate levels of disturbance create the conditions for the highest levels of community diversity. There is abundant evidence in support of this hypothesis from a wide range of systems. Please consider the role of fire on the California landscape.

Most organismal groups are more diverse in the tropics (at low latitudes) than at high latitudes. In investigating the causes of **high tropical diversity**, we can distinguish the forces that led to the *origin* of this species diversity from the forces that *maintain* this diversity. We looked at several facets of this problem. Evolutionary history and climate are probably the most important factors. During glacial episodes, the landscape was not scoured clean in the tropics as it was at high latitudes, and evolution (and speciation) proceeded apace in tropical environments. The growing season is longer in the tropics, and climatic fluctuations across the seasons are generally less dramatic, creating a longer period of time in which evolutionary processes may act. The tropics are warm and wet and **evapotranspiration rate** correlates well with species richness in many clades. Tropical forests exhibit high structural heterogeneity, and the fall of emergent trees produces high diversity in forest gaps.

Finally, we reviewed the basic ideas and evidence behind **species-area curves** and **island biogeography theory**. Studies on these subjects are important in their own right, but they are also important in the role that they have played in generating new hypotheses and research.