

### **Habitat as a universal explanation for species distribution and abundance**

In the broadest sense, Ecology can be defined in two main ways, as the study of the distribution and abundance of species, or as the study of the interactions between an organism and its environment. Thus, ecologists develop theory and test hypotheses to explain the why, where, and how of a species' existence over some broad area or at specific locales. Historically, such explanations have focused on a species' interactions with other species (prey, predator, and competitor) and its physiological adaptations to environmental abiotic conditions. That is, the distribution and abundance of a given species might be limited by other species or by climate or by both. Habitat as a limiting factor and a determinant of distribution and abundance has not received as much attention. This may be because ecologists see this as a truism – of course, species need habitat and can only exist where there is appropriate habitat. Granted, habitat as an ecological entity has been intensively studied, particularly with regard to ecologists of various types trying to work out the habitat requirements of all sorts of species. In addition, habitat selection is a widely studied ecological, evolutionary, and behavioral process. However, no one previously has attempted to develop any type of conceptual/analytical model that would focus on habitat as the *primary* determinant of species distribution and abundance. In this presentation, I begin with a brief historical review of the study of habitat. I then present a conceptual model that describes the sequential process of dispersal, settlement, and establishment (DSE) of an individual organism at a given location. Analytically the DSE process can be cast as a series of probabilities. A key component of the model is that a dispersing organism recognizes the physical structure of habitat as a cue for settlement. Thus, when the model is extended to the population and species levels it predicts that a species distribution and abundance should primarily be determined by habitat rather than by other environmental factors. To better illustrate the model, I discuss the DSE process in coral reef fish and kangaroo rats. These examples also serve to indicate the universality of habitat as a predictor of distribution and abundance.