The Department of Ecology and Evolutionary Biology Spring 2018 Seminar Series

Mid-latitude community reorganization across NEON with climate change

Current estimates from species distribution models (SDMs) anticipate community responses to climate change that range from 0 to 50% species loss. SDMs omit the joint relationships between species and the different scales at which different species are measured. Problems are compounded by the typical situation where most species are absent from most sample locations (hyper-zero-inflation). For example, the National Ecological Observation Network samples multiple species groups by a range of different methods, each with its own scale and degree of sample effort. Beyond these data considerations, the predictions from SDMs are not testable, because they refer not to current climate and its (known) current rate of change, but rather to benchmark scenarios, each of which is unlikely. New benchmarks will not be achieved or remain stable for the decades to centuries required for processes like migration and competition. For these reasons, they are not testable.

We develop a generative model of community response to climate change, generalized joint attribute modeling (GJAM), that accurately predicts the presence-absence and abundance of each species jointly as well as their organization in communities. It fingerprints the environment and location of sampled communities, refining our capacity to predict new distributions and entire communities with climate change. Sensitivity analysis provides extinction risk on climate scale (per degree C temperature change) and on a time scale—velocity (per year).

Application to the new National Ecological Observatory Network accurately predicts taxonomically diverse communities in the United States that include ground beetles, vascular plants, and small mammals. By inverse prediction, it predicts the environment and the geographic location of a sample given the community, providing an important validation of the approach. Sensitivity analysis under +2°C climate change shows community reorganization, especially large in the southern US, with greatest uncertainty in the northern US. The velocity of risk contrasts with sensitivity, being high in northern regions, despite lower sensitivity. Results have immediate application—they can be applied to change happening now and tested as data accumulate in NEON.

Join us in welcoming Dr. Jim Clark

Duke University

Friday, January 26, 2018
SERF 307 - 3:30 PM
Pre-talk Reception 3:00 PM in Dabney 575