California State University, Fresno
Department of Biology presents

Space-time models for ecological applications


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The idea that observations physically close together may be more similar while observations far apart may be more different is the idea behind Spatial Statistics, a branch of Statistics that deals with spatial data (those data with observed location coordinates such as longitude/latitude). The analysis of spatial data has become increasingly important in many fields, such as the environmental, ecological, and biological sciences, public health and medicine, social sciences, business, and sports. In ecology, where research questions typically include ``Where?" and ``When?" in addition to ``How many?", incorporating spatial and temporal information into a statistical model is particularly important. In this talk, we present two studies of ecological data and the space-time models used to fit them. In the first study, the epidemic-type aftershock sequence (ETAS) model, a class of branching models often used in seismology, is modified to describe the spread of alien red bananas found in a rainforest in Costa Rica. We then characterize the rate of spread using our modified space-time ETAS model. The second study is on the space-time distribution of marine birds in the Atlantic Ocean. Due to both zero-inflation and extreme over-dispersion exhibited in the count data, typical zero-inflated models are ineffective unless censoring is used to avoid the extremely large counts. Instead, we develop the double-hurdle model that includes a Generalized Pareto component specifically tailored to fit the extreme counts, which is especially important for assessing potential risks of offshore activities to sea ducks and other highly aggregative species. We demonstrate our model by creating predictive maps that show areas of high probability of aggregation and persistence for several species of marine bird.

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