

Wildfires in South Africa; Cherry Trees in Japan

Alan E. Gelfand, Department of Statistical Science, Duke University

Abstract

We consider two challenging ecological problems and show how they are naturally investigated using spatial survival models with time varying covariates.

The first problem involves explanation of the occurrence of wild fires. This process is of interest because over half of the world's terrestrial ecosystems depend on fire to maintain ecological structure and function and the ecological role of fire regimes can be strongly influenced by weather and climate. To undertake this analysis, we developed an extensive database of observed fires with high-resolution meteorological data to explore fire regimes in the Mediterranean ecosystem in the Cape Floristic Region (CFR) of South Africa during the period 1980-2000. We need to consider the influence of seasonally (quarterly) anomalous weather on fire probability. In addition to these local-scale influences, the Antarctic Ocean Oscillation (AAO) is a potentially important large scale influence with regard to global circulation patterns.

The second involves explaining first flowering times. The objective here is to learn about changes in the length and onset of the growing season. This process has to be examined at individual tree/plant level and in response to weather, in particular daily temperature, rather than aggregating to climate. We are broadly interested in comparison of first flowering time (or bud burst) across species but here we focus on explaining spatial variation in first flowering time. We consider first flowering dates for trees of a single species in Japan at 45 locations over 52 years, collected through 2009. The challenge with this process is to provide suitable functions of the weather - heating and chilling functions - to employ in the explanation. The difficulty is that these functions are not explicitly defined since they require measurement beginning from unknown starting dates as well as unknown thresholds. We have uncertainty in the specification of the functional covariates.

We present both analyses and our findings along with some future challenges.