

Hidden Markov models for environmental seasonality

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Abstract

Motivated by studies of wildfire seasonality, a nonhomogeneous hidden Markov random field is proposed for modelling the spatial distribution of georeferenced events during the year, by representing occurrence times as circular data. The model allows us to segment occurrences according to a finite number of latent classes that represent the conditional distributions of the data under specific periods of the year, simultaneously accounting for unobserved heterogeneity and spatial autocorrelation.

It is also capable to parsimoniously accommodate specific features of environmental data such as multimodality, skewness, and kurtosis. Parameter estimation is based on composite likelihood methods, by exploiting a computationally efficient expectation–maximization algorithm that iteratively alternates the maximization of a weighted composite likelihood function with weights updating. The proposal is illustrated in a study of wildfire occurrences in the Iberian Peninsula during a decade.