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Studying global alien species invasions between 1880 and 2005 with relational event models

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Spatio-temporal interactive processes, such as alien species invasions, play a key role in ecology. Existing methods studying such processes often simplify the dynamic structure or the complex interactions of the ecological drivers. In this talk, we show how to use relational event modelling (REM) for analyzing patterns of ecological interaction processes at large spatial scales including time-varying variables that drive these dynamics. REM relies on temporal interaction dynamics, that encode sequences of relational events connecting a sender node to a recipient node at a specific point in time. We apply REM to the spread of alien species around the globe between 1880 and 2005, following accidental or deliberate introductions into geographical regions outside of their native range. In this context, a relational event represents the new occurrence of an alien species given its former distribution. The application of relational event models to the first reported invasions of 4835 established alien species outside of their native ranges from four major taxonomic groups enables us to unravel the main drivers of the dynamics of the spread of invasive alien species. Combining the alien species first records data with other spatiotemporal information enables us to discover which factors have been responsible for the spread of species across the globe. Besides the usual drivers of species invasions, such as trade, land use, and climatic conditions, we also find evidence for species-interconnectedness in alien species spread. Relational event models offer the capacity to account for the temporal sequences of ecological events such as biological invasions and to investigate how relationships between these events and potential drivers change over time.

Keywords

relational event modelling, dynamic networks, ecology, case-control sampling, generalized additive modelling

Topics

• Statistical methods and models for network analysis

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