

THEMATIC SEMESTER ON MARKOV PROCESSES AND THEIR APPLICATIONS

Series of Invited Talks

Faculty of Mathematical Sciences
Universidad Complutense de Madrid
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"Spatial Population Synchrony in Two-species Stochastic Dynamics Models"

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Tuesday, September 26, 2023, 16:00-17:00. Online

Markovian processes have been widely applied in stochastic dynamics models in Ecology, to analyze the effects of both demographic and environmental variability in the species population dynamics and stability. Such stochasticity is usually modeled through Itô Stochastic Differential Equations, which include Wiener processes. However, when trying to study spatial models, as for example it could be the dynamics of a species in a multi-patched habitat, we must generalize these Wiener processes to include the possible existence of spatial correlations of the environmental variable conditions. For example, P.A.P. Moran already proved that the existence of such a spatial correlation (or synchrony) can be transferred from the environmental variability to the dynamics of the population size of the species, which have consequences for the species resistance against extinction events. To model this spatially correlated environment, multivariate random fields with the required spatial covariance should be employed. We have then analyzed the spatial community dynamics in two-species ecological systems with these spatially correlated random fields. First, we have seen that inter-species competition may increase the population synchrony of the species, reinforcing the previously analyzed synchronization effect of dispersal. Then, we have also obtained how, in predator-prey systems, predators tend to be synchronized at longer distances than their prey. And more generally, we have obtained that the typical synchrony distance tends to increase from the species more directly affected by the environmental random fields, to other species of the community linked via species interactions.

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