Statistical integration for spatio-temporal modeling of species distribution in ecology

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Résumé

Mapping species distribution in space and time is a key challenge for conservation. Typically, such information is critical to identify essential habitats or biodiversity hotspots and to design protected areas. Massive and heterogeneous datasets are progressively becoming available to scientists to map species distribution, e.g., citizen science data, camera-trap data, catch declarations from fishers, and hunting records. Combining all these datasets to infer species distribution at a fine spatio-temporal resolution could unravel huge possibilities for ecology and conservation.
However, combining these data into a single spatio-temporal framework raises strong methodological issues. Generally, these data are not sampled following a standardized sampling scheme (opportunistic sampling); they do not have the same spatial and temporal resolution, and they can be aggregated at a coarse resolution while the process under study needs to be inferred at a finer scale (change of support problem). Last, all these data have to be integrated into a single framework while ensuring consistency between the different datasets. In this presentation, I will outline statistical developments that address these different methodological challenges. All these developments are based on concrete ecological applications from fisheries science, marine ecology, and broadly, species distribution modeling.

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