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Benefits and limitations of model-based data integration for the estimation of temporal trends in biodiversity and identification of trend drivers

Current biodiversity strategies and conservation policies set targets for halting biodiversity loss and supporting the recovery of wild populations. To track progress towards achieving these biodiversity conservation targets, structured monitoring programs were developed that provide solid evidence on population trends. However, due to the resources needed to coordinate and run such programs, they are usually restricted to few taxa and have a limited spatial and temporal coverage. These constraints restrict the ability of using data from such structured monitoring programs to precisely estimate trends for less common species and to analyze drivers of population change. In addition to these well-designed datasets, the availability of biodiversity data gathered by citizen scientists increased in the last decade. Model-based integration of those structured data from standardized monitoring programs and less structured data from citizen science platforms offers potential benefits both for assessing biodiversity trends as well as identifying trend drivers. In a real-life case study, we evaluated for 26 common farmland bird species in Germany, if and how data integration improves the estimation of temporal trends over the 15 years. We integrated five different data sources that varied with respect to the degree of standardization in field methods and sampling design, the level of observer skills, and inherent spatial bias. The results showed that integrated models estimated temporal trends with higher precision compared to models built on the structured data only and indicating that increased data quantity lowers the uncertainties around the estimated trends enabling earlier detection of decreasing of increasing trends. In this talk we will also present further ongoing analysis based on data simulation that will show the benefits and limitations of model-based data integration, particularly addressing issues related to (i) data quantity, (ii) data quality and (iii) gradient coverage. Together these results will pave the way towards the inclusion of model-based data integration approaches in biodiversity trend monitoring.