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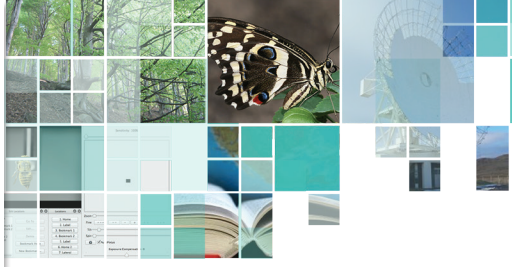

POLICY BRIEF 4

Optimizing long-term monitoring schemes for biodiversity mapping

Biodiversity is undergoing important decline worldwide due to a range of human-related driving forces. An increasing number of political commitments aim to halt this loss. Understanding and reporting on biodiversity changes is required for tracking the progress of biodiversity-oriented policy instruments and informing decision makers of possible positive or negative side effects of other policy decisions.

Biodiversity data requirements for conservation decision-making

Long-term biodiversity monitoring schemes are required across different spatial scales and administrative levels to estimate temporal trends in biodiversity. In such schemes, field data are often repeatedly recorded in a network of sites according to established procedures. Monitoring data can then be used to generate indicators to document the changes in biodiversity components as they respond to specific driving forces (see previous EU BON policy briefs).

Up-to-date knowledge on the geographical distribution of biodiversity is needed for efficient conservation decision-making (e.g. reserve selection or impacts of climate change) and for reporting commitments (e.g. under Articles 12 and 17 of EU Birds and Habitats Directives). Mapping the distribution of species and documenting how such distributions change over time can provide key information to guide effective conservation planning. Large-scale biodiversity atlas projects, such as the European Breeding Bird Atlases, provide a great deal of geographical information on biodiversity, but they are generally completed over

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considerable time periods (3-5 years) and repeated at long time intervals (often more than 10 years), which makes them less suitable to follow regular changes in species distributions over time and therefore less appropriate information source for decision makers.

Towards cost-effectiveness in biodiversity inventories

Several recent scientific studies have shown that long-term monitoring data may actually be used for both monitoring and mapping purposes, if they are integrated in biodiversity modeling tools along with digital information on environmental dynamics (Figure 1). In addition to their prime objective, monitoring schemes may therefore also constitute an important source of data to estimate how biodiversity is distributed at a large spatial scale and how such distribution changes over time, at a time scale that is relevant for decision makers. Hence, coupling biodiversity monitoring and mapping efforts within a general framework is an effective approach to support environmental decision-making.

Although the potential is clear, it is not an easy challenge due to possible conflicts in the data collection requirements for biodiversity monitoring and mapping purpose. For instance, an appropriate sampling design for biodiversity monitoring requires repeated observations at the same sampling sites, which might fail to produce enough spatial information to build accurate maps of biodiversity.

Researchers from the EU project EU BON have contributed to provide an innovative analytical framework that may be used to aid in the establishment of monitoring schemes aiming to generate appropriate data for the production of relevant maps of biodiversity. The method was proposed to optimize the sampling design of a monitoring scheme in order to provide biodiversity modeling tools with sufficient information for mapping species distributions.

The newly developed method can be applied when decisions about data collection strategies in the monitoring schemes are made, that is, before the start of field data collection or when there is a need to improve the sampling design of an ongoing scheme. It makes use of large-scale atlas data to feed the optimization method and, hence, can be applied to a variety of species groups (e.g. butterflies, birds, bats) in any region where such distribution data are available and potentially at any spatial scale. Optimizing sampling efforts becomes particularly interesting when professional experts carry out data collection in the field as this would have a direct consequence for the costs of monitoring efforts. The novel method proposed within the context of the EU BON project is also relevant for species groups where volunteers are responsible for data collection, because the method can provide guidance on the best ways to optimize sampling designs with the volunteer manpower available.

Application of the newly developed approach

The ability of biodiversity modeling tools to generate distribution maps is strongly dependent on the environmental heterogeneity of the region of interest and the rate of occupancy of the species in the region. When applied to bird populations in Southern Belgium, the optimization method indicates that the percentage of the region that needs to be sampled to create credible distribution maps for birds is around 4-5%. Importantly, such a sampling effort should not be considered as a rule of thumb because it is based on the specific regional context. The application in southern Belgium illustrates that a substantial sampling effort may be needed to derive accurate biodiversity maps from long-term monitoring data. A sampling

of 4-5% equals a surface of 650-850 km2 and this is actually higher than the coverage implemented in most of the existing monitoring schemes worldwide. However, approaches are increasingly available to find trade-offs between the sampling effort required in space and over time for the same monitoring scheme to integrate in its objectives both the estimation of population trends and the mapping of biodiversity.

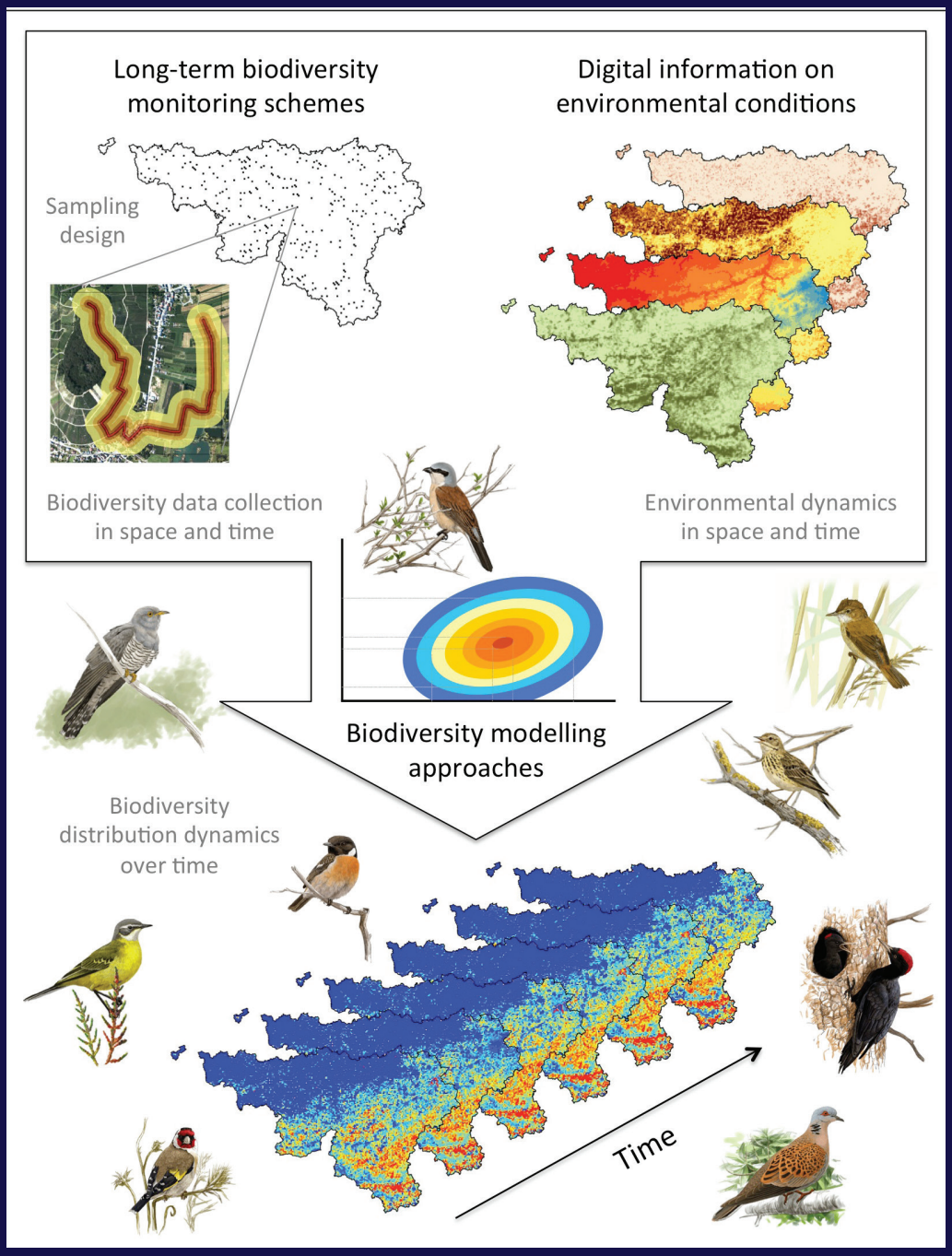

Figure 1. Long-term biodiversity monitoring data may be integrated in biodiversity modeling tools along with digital information on environmental dynamics to produce detailed mapping of biodiversity on a regular basis over time.

Contacts

Nicolas Titeux

Forest Sciences Centre of Catalonia, Spain

nicolas.titeux@ctfc.es
+34 973 48 17 52 – 293

Sergi Herrando

Forest Sciences Centre of Catalonia, Spaim

ornitologia@ornitologia.org
+34 93 458 78 93

Lluís Brotons

Forest Sciences Centre of Catalonia

lluis.brotons@ctfc.cat

Publication date

16.04.2015

Designed by PENSOFT

Photos: Dirk S. Schmeller

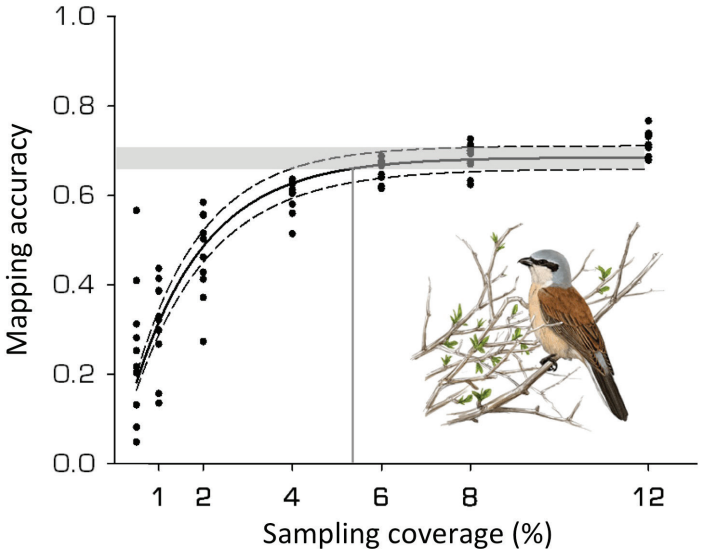

Figure 2. Estimation of the minimum sampling effort (i.e. percentage of the region) needed in a bird monitoring scheme to create accurate distribution maps for the Red-backed shrike (Lanius collurio) in southern Belgium.

Outlook

As an integrated component of a biodiversity monitoring scheme, biodiversity distribution mapping provides key information to guide effective conservation planning and decision-making at the relevant spatial and temporal scales. The integration of biodiversity modeling techniques into monitoring projects is an effective approach to optimize the use and information value of biodiversity data, as it offers the possibility to estimate biodiversity dynamics both in space and over time. We believe the innovative method developed within the context of the EU BON project will help in the design of the data collection strategies for future monitoring schemes and biodiversity inventories aiming to achieve such integration.

Further reading

Aizpurua O., Paquet J.-Y., Brotons L. & Titeux N. (2015) Optimising long-term monitoring projects for species distribution modelling: how atlas data may help. Ecography, 38, 1, 29-40.

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