

Title

Optimizing protected area expansion in Italy through systematic conservation planning and climate-informed prioritization

Authors and affiliations

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Abstract

This presentation explores the use of Systematic Conservation Planning (SCP) and Integer Linear Programming (ILP) to identify priority areas for the expansion of protected areas in Italy in line with the EU Biodiversity Strategy for 2030. Using the R package *prioritizr*, the study integrates ecological and socio-economic data to optimize biodiversity conservation outcomes while minimizing opportunity costs.

The analysis is based on 294,559 planning units (1 km² cells) and 489 biodiversity features, including vertebrates, vascular plants, EUNIS habitats, and climatic stability layers.

Conservation targets were assigned according to species distribution ranges and adjusted to reflect Italy’s contribution to the European range of each species. Different weighting schemes for climate stability variables and varying cost penalties were tested to evaluate trade-offs between biodiversity protection, climate resilience, and socio-economic constraints.

Results highlight how climate-related priorities and economic costs influence the spatial configuration of conservation solutions, biodiversity shortfalls, and fragmentation patterns. The study identifies optimal scenarios for expanding protected and strictly protected areas to achieve the 30% and 10% EU conservation targets, respectively, while balancing ecological effectiveness and land-use costs.