



## Environmental heterogeneity surrogates in systematic conservation planning

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### ABSTRACT

Systematic conservation planning tools have been broadly used to spatially identify biodiversity management priorities and help minimize potential impacts from surrounding human activities. Fine-filter approaches that focus on specific species are most commonly used for setting nature conservation priorities worldwide. Alternatively, instead of using species as biodiversity surrogates, coarse-filter approaches focus on preserving environmental heterogeneity (EH), such as diversity in climate and topography. The hypothesis behind this approach is that by increasing the available environmental niche space, the chances of preserving biodiversity is maximized, since species with various environmental needs can coexist even in restricted geographic space. EH has gained increasing attention during the last decade yet its connection to conservation planning still remains limited.

We use a recently proposed methodology, based on Rao's quadratic entropy indices and we estimate EH priority conservation areas in the European Mediterranean ecoregion, from Cyprus to Portugal. We use bioclimatic and topographic variables from two widely used sources for climate and ecological modelling, the ENVIREM and the Chelsa Climate databases. Using various moving window extends, we identify areas which present high EH and should be given additional conservation focus. Based on existing biodiversity conservation goals and policies, we identify specific EH conservation targets i.e. spatial networks including the 5%, 10% and 17% of the most diverse (priority) areas.

We show that the Rao methodology is efficient in quantifying EH for large scale spatial analyses and should be further considered in future conservation planning techniques. Around one third of the EH priority areas are identified in Greece (from 28% to 35% according to the conservation target), one fourth in Italy (23% - 29%), and around one fifth in France (17% - 23%) and Spain (16% - 22%). EH priority areas within Portugal, Croatia and Cyprus cover a very small surface—representing less than 2%—of the total EH priority areas of the European Mediterranean ecoregion. We finally estimate the overlaps of the EH priority network with existing protected area (PA) networks, i.e. National Parks, Key Biodiversity Areas and Natura 2000 areas. We show that EH priority areas are included only partially in existing protected PA networks and future conservation guidelines should be based on both biodiversity and environmental surrogates to be more efficient in protecting biodiversity in a changing environment.