

Where to expand and establish new protected areas?

A systematic analysis to identify and prioritize new protected area locations

Level: Master

Start: Any time

Project form: Spatial analysis, conservation planning

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Background and aim

Protected areas are one of the main tools for halting biodiversity loss (Pacifiçi et al. 2020). However, protected areas are often placed in locations of low economic value rather than of high biological value (Venter et al. 2018; Di Marco et al. 2019; Yang et al. 2020). The aim of this internship is to identify priority areas for the expansion of the protected area network to reach internationally agreed targets (30% of the terrestrial area under protection) and efficiently protect biodiversity. You will focus on a specific continent (e.g., Africa, Asia, Europe, South America and the Caribbean, North America, or Oceania) and a specific taxonomic group (e.g., amphibians, birds, mammals, or reptiles).

Approach

In this research you will perform systematic conservation planning to identify priority areas for conservation for a specific species group and continent. To that end, you will first establish species distribution models (SDMs) for an appropriate selection of species by relating species' occurrence data (e.g., from the Global Biodiversity Information Facility; GBIF) to a selection of relevant environmental variables (e.g., elevation, climate, land cover/use, and/or the human footprint index). You will apply the SDMs to obtain spatial predictions of the species' current and potential future distribution within the selected continent. Next, you will use the predicted species distributions combined with the current spatial distribution of protected areas as input to systematic conservation planning software (e.g., Zonation; prioritizr) to identify and rank sites for protected area expansion. You will also explore how the ranking of sites may change if you include additional biodiversity features (e.g., distribution of old growth forests (Gibson et al. 2011), remaining wilderness areas (Watson et al. 2018), or human settlement (Ellis et al. 2021)) and if you account for the costs of protection.

Expected outcomes

Your project will result in a set of maps showing priority areas for the expansion of protected areas (see Fig. 1 for an example). This can be used to advise continent- and country-level (i.e., 30% of each country should be protected) conservation. The results of the project may also be used for the development of new course material for the Biodiversity Assessment MSc course. You may also collaborate with fellow students by focusing on different continents and/or species groups.

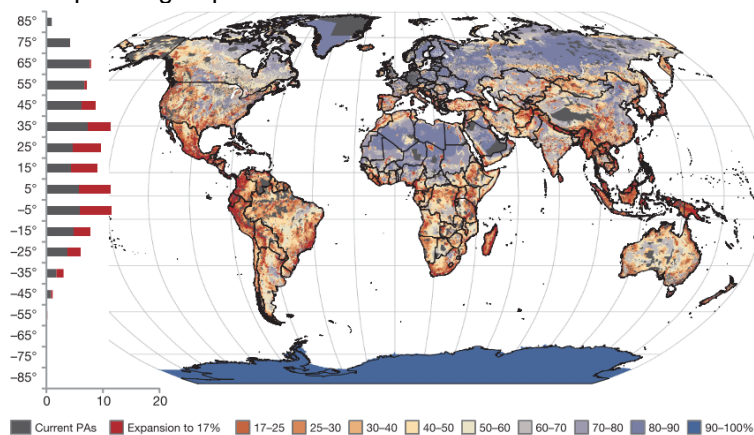


Figure 1. Global priority map of protected area expansion (Pouzols et al. 2014).

Literature

- Di Marco M, Ferrier S, Harwood TD, Hoskins AJ, Watson JEM. 2019. Wilderness areas halve the extinction risk of terrestrial biodiversity. *Nature* **573**:582–585. Springer US. Available from <http://dx.doi.org/10.1038/s41586-019-1567-7>.
- Ellis EC et al. 2021. People have shaped most of terrestrial nature for at least 12,000 years. *Proceedings of the National Academy of Sciences of the United States of America* **118**:1–8.
- Gibson L et al. 2011. Primary forests are irreplaceable for sustaining tropical biodiversity. *Nature* **478**:378–381. Nature Publishing Group.
- Pacifiçi M, Di Marco M, Watson JEM. 2020. Protected areas are now the last strongholds for many imperiled mammal species. *Conservation Letters* **13**:1–7.
- Pouzols FM, Toivonen T, Minin E Di, Kukkala AS, Kullberg P, Kuustera J, Lehtomaki J, Tenkanen H, Verburg PH, Moilanen A. 2014. Global protected area expansion is compromised by projected land-use and parochialism. *Nature* **516**:383–386.
- Venter O, Magrach A, Outram N, Klein CJ, Possingham HP, Di Marco M, Watson JEM. 2018. Bias in protected-area location and its effects on long-term aspirations of biodiversity conventions. *Conservation Biology* **32**:127–134.
- Watson JEM, Venter O, Jasmine L, Jones KR, Robinson JG, Possingham HP, Allan JR. 2018. Protect the last of the wild. *Nature* **563**:27–30.
- Yang R et al. 2020. Cost-effective priorities for the expansion of global terrestrial protected areas: Setting post-2020 global and national targets. *Science Advances* **6**:1–9.