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A MODEL TO MINIMIZE COSTS AND PROMOTE SPECIES PERSISTENCE UNDER CLIMATE CHANGE

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Biodiversity has been (and predicted to be) severely threatened by the effects of changing climates. Because climate is one of the most prominent drivers of species spatial distributions, its changes are likely to cause species to readjust their spatial ranges. But species are limited by intrinsic (life history traits) and landscape-context (habitat fragmentation) factors in their capacity to follow suitable climates, as these rearrange in space along time. The identification of the areas more likely to support spatial readjustments of multiple ecologically-relevant species is therefore a pivotal step to proceed effectively in conservation planning. This task is highly challenged by the tight budgets that typically are available by conservation agents, forcing the selection of areas to be made thoroughly. We propose to formalize this issue by a two-stage mixed integer linear programming model that minimizes the invested cost while safeguarding species persistence targets for a given time-horizon characterized by widespread changing climates. The first stage tunes persistence targets for each species restricted by a bound on the size of area to select. The second stage identifies a set of areas that ensure the levels of persistence obtained in the first stage, while having minimum cost. We also present a heuristic for the problem and report results of computational tests comparing exact and heuristic solutions using simulated data with 10 and 50 virtual species on gridded maps composed by 100, 500 and 1000 cells, defining species' climatic suitability across four time periods.

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