What are ENM/SDM and why do we use them?

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Background

The goal of Ecological Niche Modeling (ENM) is to infer the ecological niche of species. A typical set of questions that ENM tries to answer is:

- What is the optimal temperature for this species?
- What is the range of temperature that this species can tolerate?
- What is the minimum level of precipitation that this species need to survive?
- Is this species limited by temperature of precipitation?

ENM works entirely in environmental space. Species Distribution Modeling (SDM) is the projection of a ENM into geographical space. The workflow of SDM is always to first perform an ENM and then to use this to achieve a SDM.

The applications of ENM/SDM are varied. Insights from ENM when employed alone (i.e. without an SDM) are useful mostly for academic and research purposes. In addition to these, SDM have conservation applications. For instance, SDM can project future biodiversity changes [@sinclair2010useful], highlight species particularly sensitive to future climate changes [@zurell2023predicting], and help designing protected areas and guide policy making [@villero2017integrating].