

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

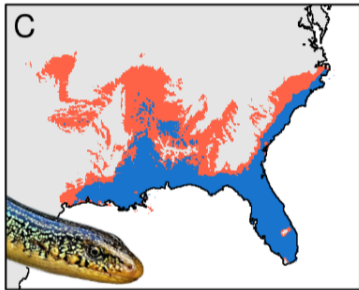
A brief history of SDMs

- ▶ 1807: Essay on the Geography of Plants (Humboldt)
- ▶ '10s-'20s: Grinnell & Elton
- ▶ '50s-'60s: Hutchinson, MacArthur, & Wilson
- ▶ '90s: Quantitative SDMs
- ▶ 2000s: SDMs as a recognized field
- ▶ 2010s: Boom of SDMs
- ▶ 2020s: Overflow of SDMs

The why of SDMs

- ▶ Fundamental theory
- ▶ Large-scale patterns
- ▶ Project future changes
- ▶ Conservation

The why of SDMs – Fundamental theory

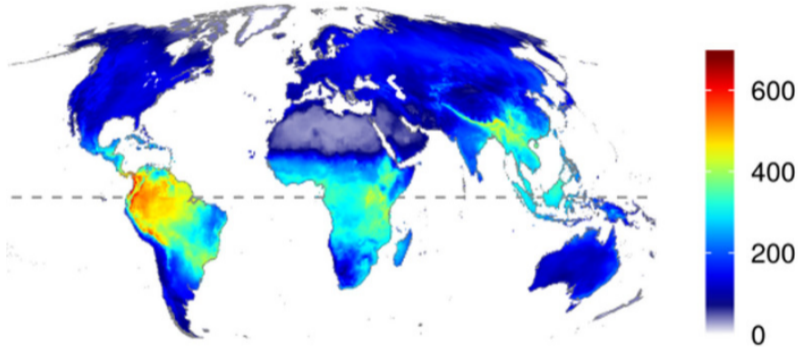


Suitable only with
constant climate

Suitable even with
variable climate

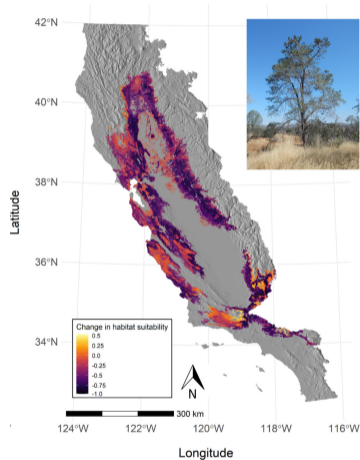
Effect of climate instability (Berti et al., 2025)

The why SDMs – Large scale patterns



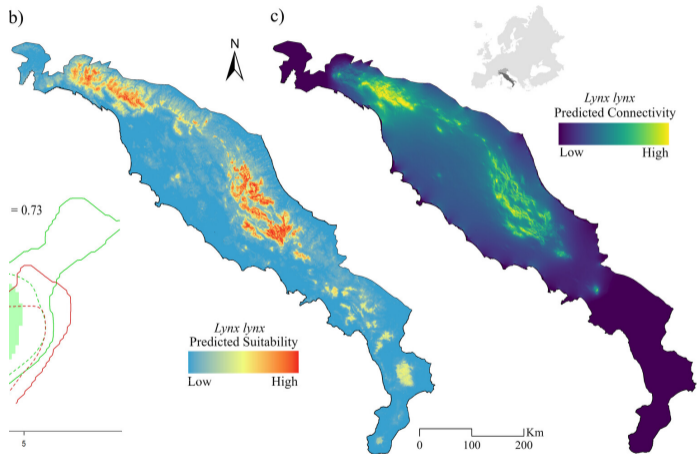
Vertebrate species richness (Biber et al., 2019)

The why SDMs – Project future changes



Change for *Pinus Sabiniana* (Franklin, 2023)

The why SDMs – Conservation

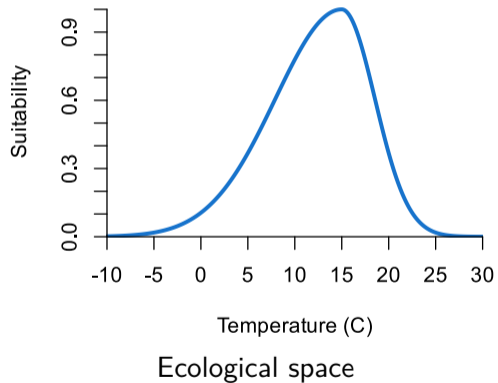


L. lynx (Serva et al., 2025)

The only theory you really need to know

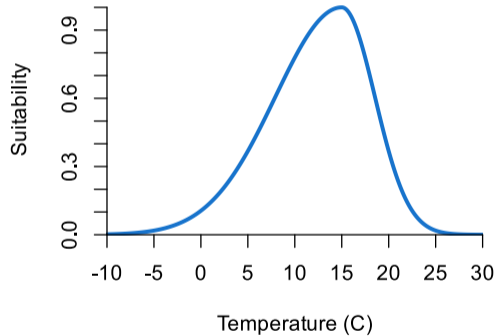
Duality of SDMs

Ecological niche model (ENM)



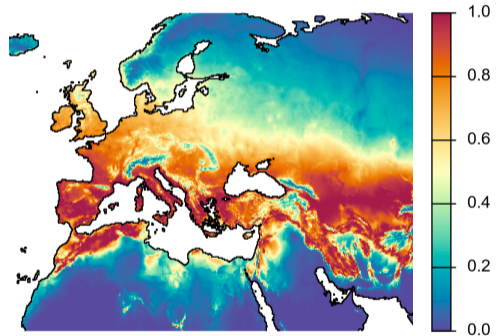
Duality of SDMs

Ecological niche model (ENM)



Ecological space

Species distribution model (SDM)



Geographic space

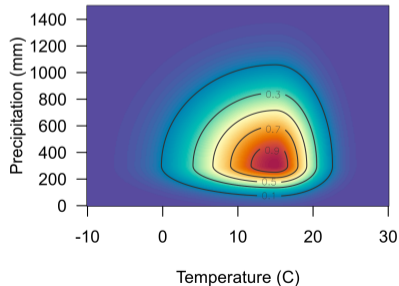
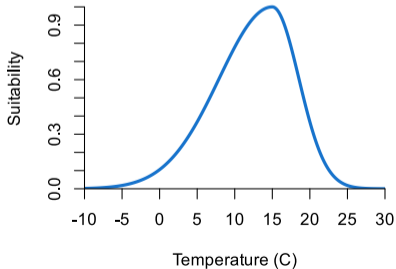
The niche of species

► Convex

If a species tolerates two environmental conditions e_1 and e_2 , it should tolerate a third $e_3 : e_1 \leq e_3 \leq e_2$

► Multidimensional

Species generally respond to more than one environmental condition



One of many niches

Fundamental (Grinnellian) niche

+

Biotic (Eltonian) niche

+

Dispersal & meta-population niche

=

Realized niche

One of many niches

Fundamental (Grinnellian) niche

+

Biotic (Eltonian) niche

+

Dispersal & meta-population niche

=

Realized niche