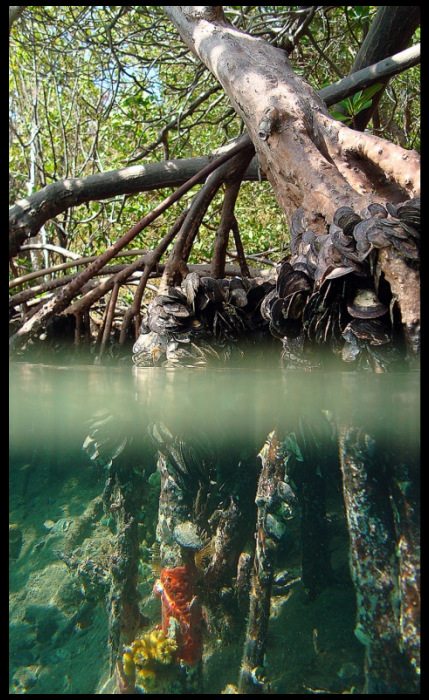
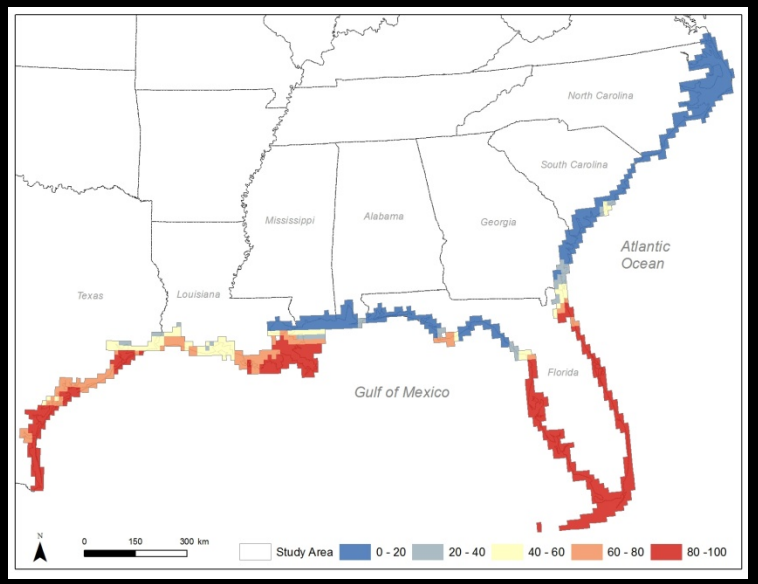
Distribution Modeling

Unit 3: Approaches to Vulnerability Assessment





A rose by any other name…

- Ecological niche modeling
- Element distribution modeling
- Predictive range mapping
- Habitat suitability modeling
- Climate envelope modeling

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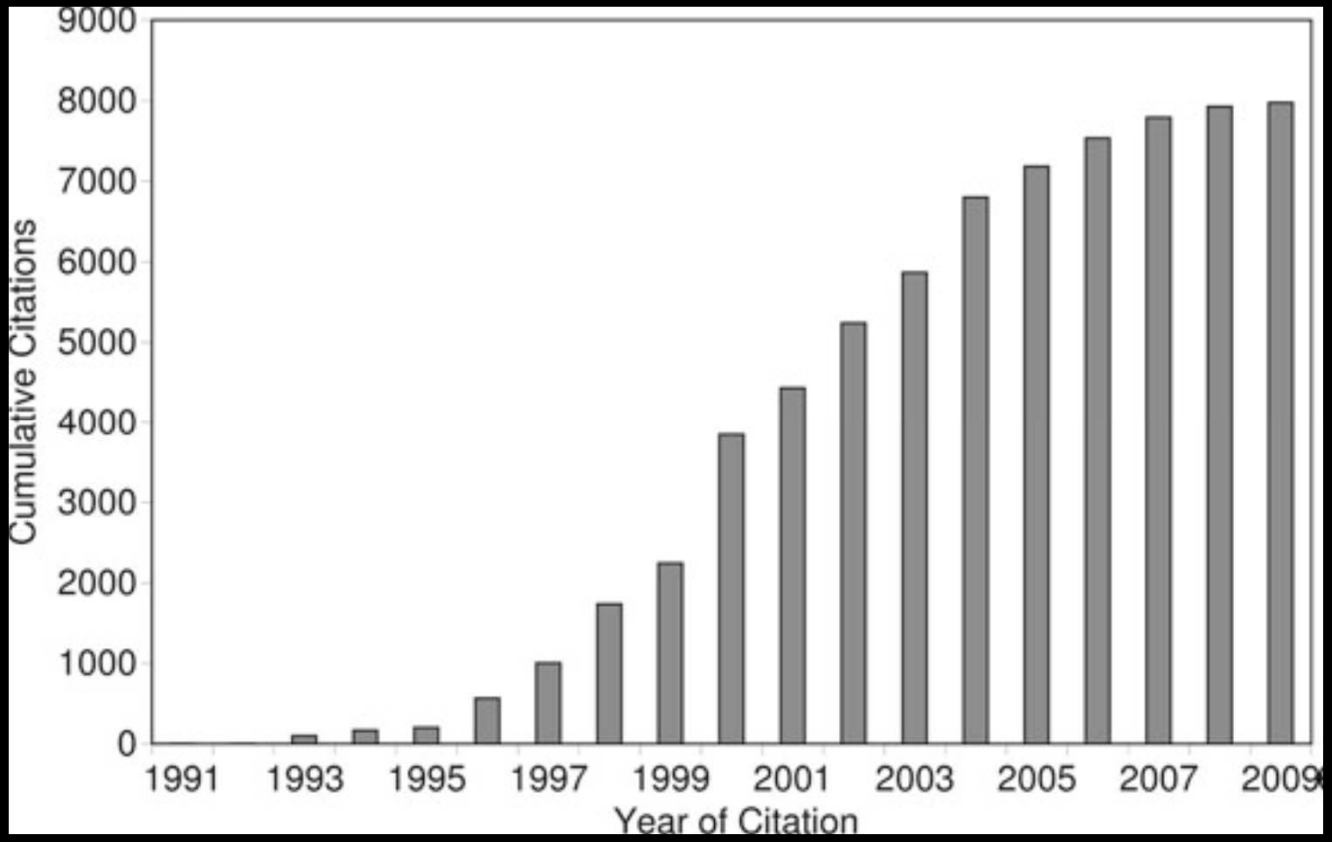
THE GOAL: capture species-environment relationships that characterize where the species can occur on the landscape

Species distribution modeling is widely used



From Johnson et al. 2012. in A.H. Perera et al. (eds.), *Expert Knowledge and Its Application in Landscape Ecology*

Common uses

- Discovery of new populations
- Risk of species invasions
- Reserve selection and design
- Restoration, translocation, reintroductions
- Climate change impacts on biodiversity

Methods for modeling species responses to climate change

- Forecasting distribution responses

  Correlative models (PATTERNS):

  - Phenomenological
  - Relate current distributions to environmental variables

  Mechanistic models (PROCESSES):

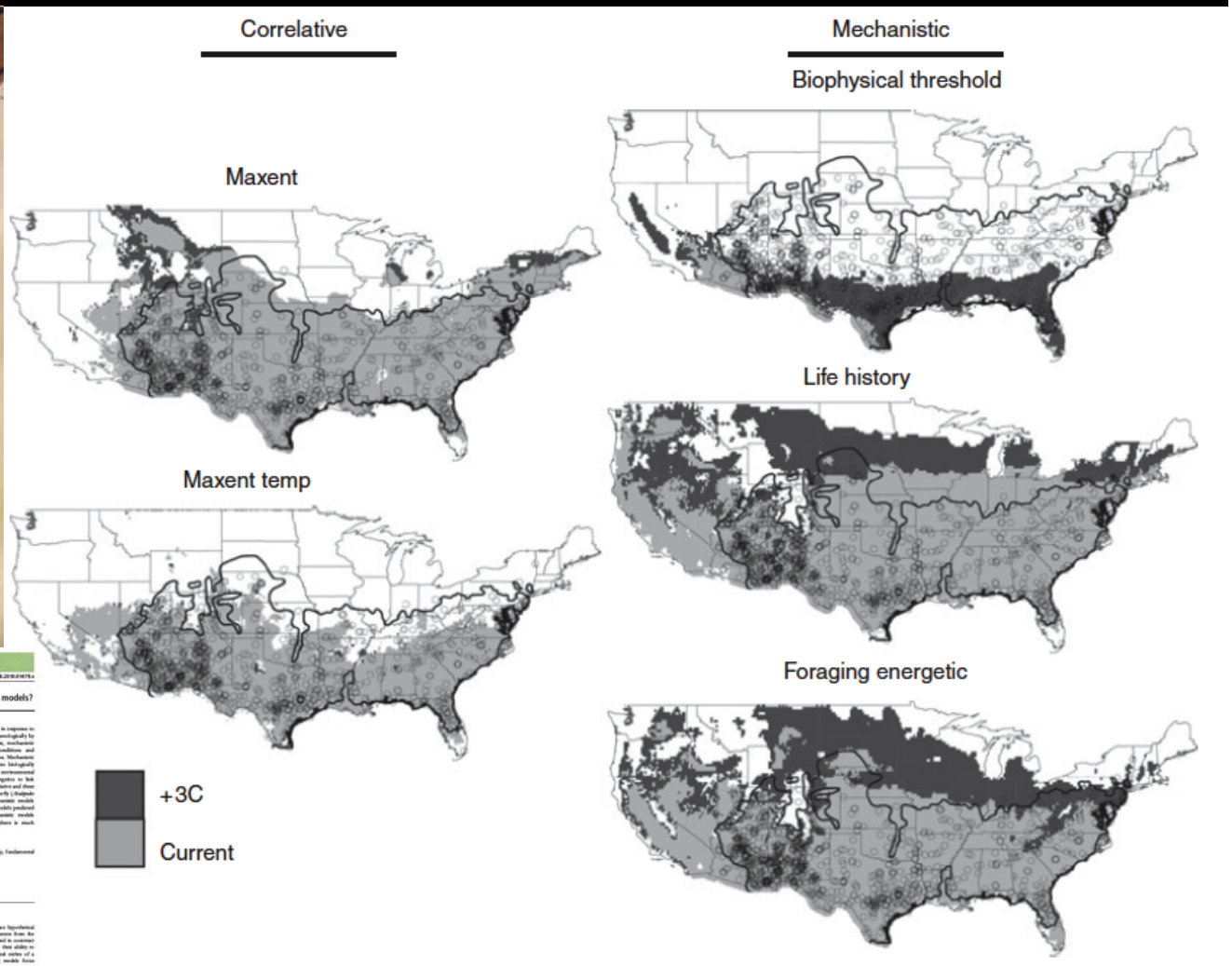
  - Use explicit relationships between environmental variables and organismal performance
  - Estimated independently of species current distribution

Methods for modeling species responses to climate change

ECOLOGY LETTERS

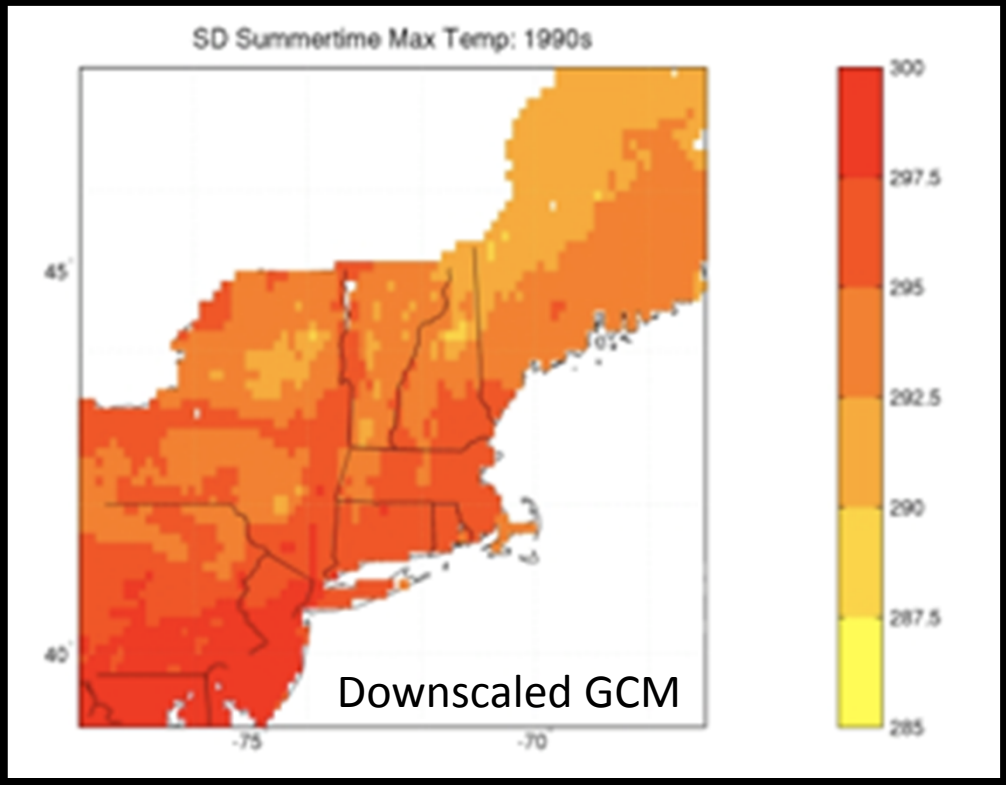
REVIEW AND SYNTHESIS

Can mechanism inform species' distribution models?



re 1 Range predictions for *Sceloporus undulatus* in current climates (light gray) and predicted range expansions following a uniform 3 °C
perature increase (dark gray). Localities (o) and the atlas range polygon are shown.

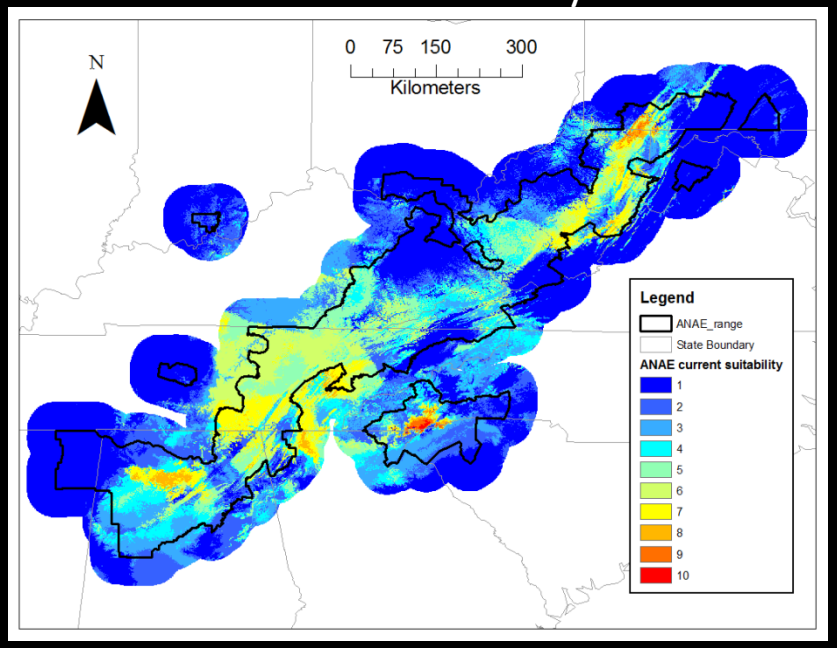
How can distribution models contribute to a vulnerability assessment?



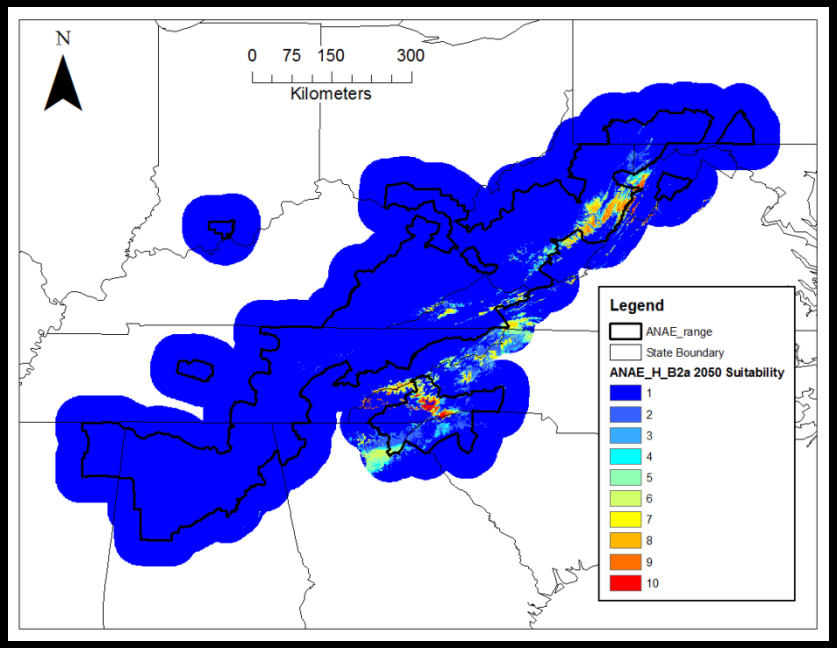
Qualitative assessment – estimate exposure qualitatively and piecemeal

How can distribution models contribute to a vulnerability assessment?

Current suitability

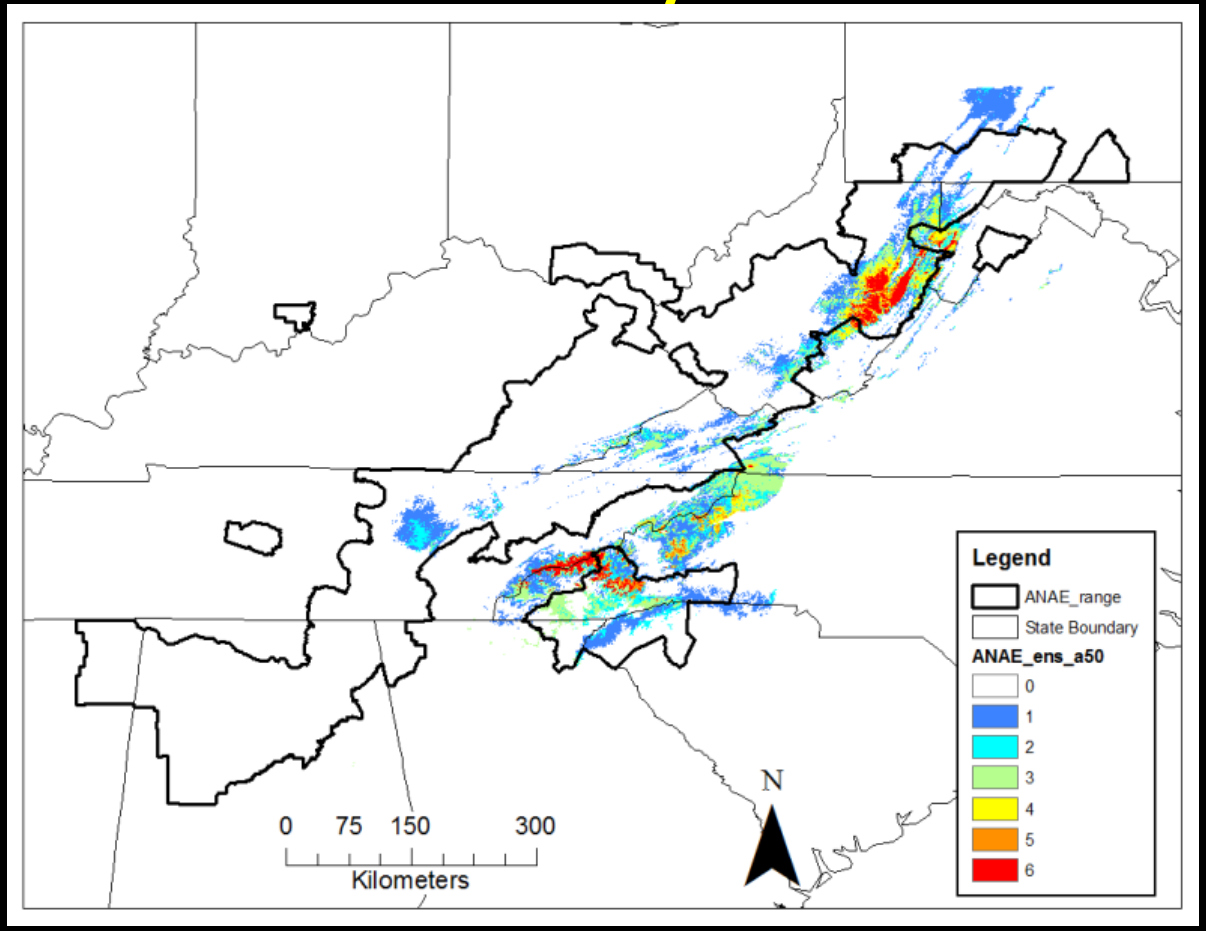


Suitability in 2050



Exposure can be assessed in a quantitative and spatially explicit manner

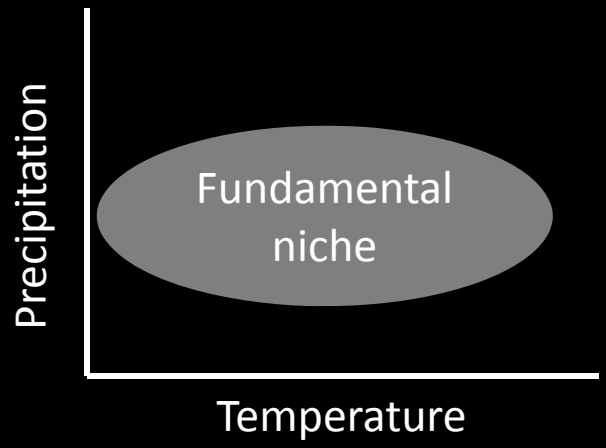
How can distribution models contribute to a vulnerability assessment?



Uncertainty also addressed and conveyed to stakeholders in a clear and spatially explicit way

Issues to consider

- In many cases we only know the realized niche of a species



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