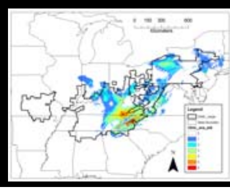
Distribution Modeling

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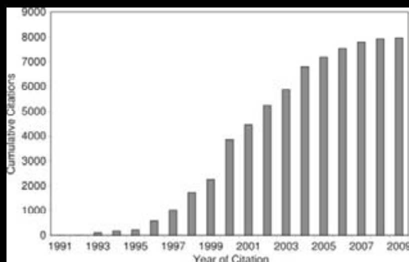
THE GOAL: capture species-environment relationships that characterize where the species can occur on the landscape

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*

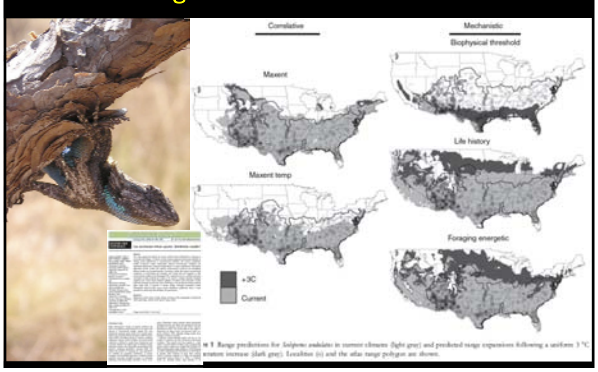
Methods for modeling species responses to climate change

- Forecasting distribution responses

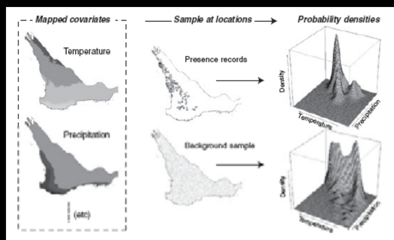
  Correlative models:
  - Phenomenological
  - Relate current distributions to environmental variables

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

Methods for modeling species responses to climate change



How can correlative distribution models contribute to a vulnerability assessment?



Current species - environment relationships are projected onto forecasted climate scenarios

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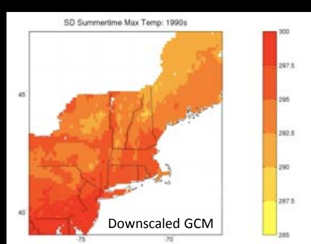

Qualitative assessment – estimate exposure qualitatively and piecemeal

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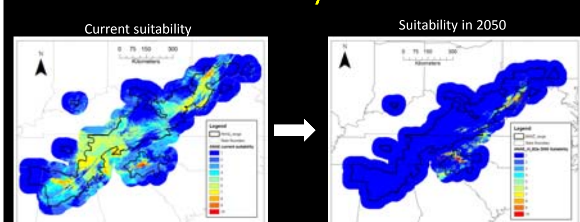
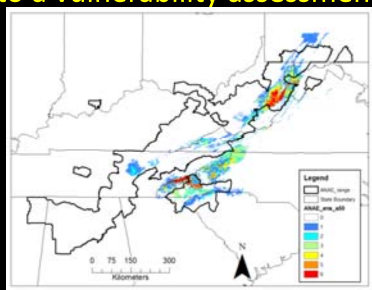


Exposure can be assessed in a quantitative and spatially explicit manner

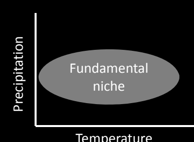
How can distribution models contribute to a vulnerability assessment?



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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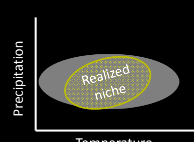

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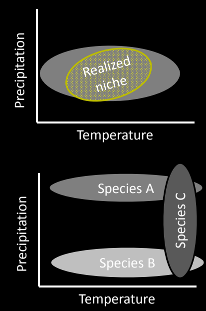
- There may not be current analogs of future climate or future communities



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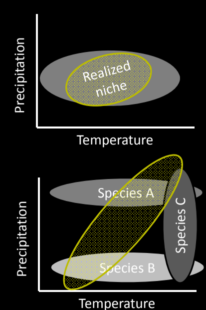

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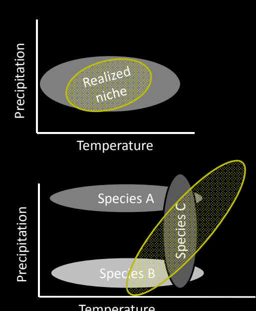

Categories of correlative distribution modeling

- Deductive
  - Typically based on expert knowledge
  - Identify key habitat/environmental requirements and map them
  - National GAP program

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- Inductive
  - Requires knowledge of species occurrence data
  - Uses an algorithm to identify species-environment relationship

Selecting a tool for correlative modeling

DOMAIN
Logistic regression
MaxEnt
GARP
Random Forests
Mahalanobis Distance


Novel methods improve prediction of species' distributions from occurrence data