Intro to Ecological Niche Models with MaxEnt

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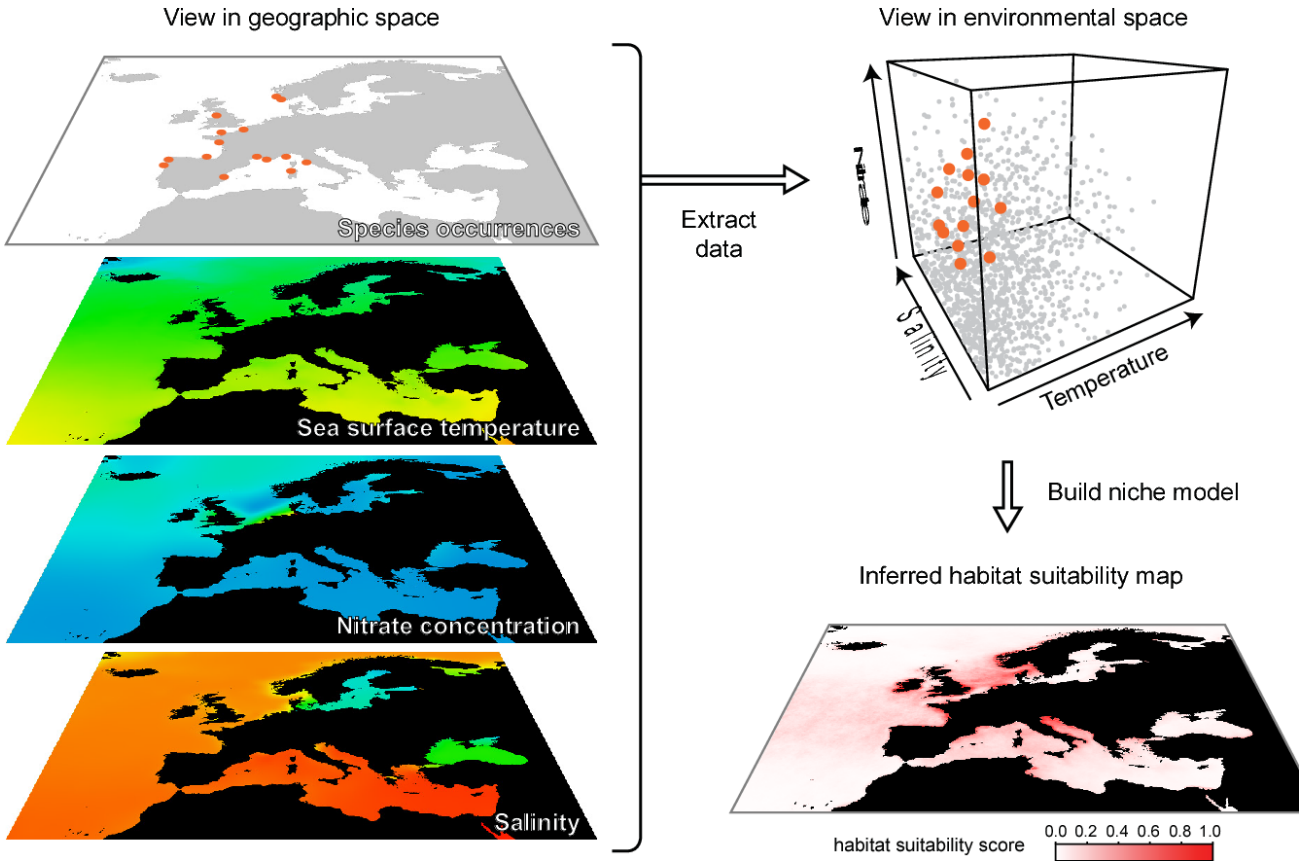
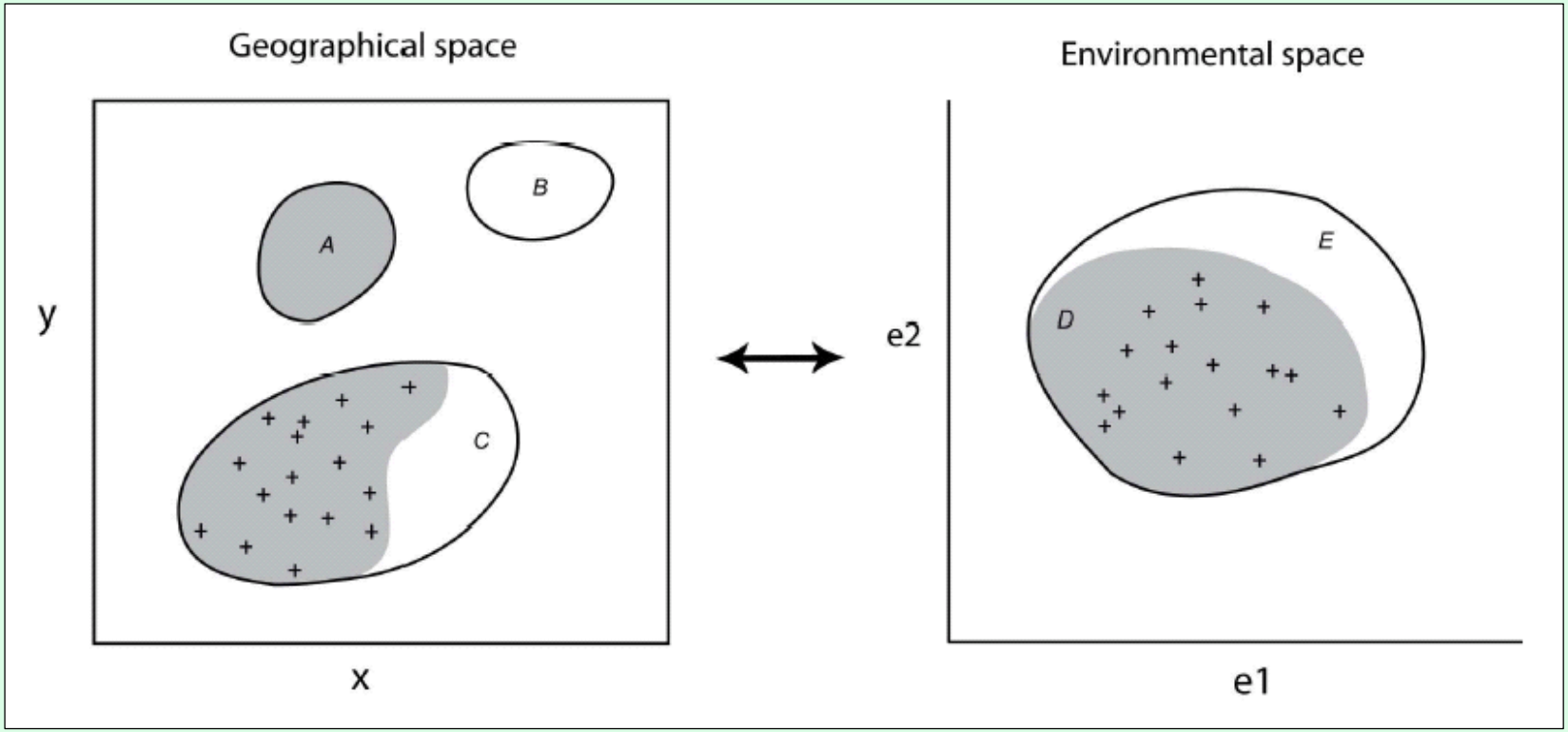


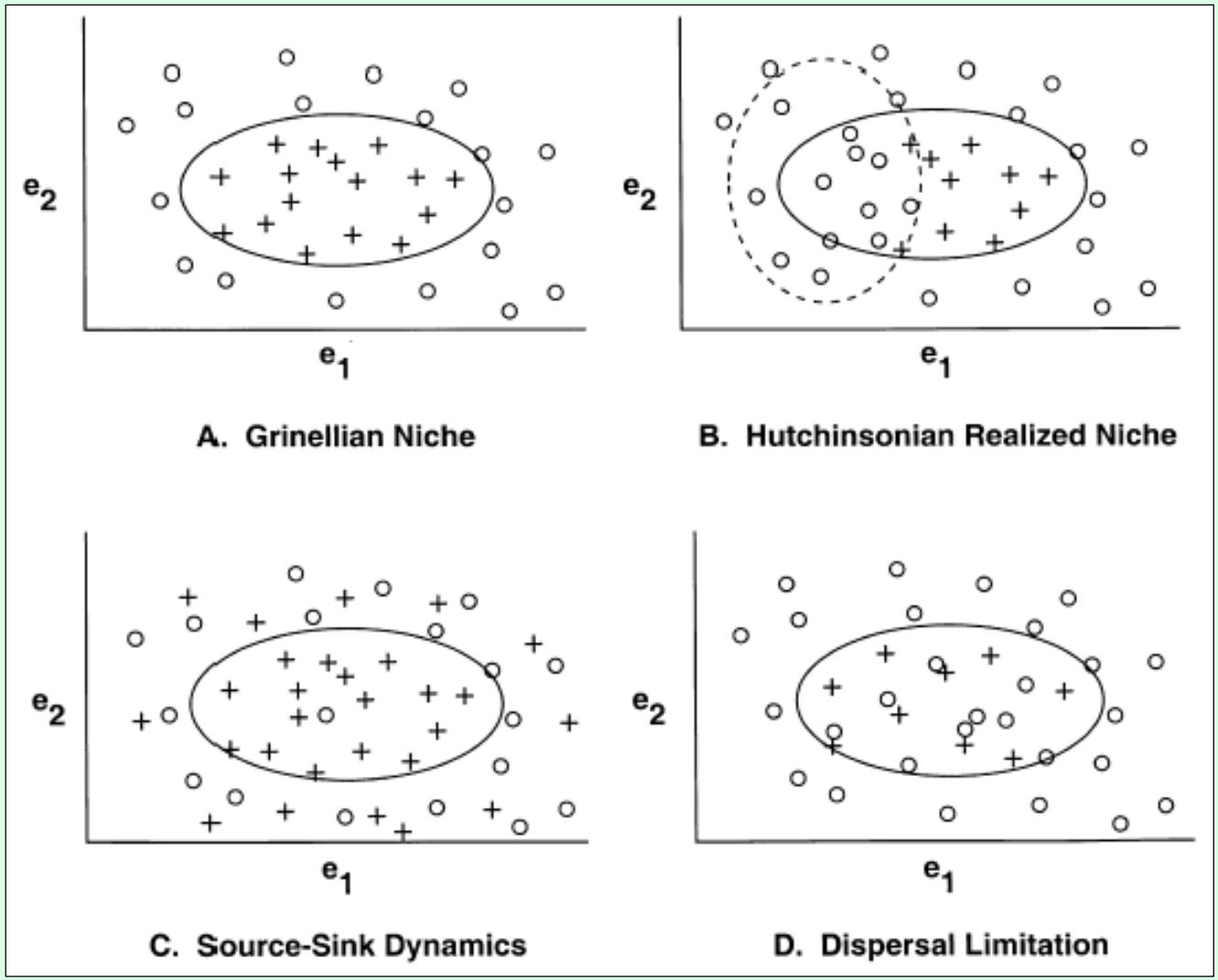
Rossetto Marcelino & Verbruggen 2015

G-space and E-space



(Pearson, 2008)

Niche theory



(Pulliam, 2000)

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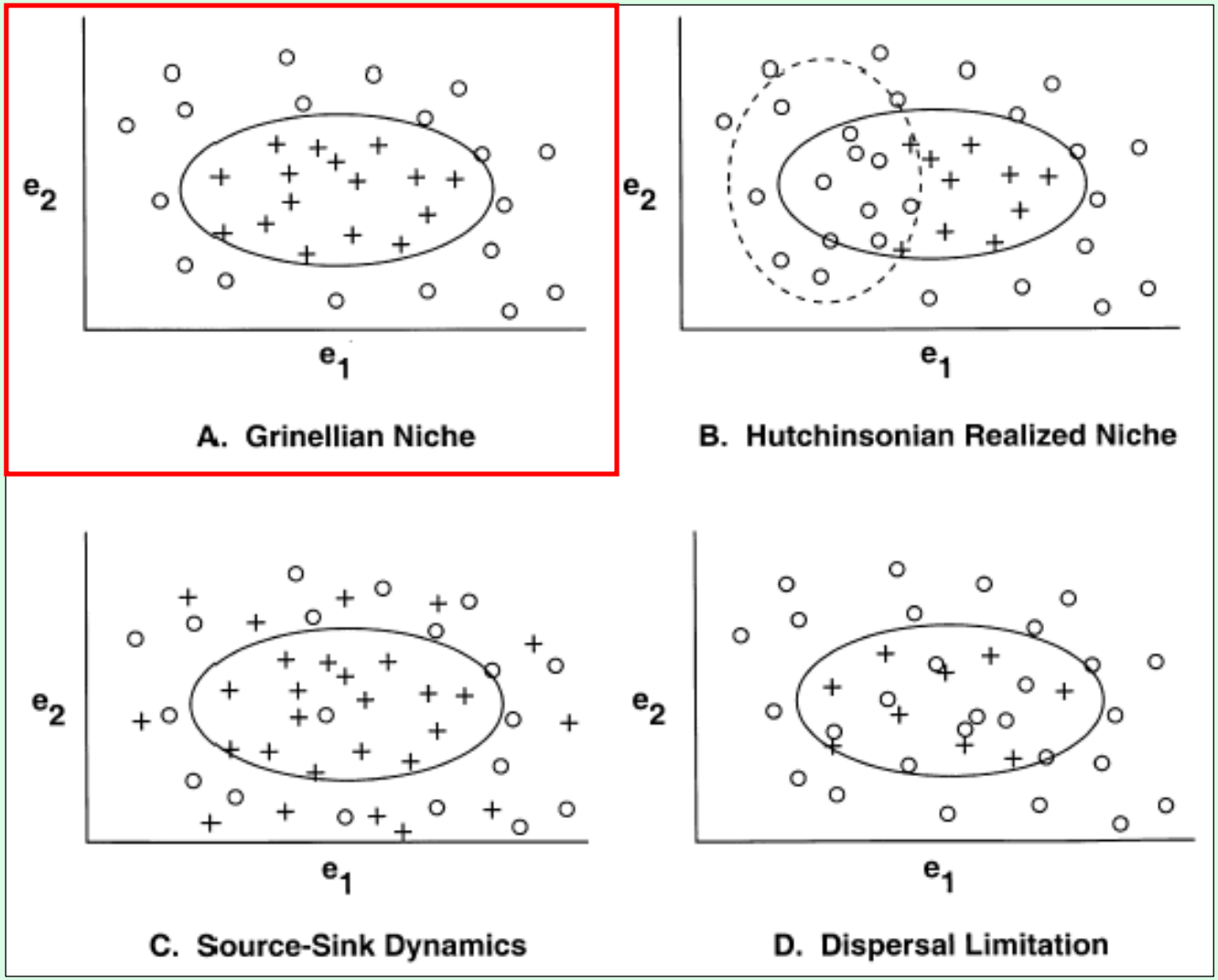

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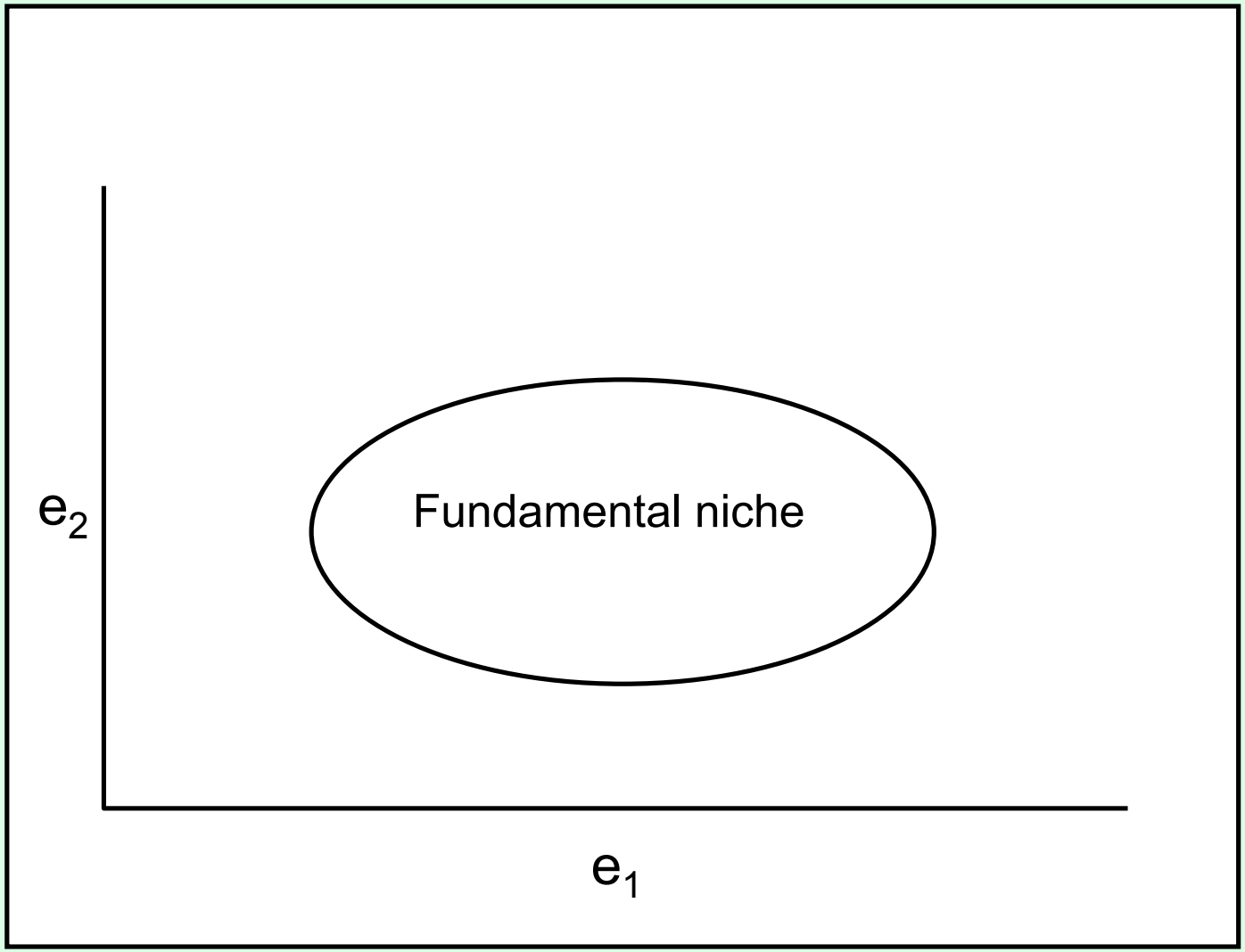

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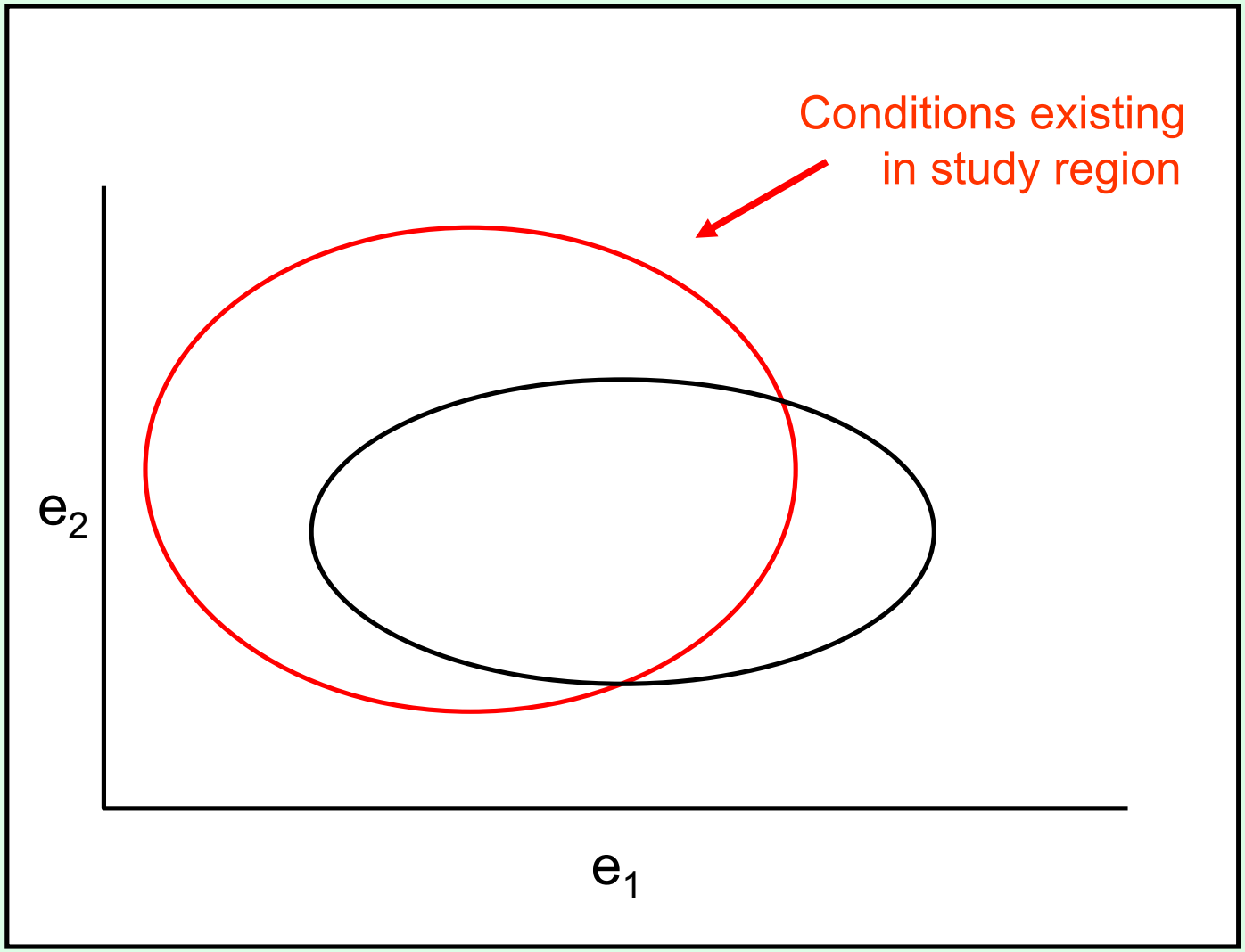

(Jackson and Overpeck, 2000)

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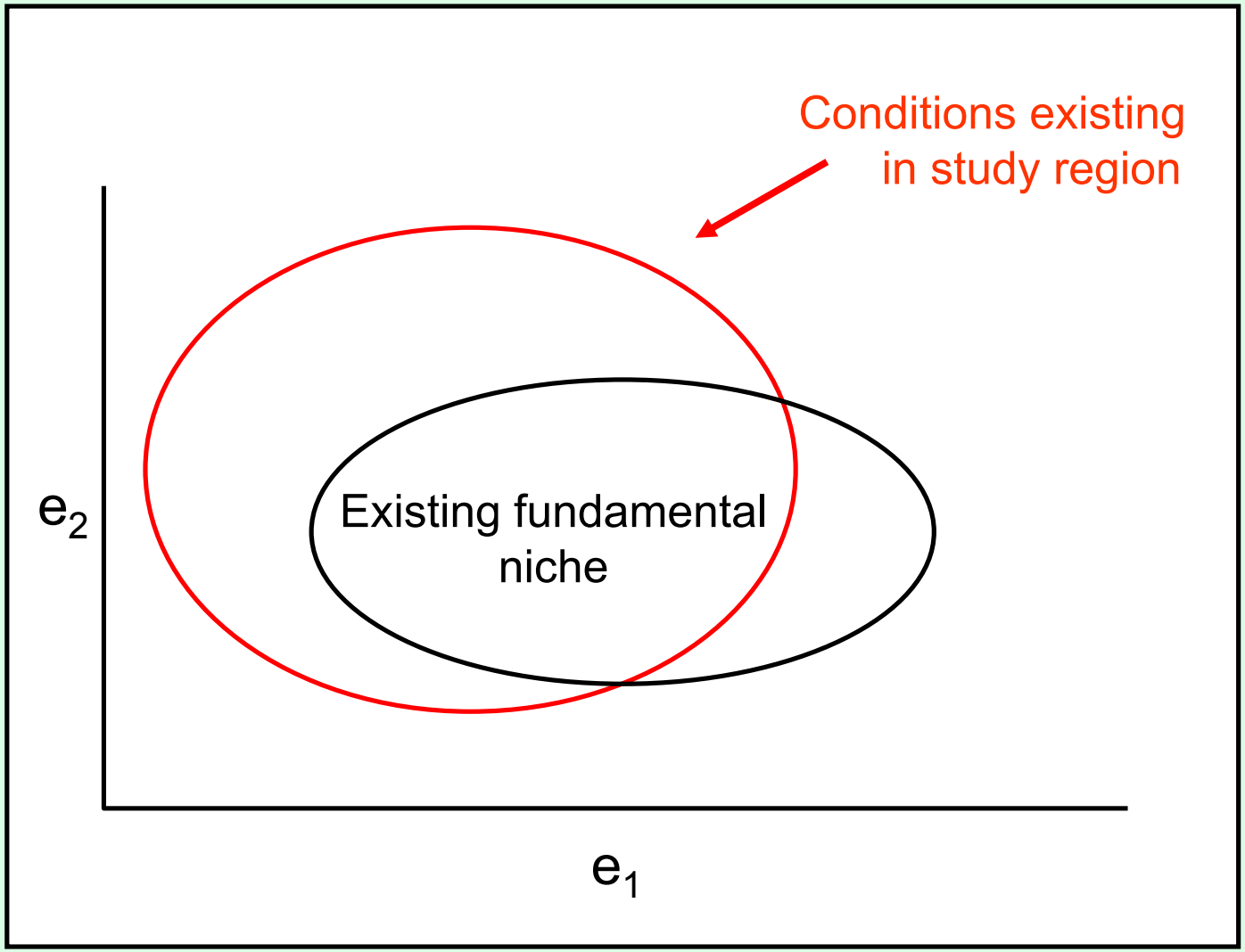

(Jackson and Overpeck, 2000; their “potential niche”)

Non-equilibrium distributions

Occupied distributions may be smaller than *abiotically suitable distributions* due to:

1. Contingent factors
    a. lack of dispersal
    b. local extinction

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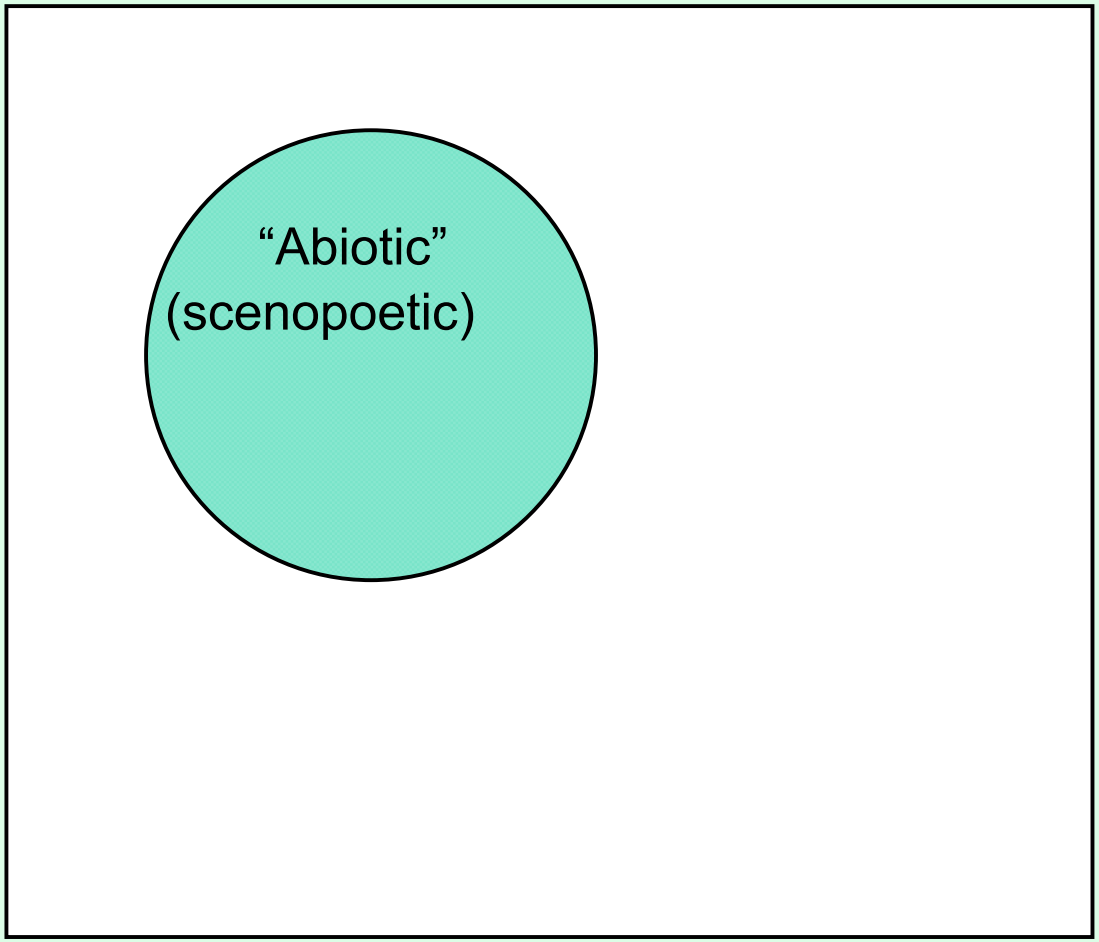
3. Human modifications of the landscape

Non-equilibrium distributions



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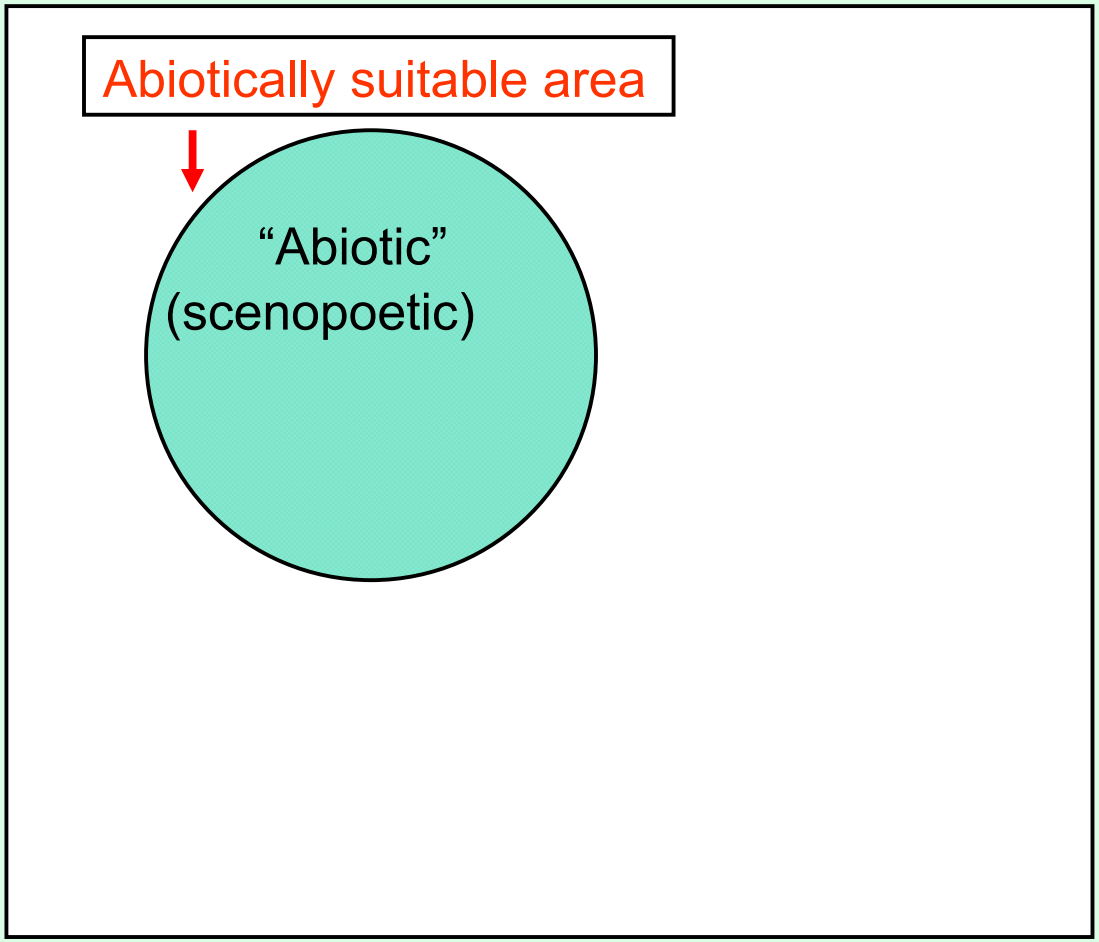

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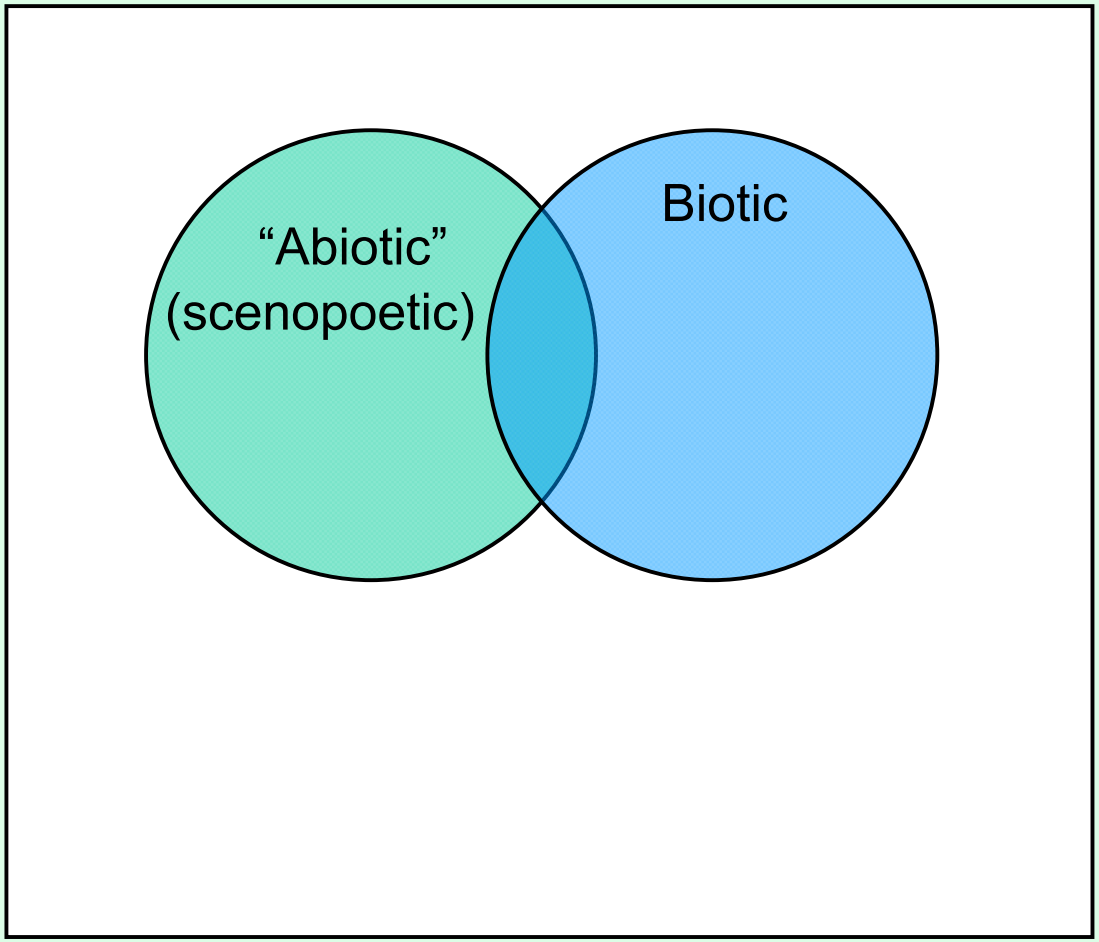

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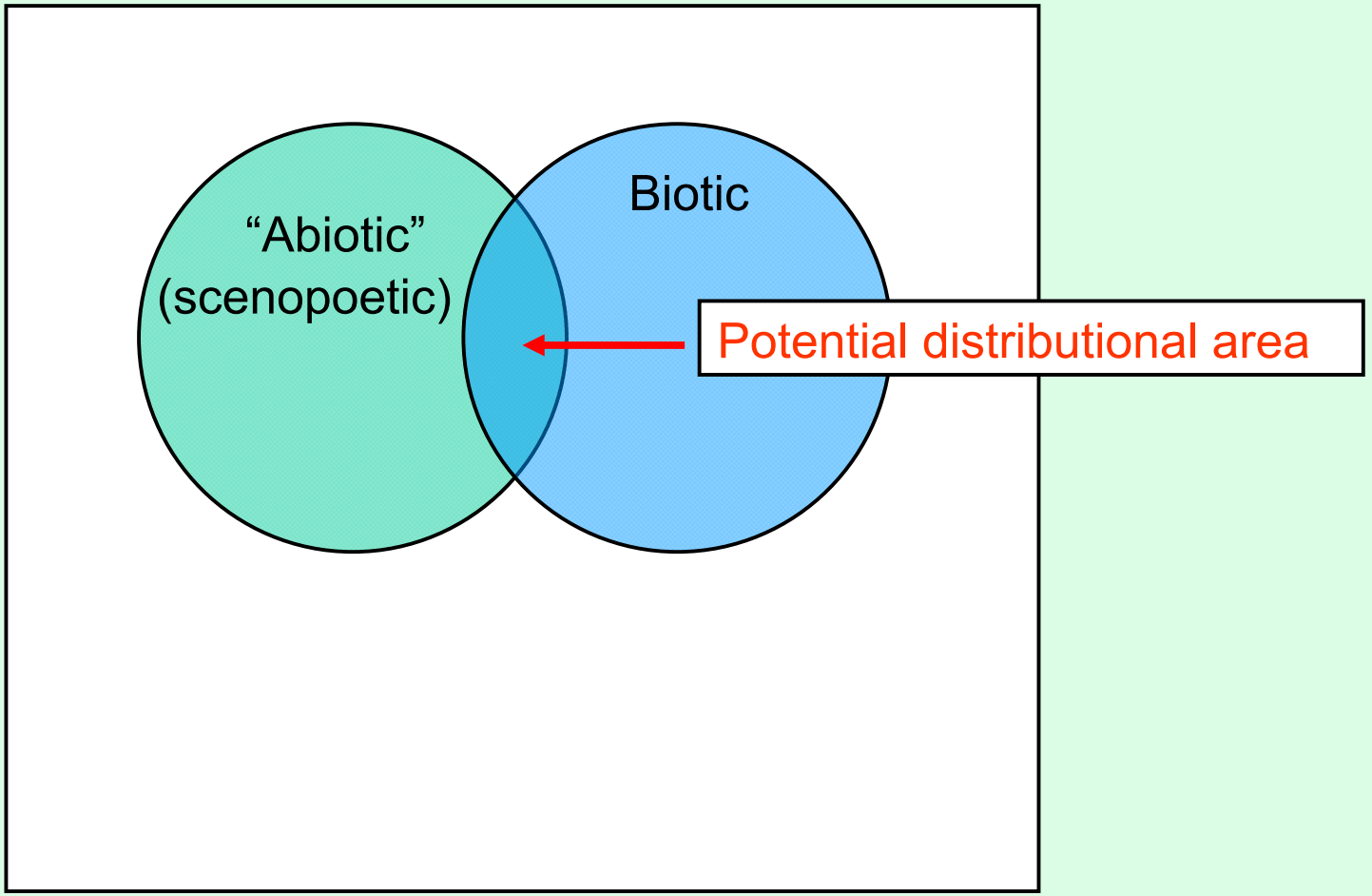

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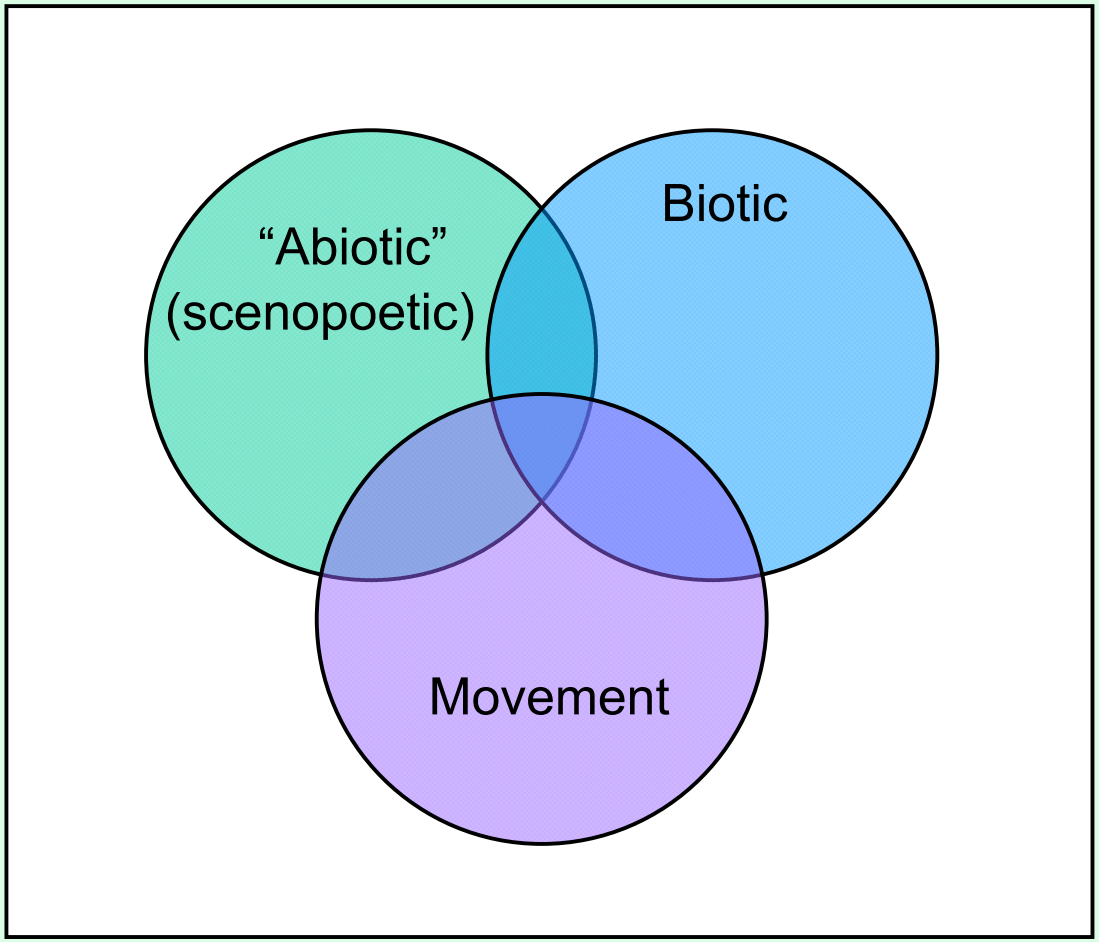

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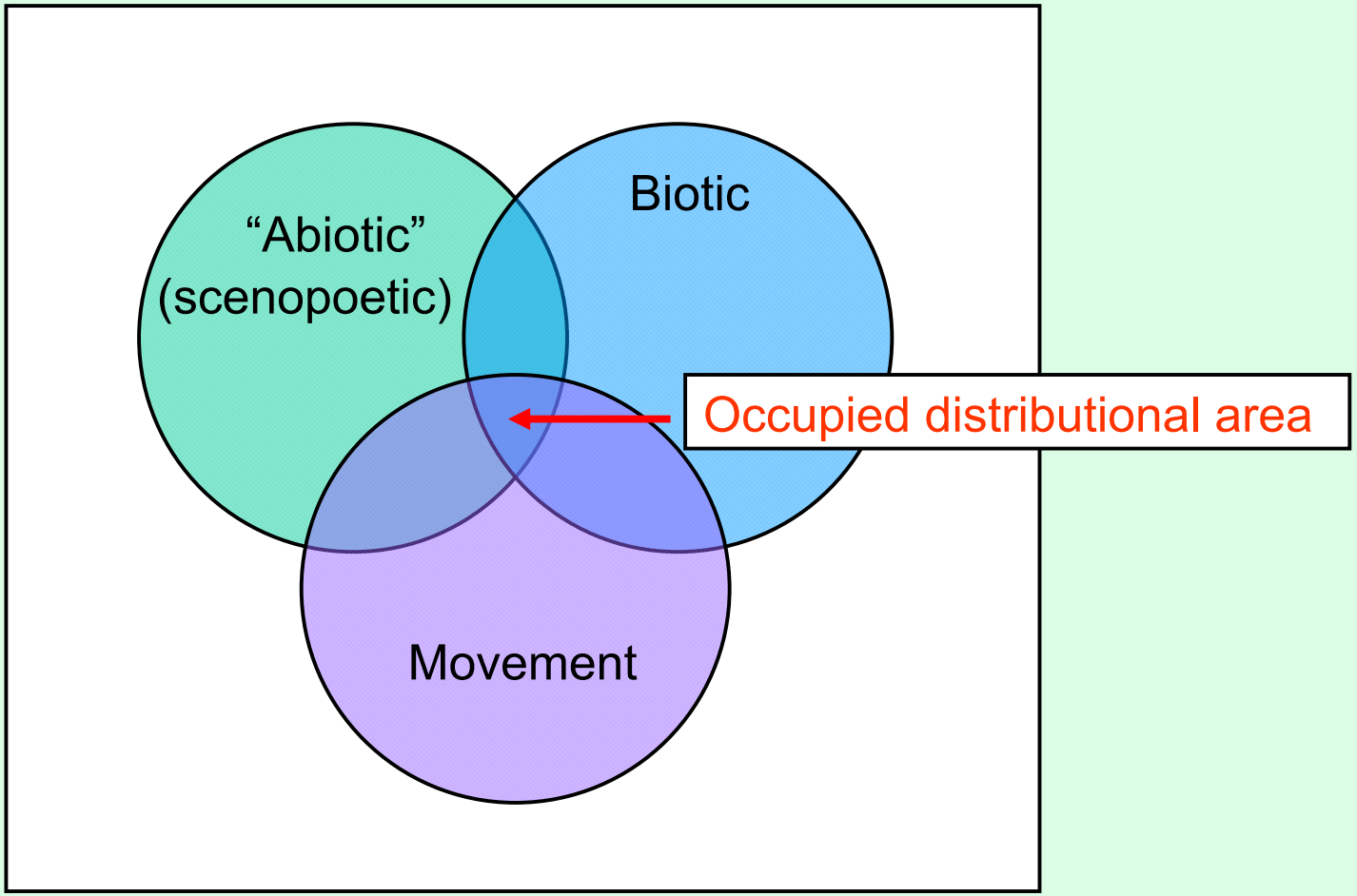

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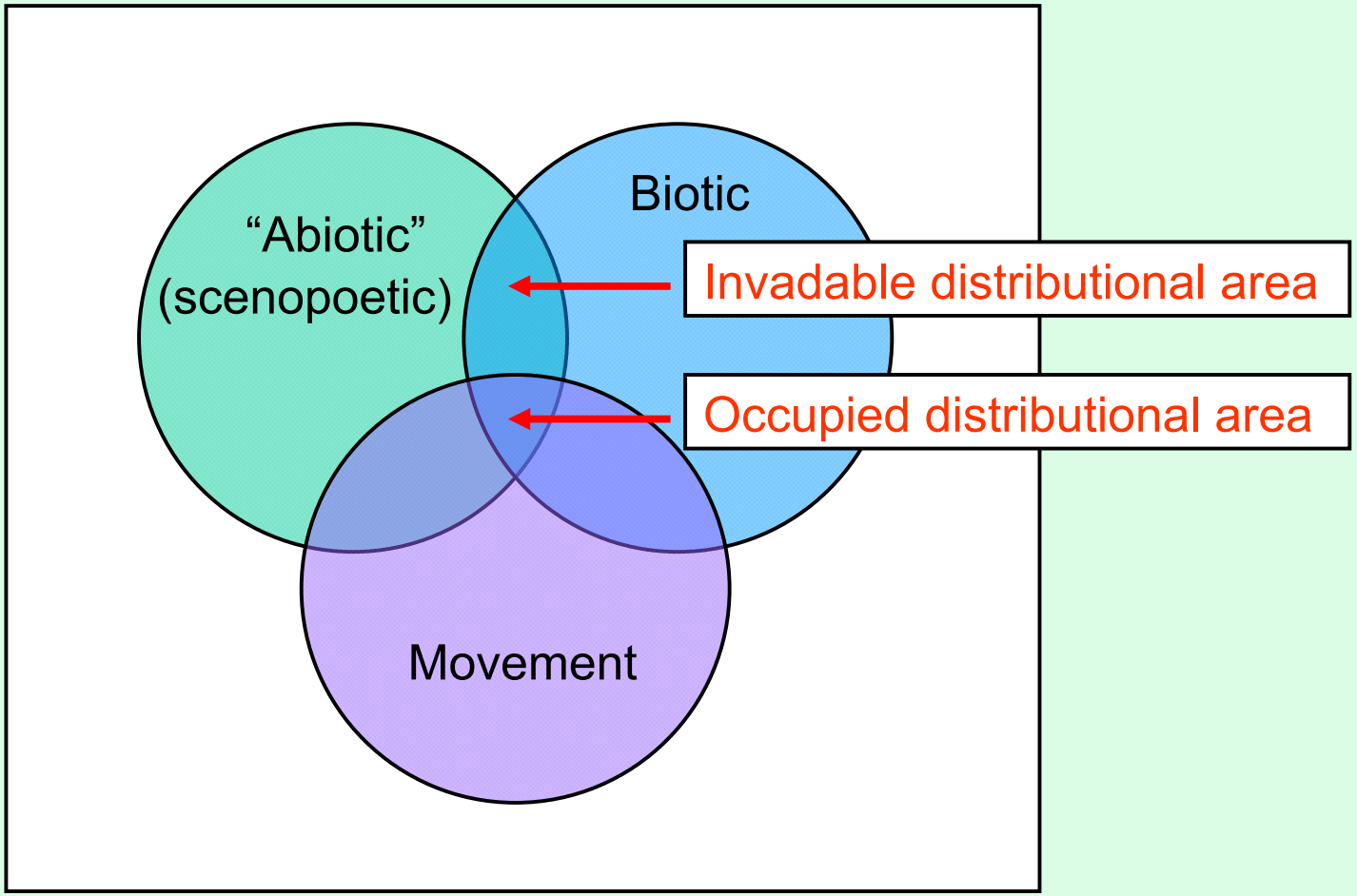

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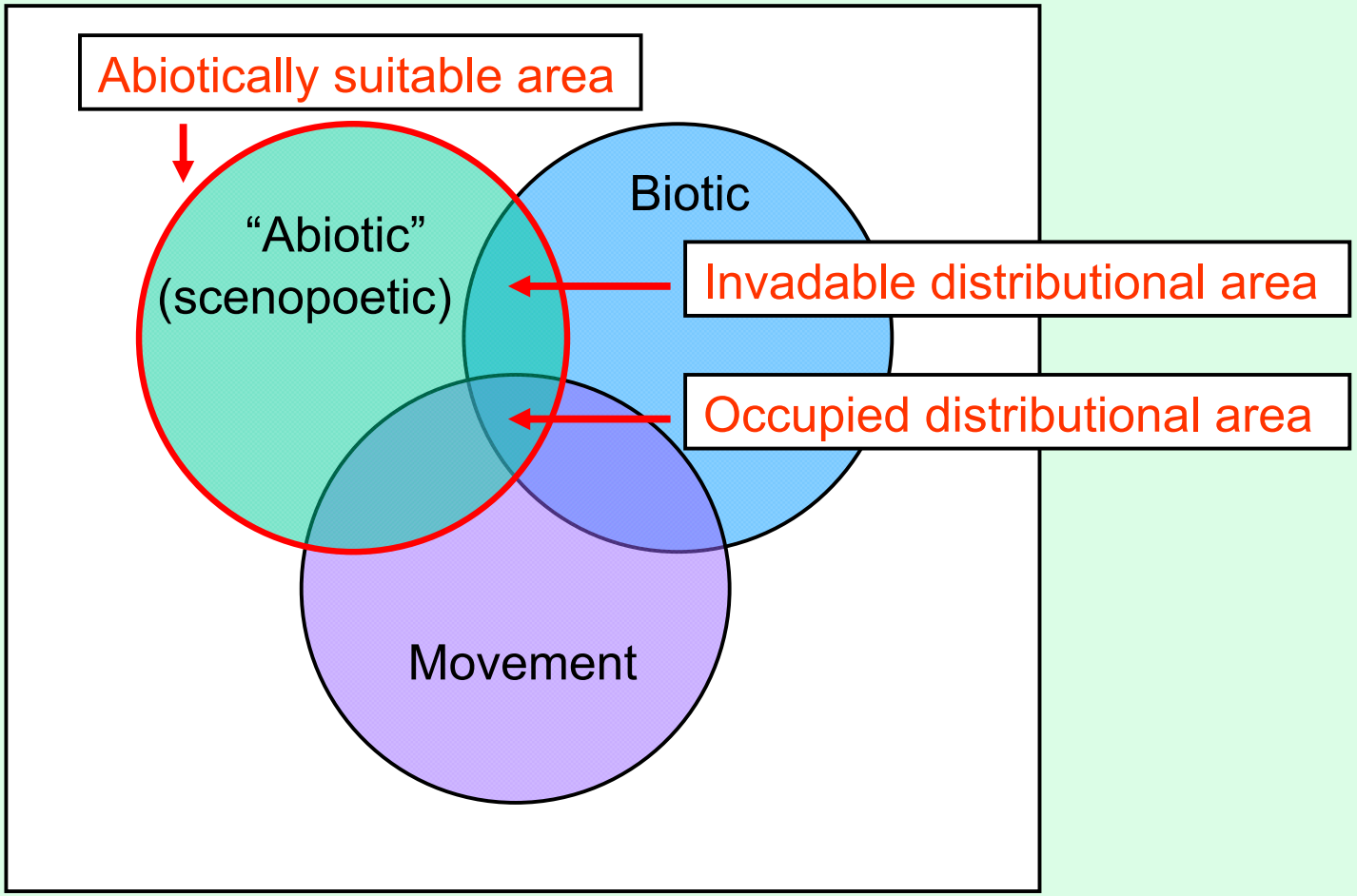

The Problem: Species Habitat Modeling

- goal: model distribution of plant or animal species

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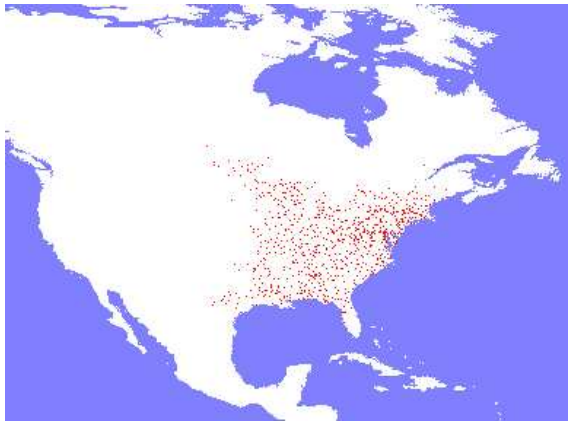

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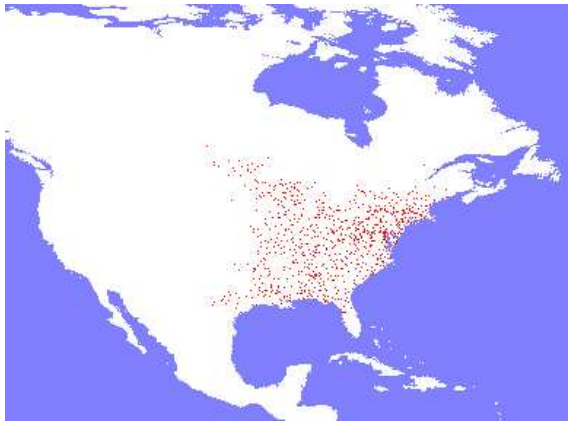
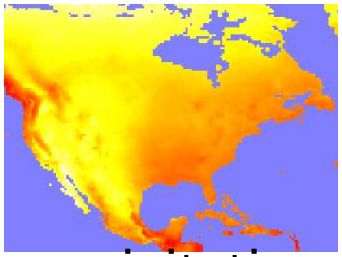
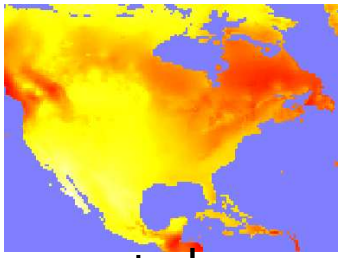


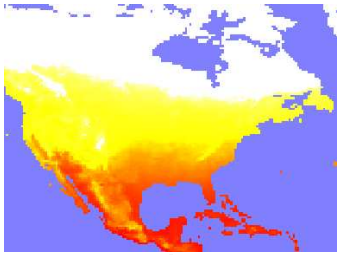
- given: environmental variables



precipitation



wet days



avg. temp.

...

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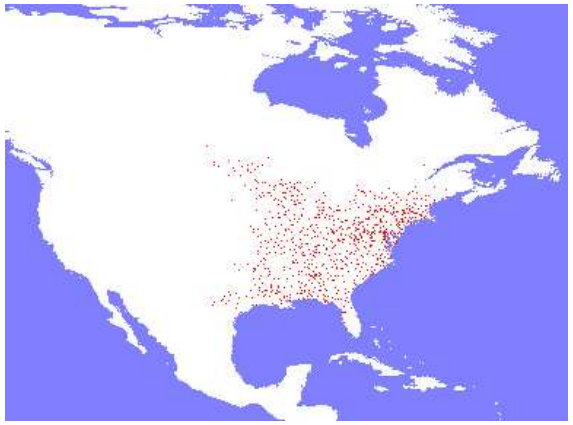

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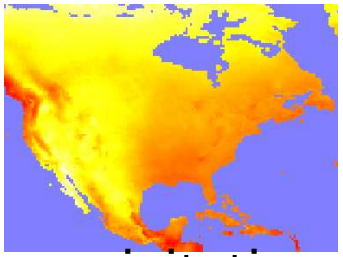

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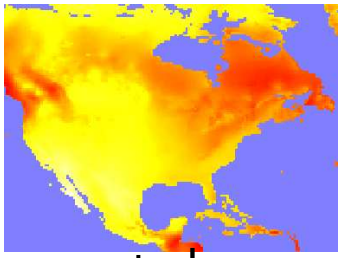

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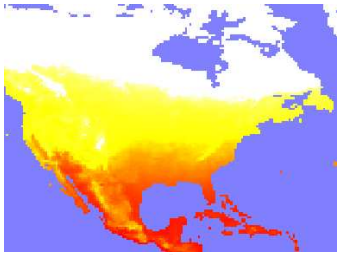
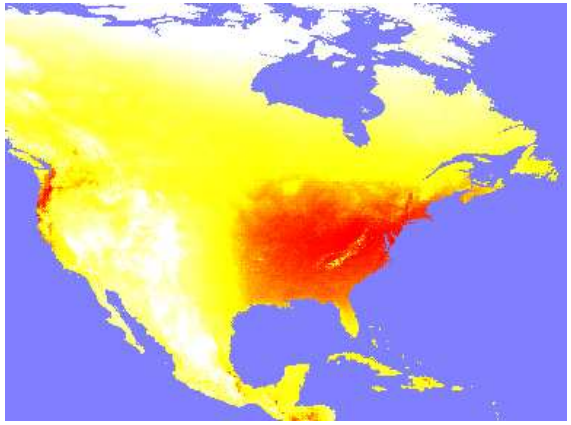


avg. temp.

. . .

- desired output: map of range



Biological Importance

- fundamental question: what are survival requirements (niche) of given species?
- core problem for conservation of species
- first step for many applications:
  - reserve design
  - impact of climate change
  - discovery of new species
  - clarification of taxonomic boundaries

Our Approach

- assume presence records come from probability distribution π
- try to estimate π
- apply maximum entropy approach

Maximum Entropy (Maxent) method

Estimates *target probability distribution*

by finding probability distribution (statistical model) of *maximum entropy* (i.e., most spread out, closest to uniform)

subject to *constraints*

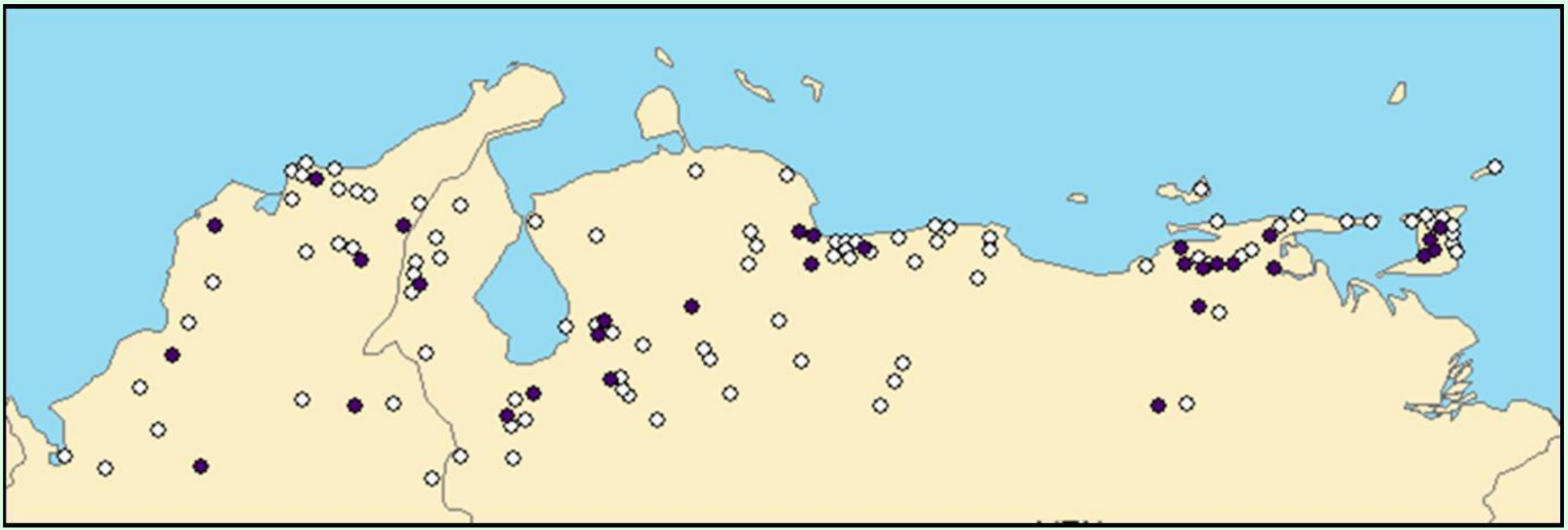
Maximum Entropy (Maxent) method

Constraints: what we know about the features

Data from the sample points (the known occurrence localities, in our case)

Random subsets

random split-sample approach: easy test, cannot detect overfitting to bias



White: calibrate the model

Black: evaluate the model

Now we will review the output of MaxEnt and the interpretation of the results

Please leave us your anonymous feedback in this link:

https://docs.google.com/forms/d/1yVSL1lPiFVuJqPPi0v19oQBGyoJqZBoDEYLTcHTpB-M/edit?usp=sharing

it is super, super important for us!!

Many of the slides were taken from presentations by Robert P. Anderson & Robert Schapire