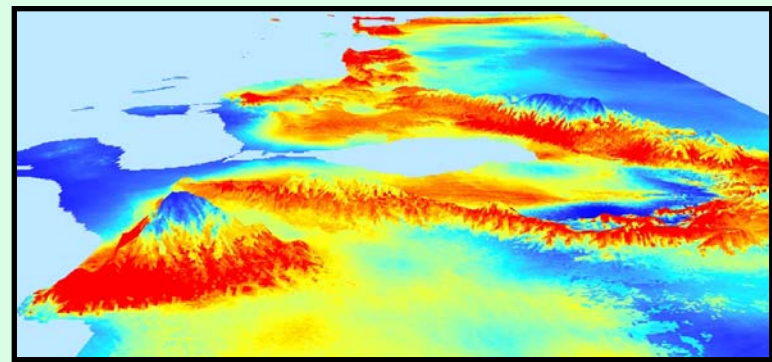
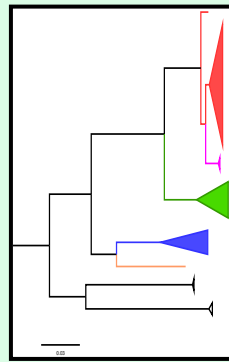


# From ecological niches to geographic distributions and back

Robert P. Anderson  
Department of Biology  
City College of CUNY



# Niches: inherited physiologies

## Mechanistic

process-based

physiology

lab or greenhouse  
experiments

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statistical

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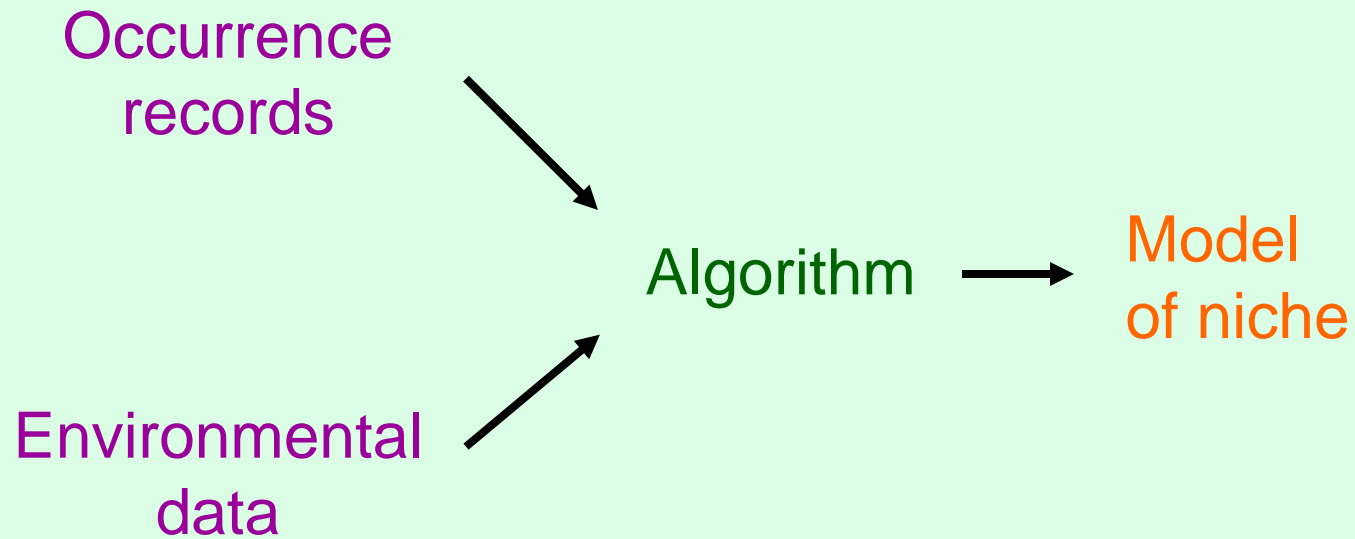
## Correlative

statistical

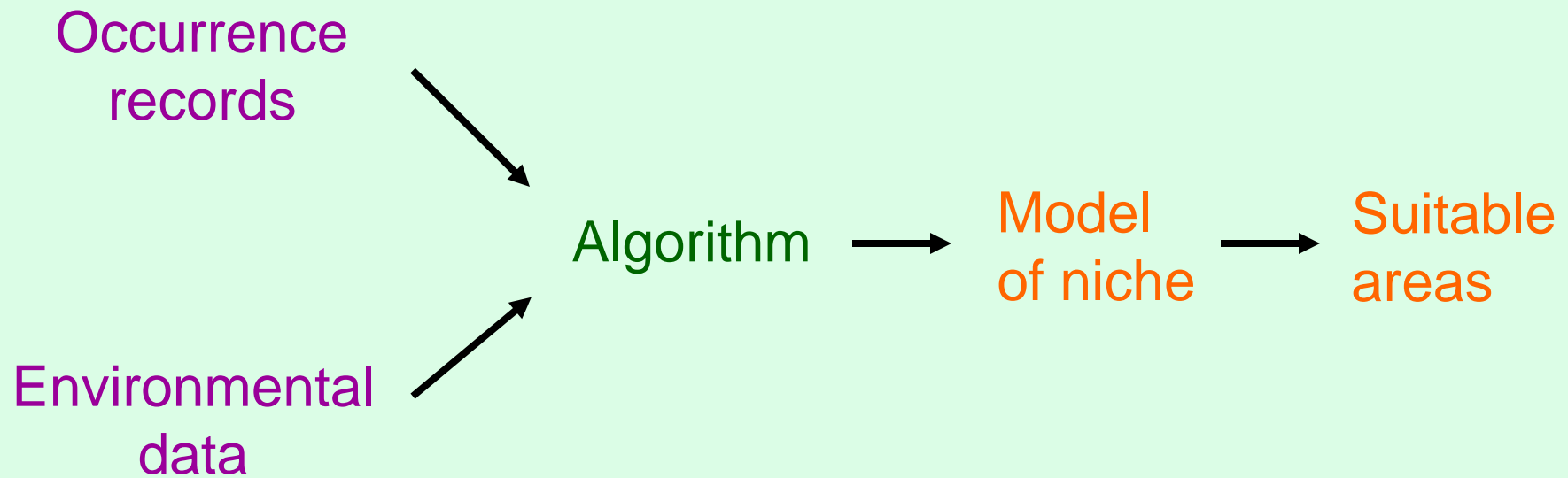
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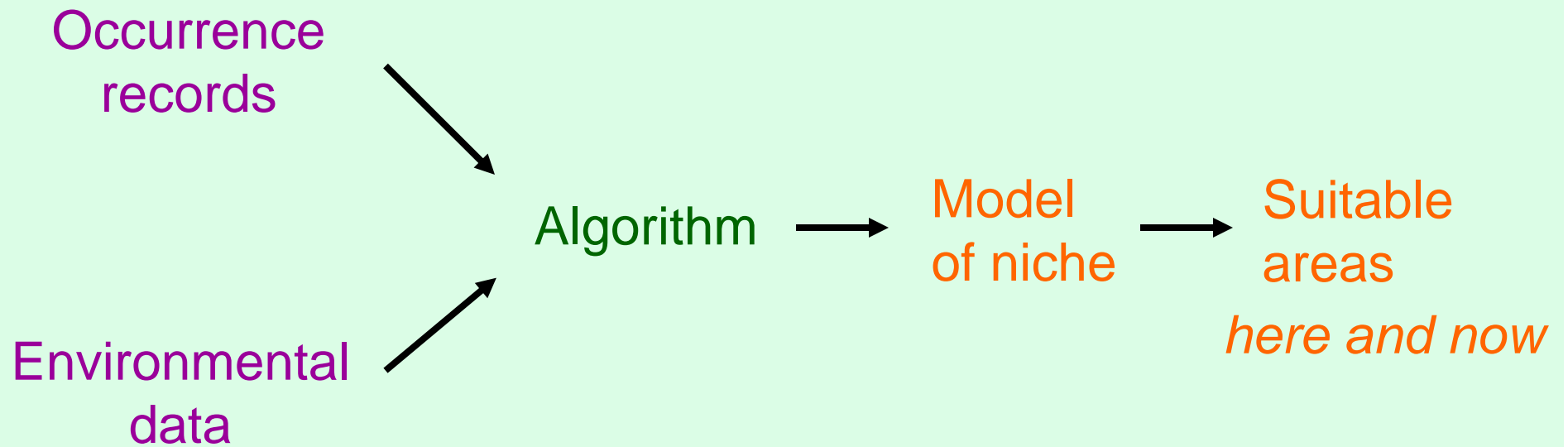
# Presence-only methods for modeling species distributions



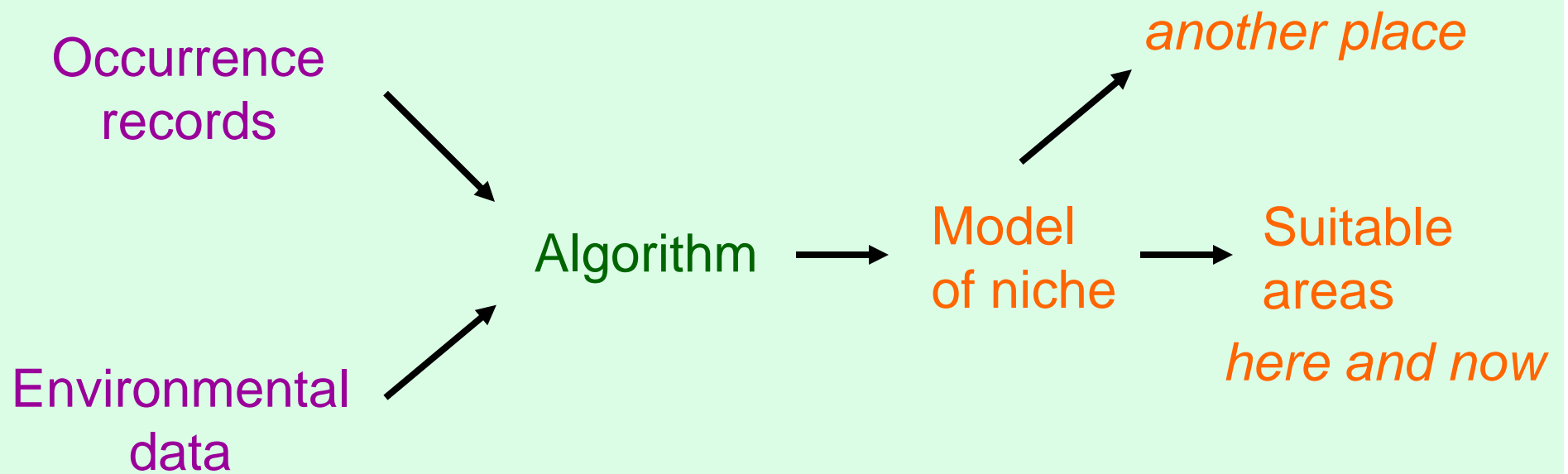
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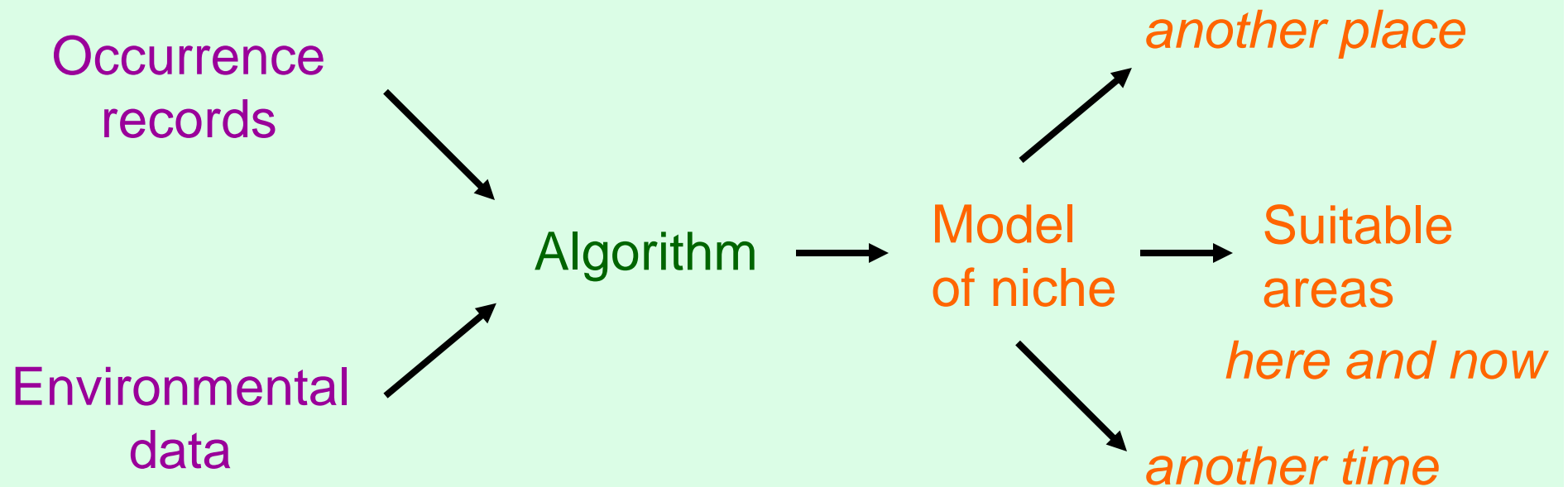


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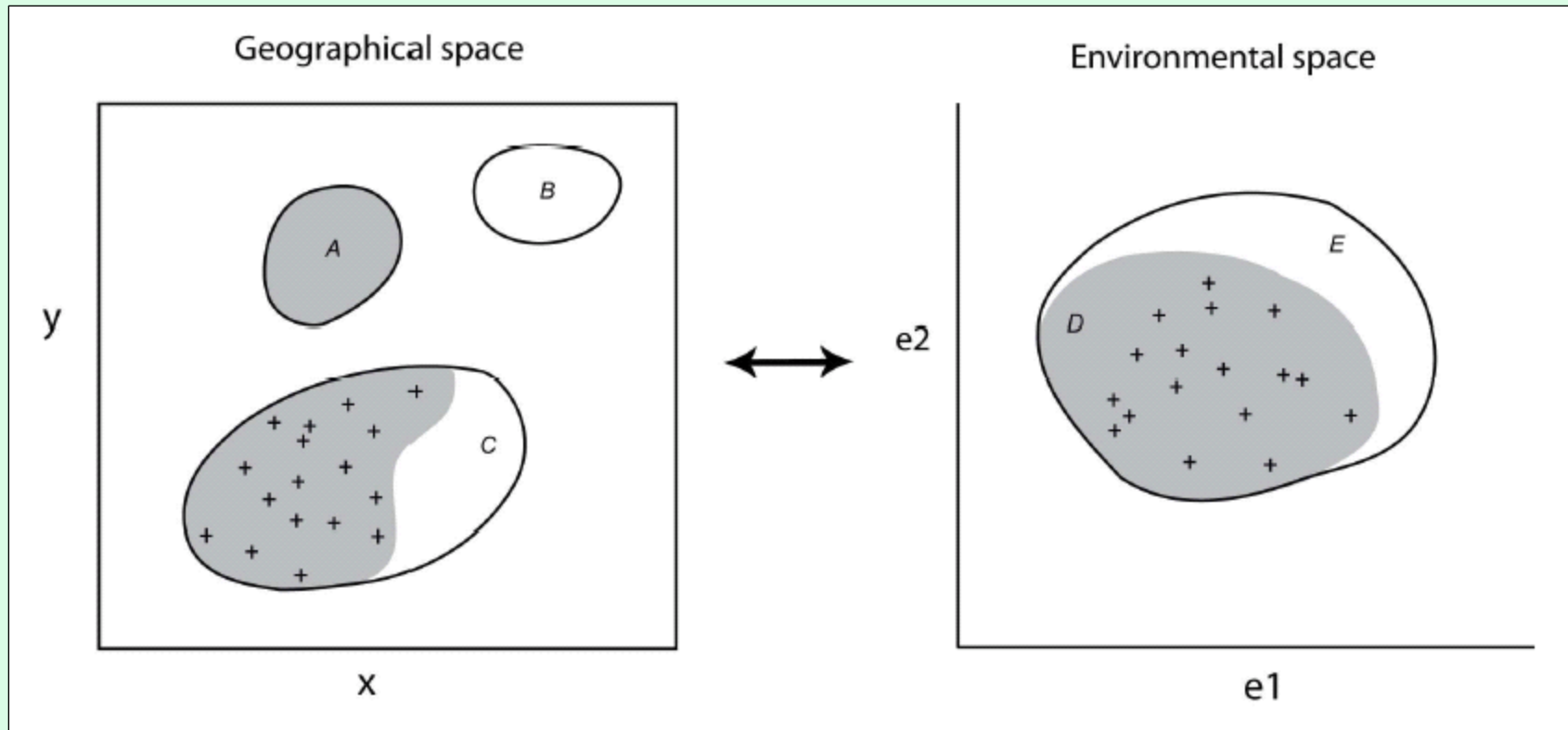




# Presence-only methods for modeling species distributions

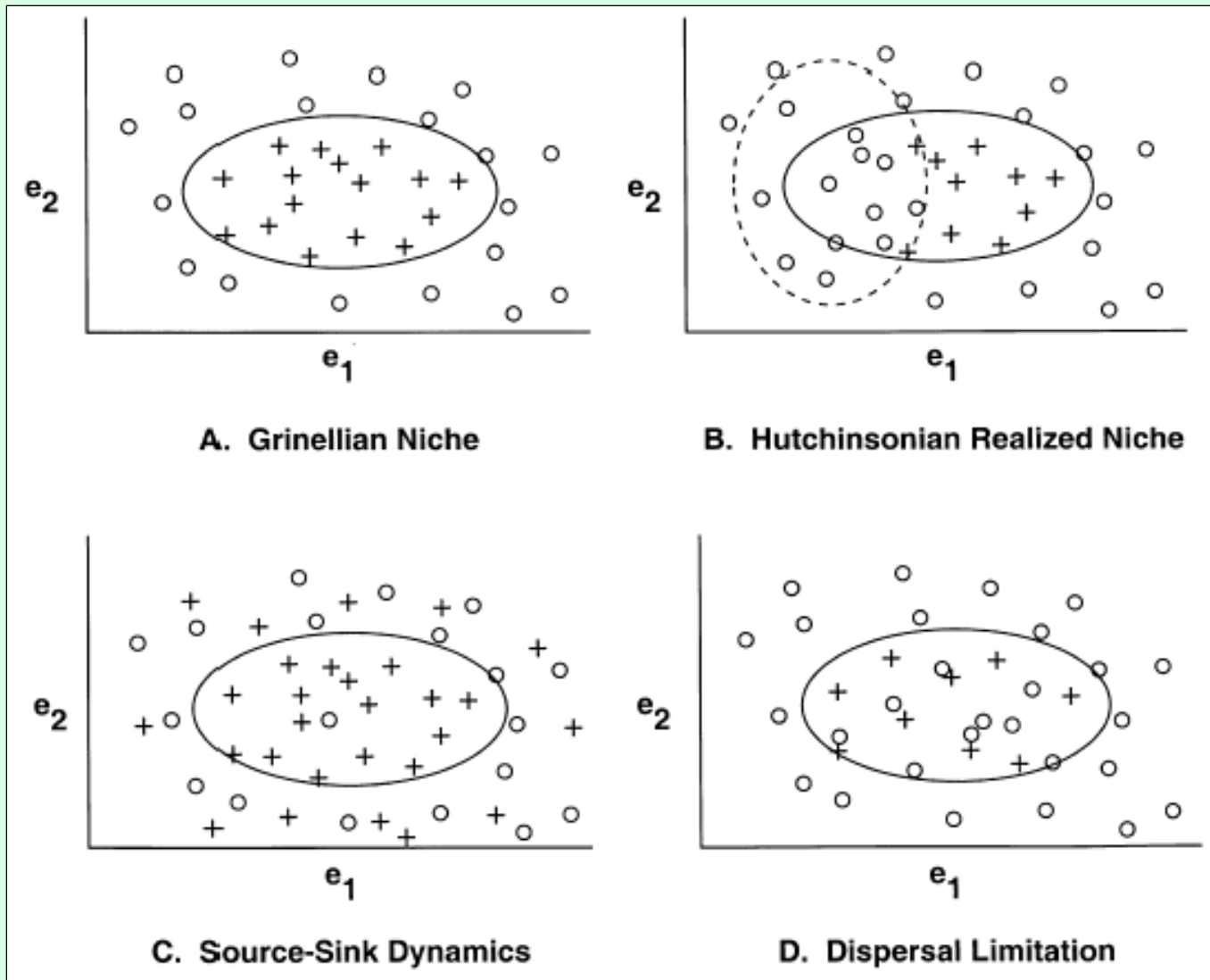


# G-space and E-space



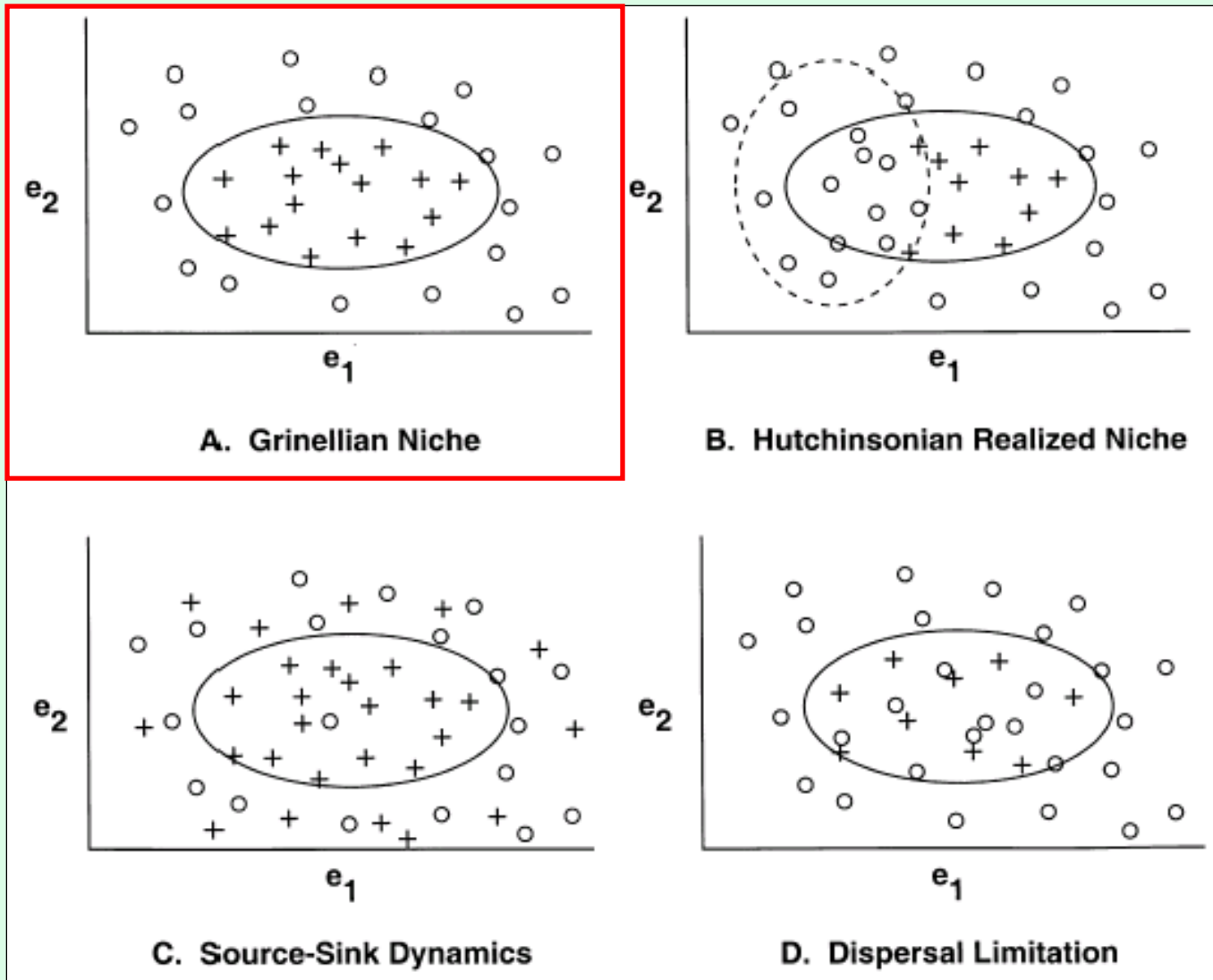
(Pearson, 2008)

# Niche theory



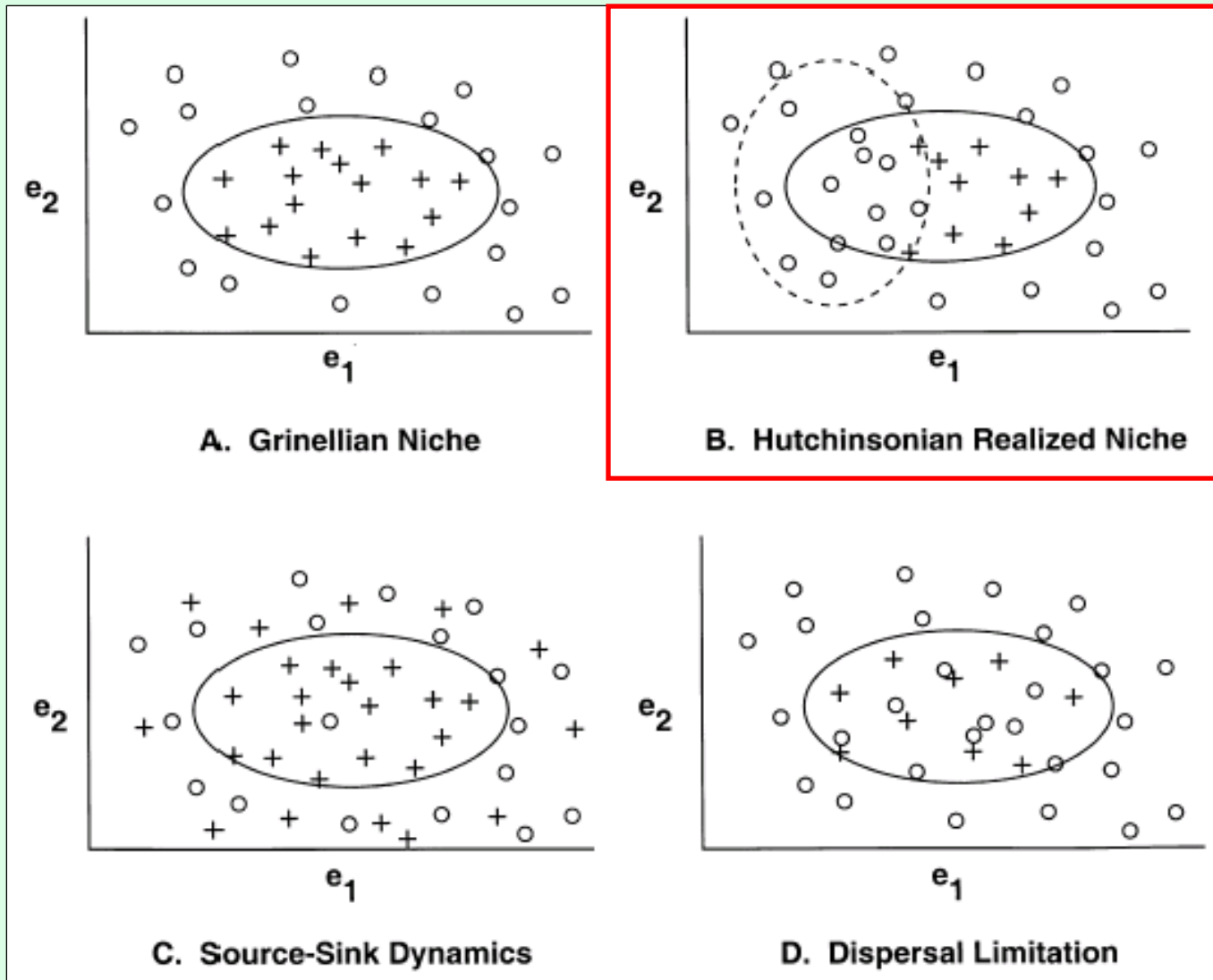
(Pulliam, 2000)

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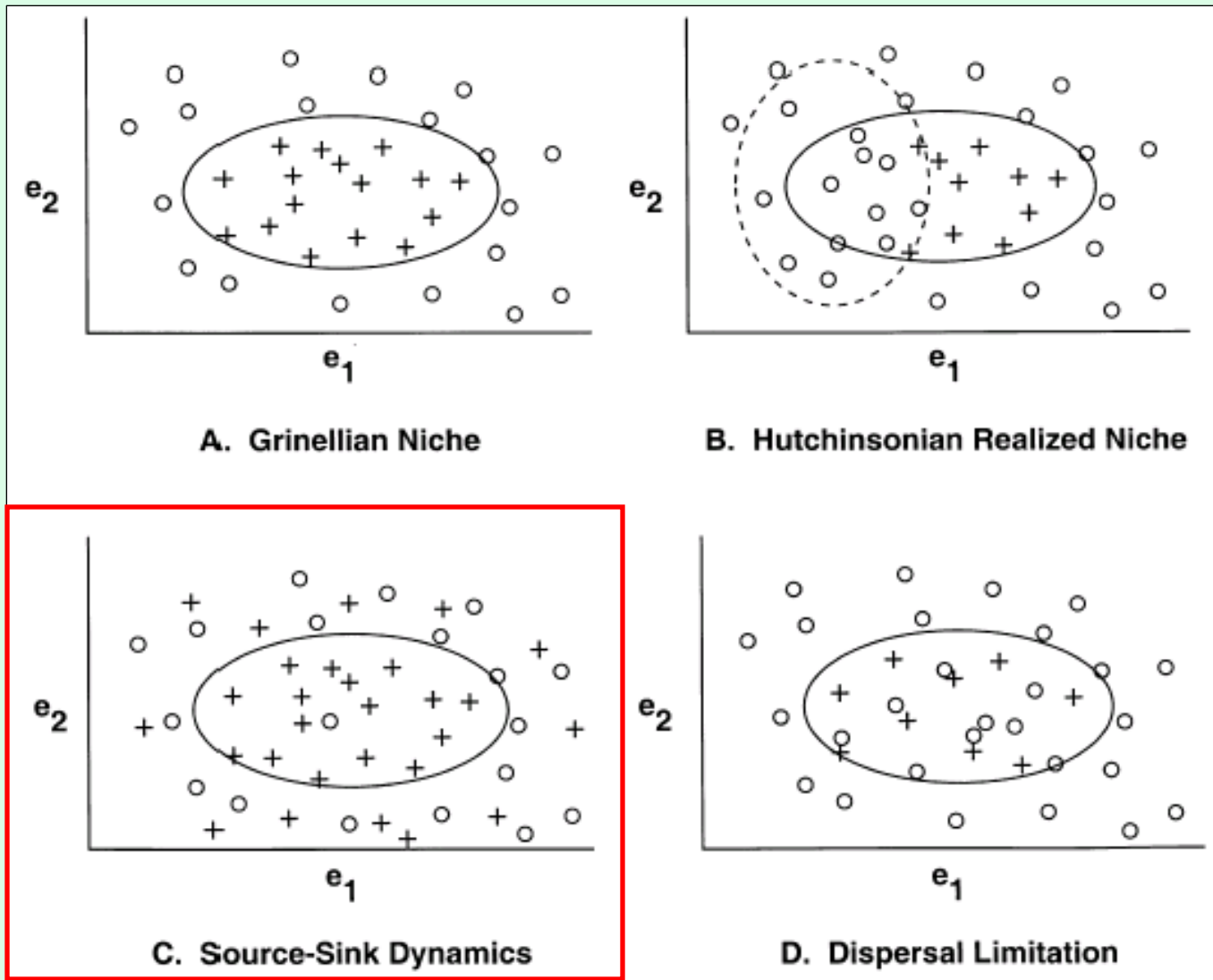
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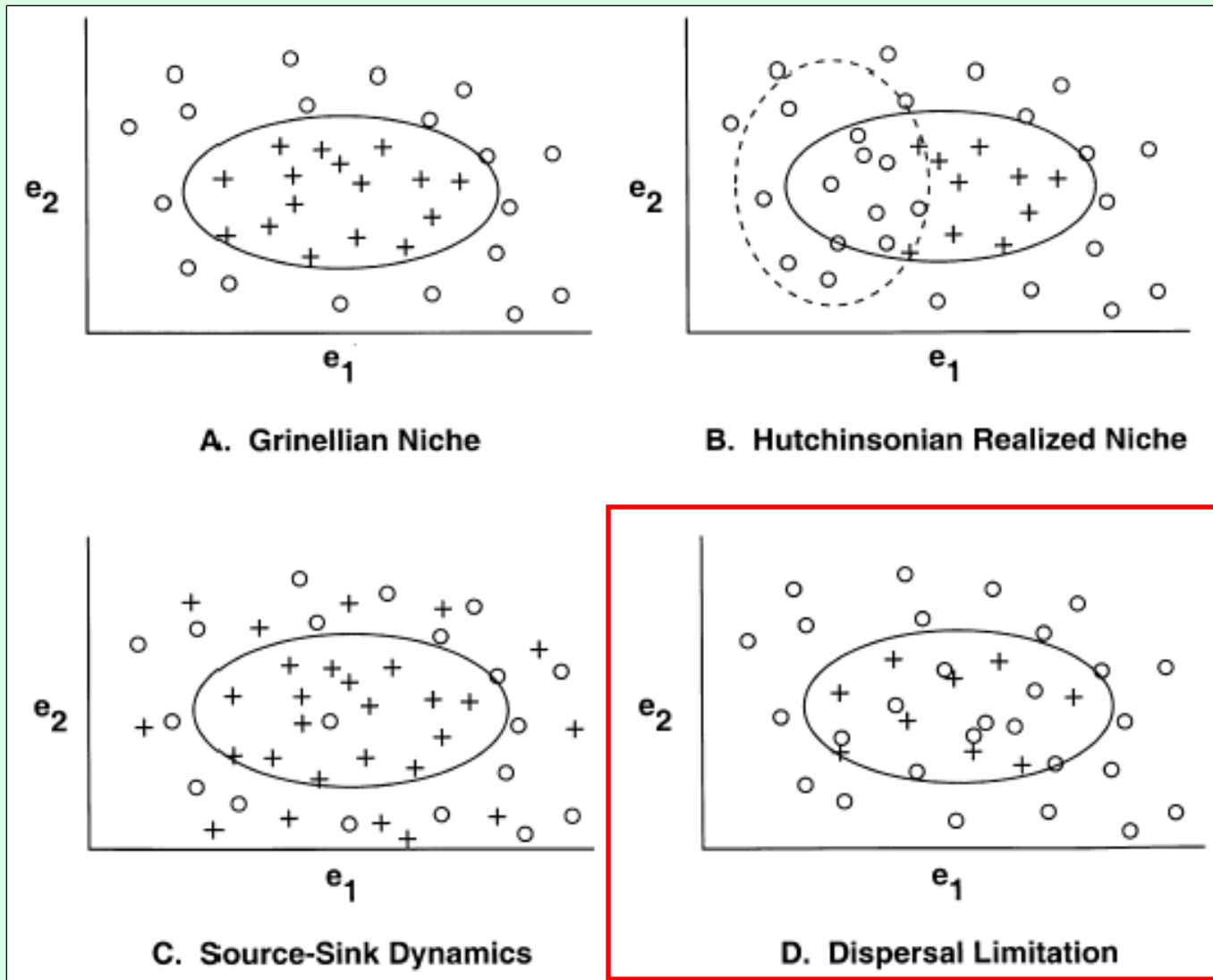
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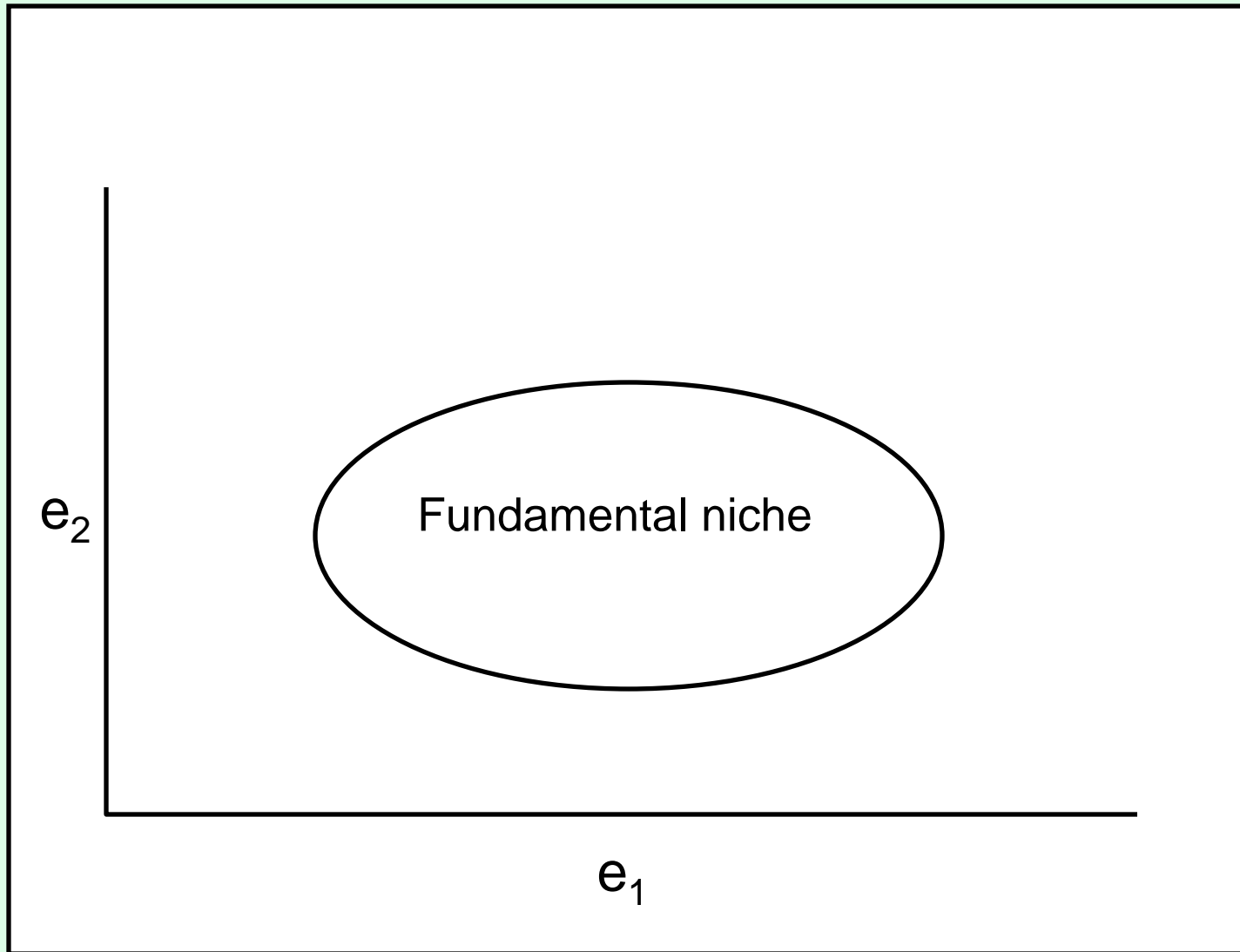
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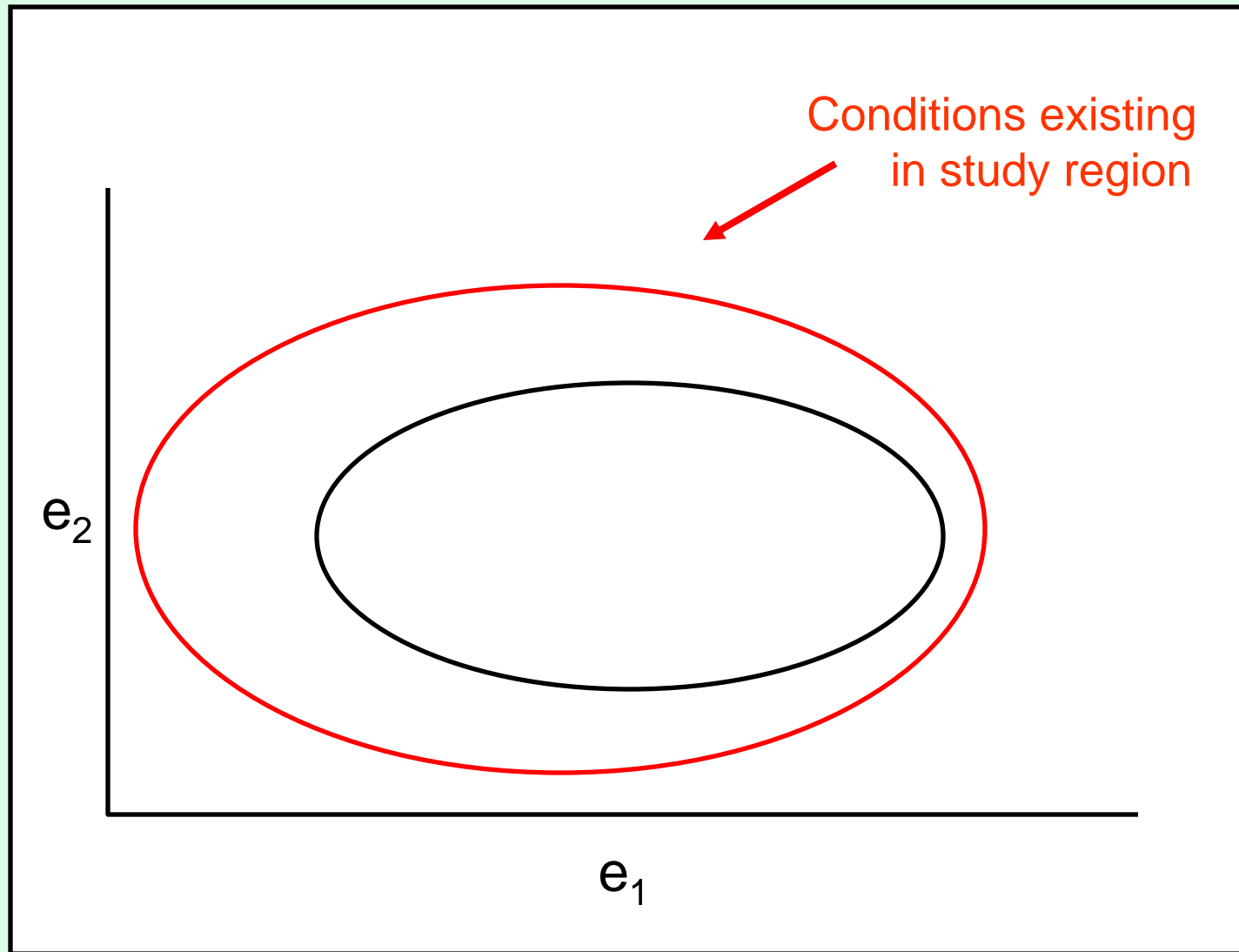
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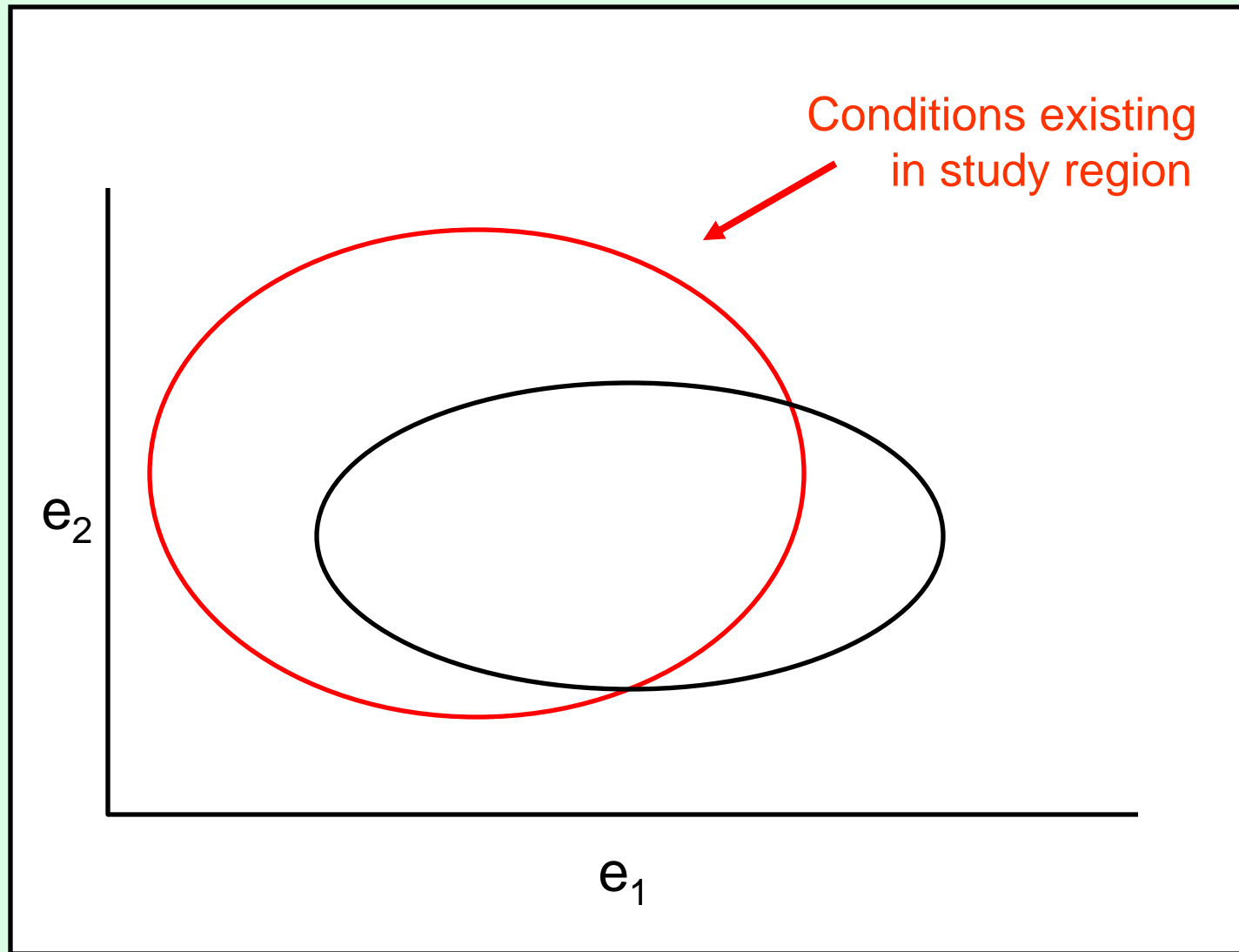


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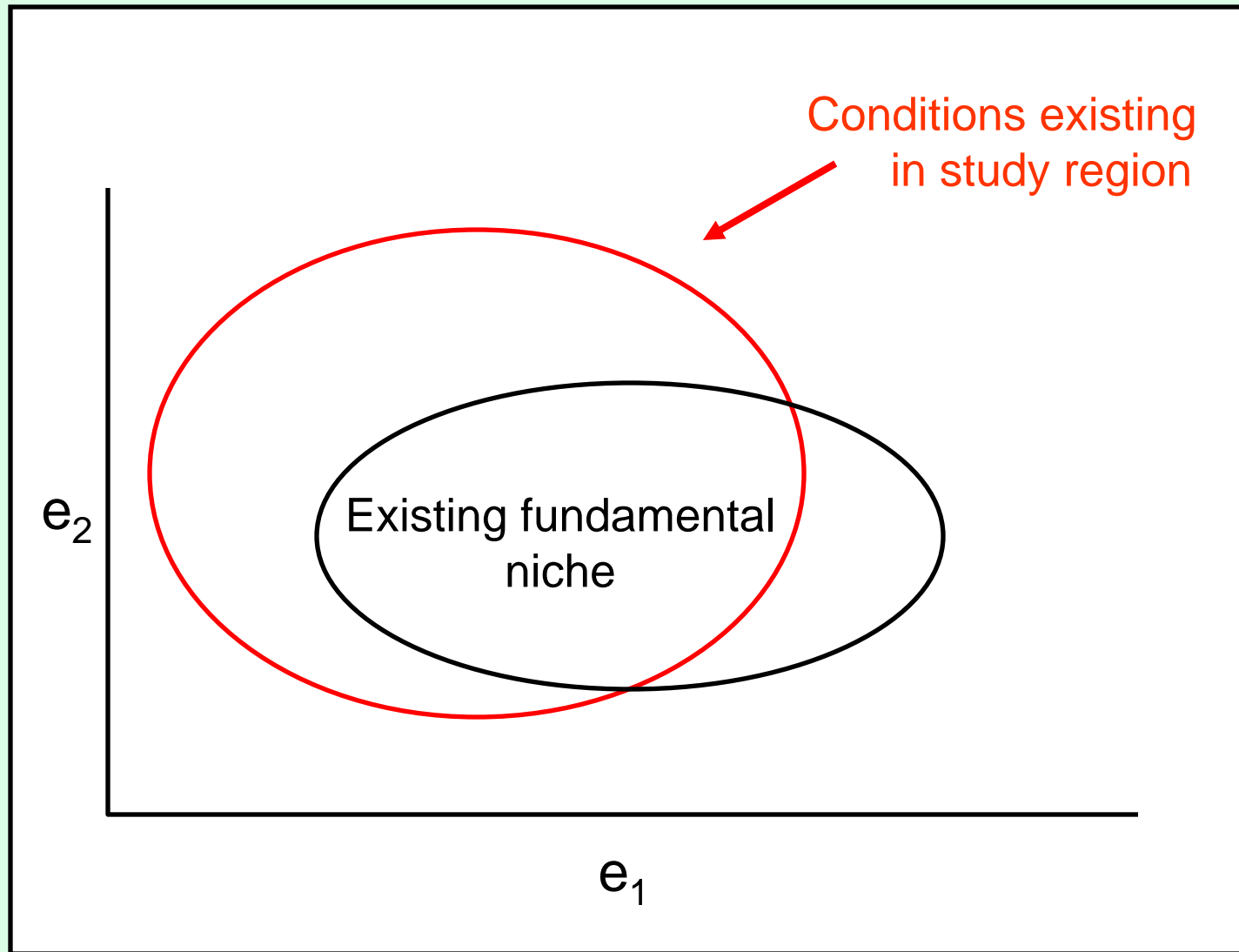
(Jackson and Overpeck, 2000)

# Niche theory



(Jackson and Overpeck, 2000)

# Niche theory



(Jackson and Overpeck, 2000; their "potential niche")

# Ecological niches

## Eltonian niche

linked variables (modified  
by the species)

fine scale

density-dependent;  
resource-impact vectors

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Chase and Leibold (2003)  
*Ecological niches: linking  
classical and  
contemporary  
approaches*. Chicago U.  
Press

# Ecological niches

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un-linked variables (not modified  
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# Ecological Niches and Geographic Distributions

A. Townsend Peterson, Jorge Soberón,  
Richard G. Pearson, Robert P. Anderson,  
Enrique Martínez-Meyer, Miguel Nakamura,  
and Miguel Bastos Araújo

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# Hutchinson?

Fundamental niche

other (reduced) niche spaces  
(inspired by realized 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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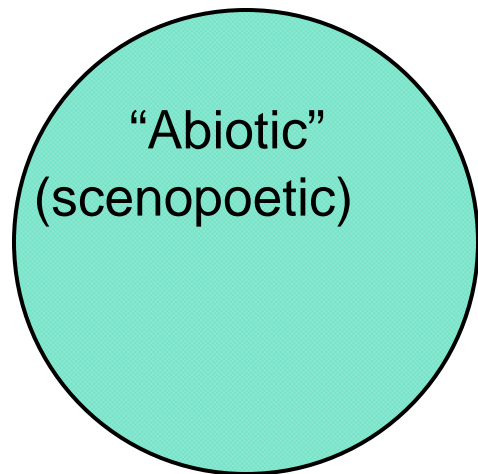
1. Contingent factors
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  - b. local extinction
2. Biotic interactions (e.g., competition)

## Non-equilibrium distributions

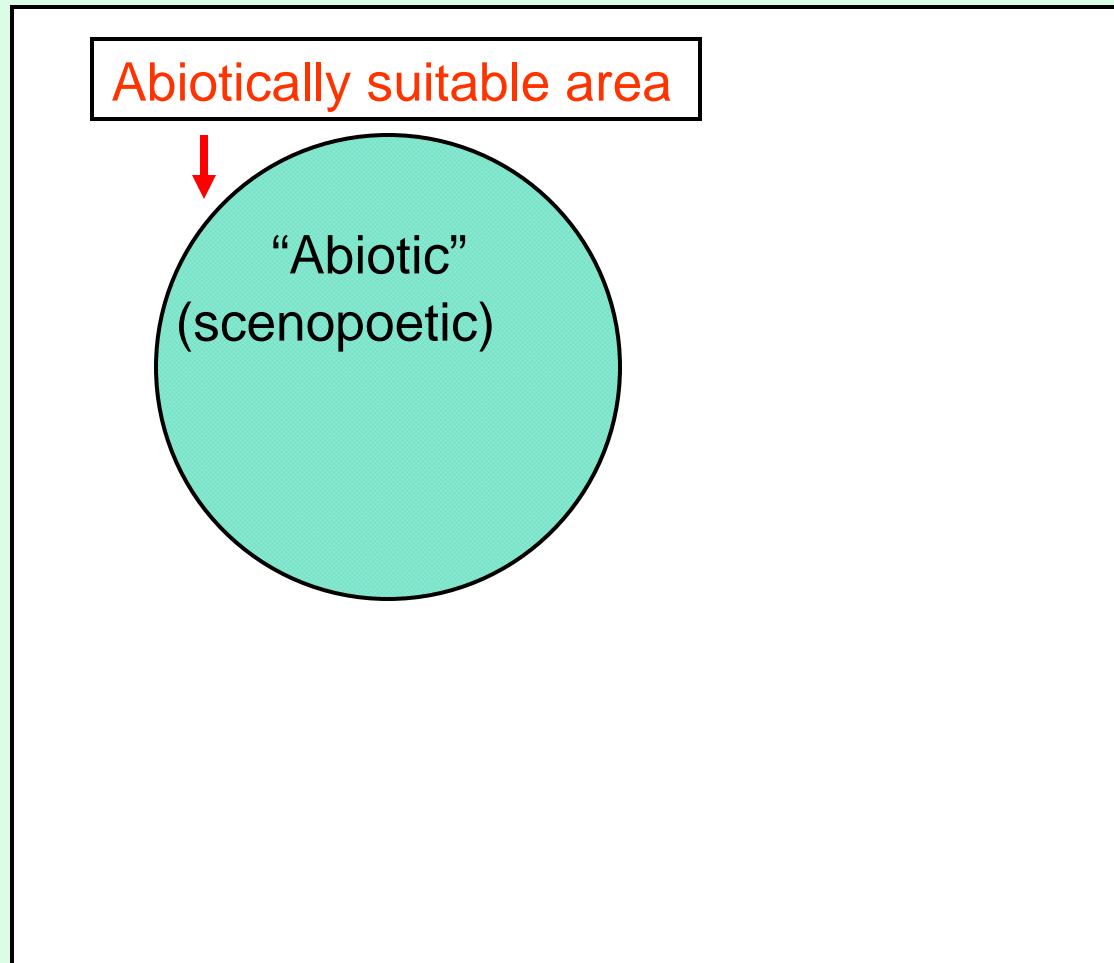
*Occupied distributions* may be smaller than *abiotically suitable distributions* due to:

1. Contingent factors
  - a. lack of dispersal
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2. Biotic interactions (e.g., competition)
3. Human modifications of the landscape

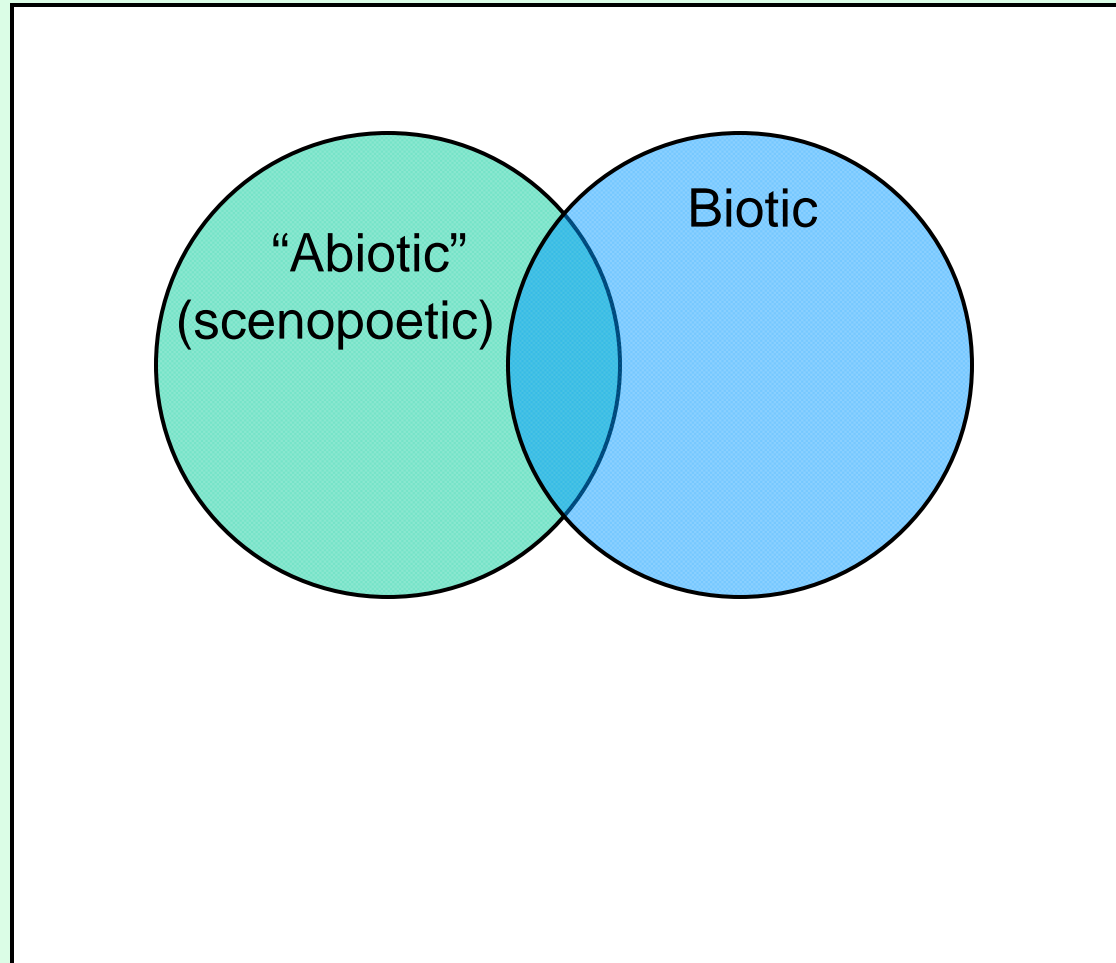
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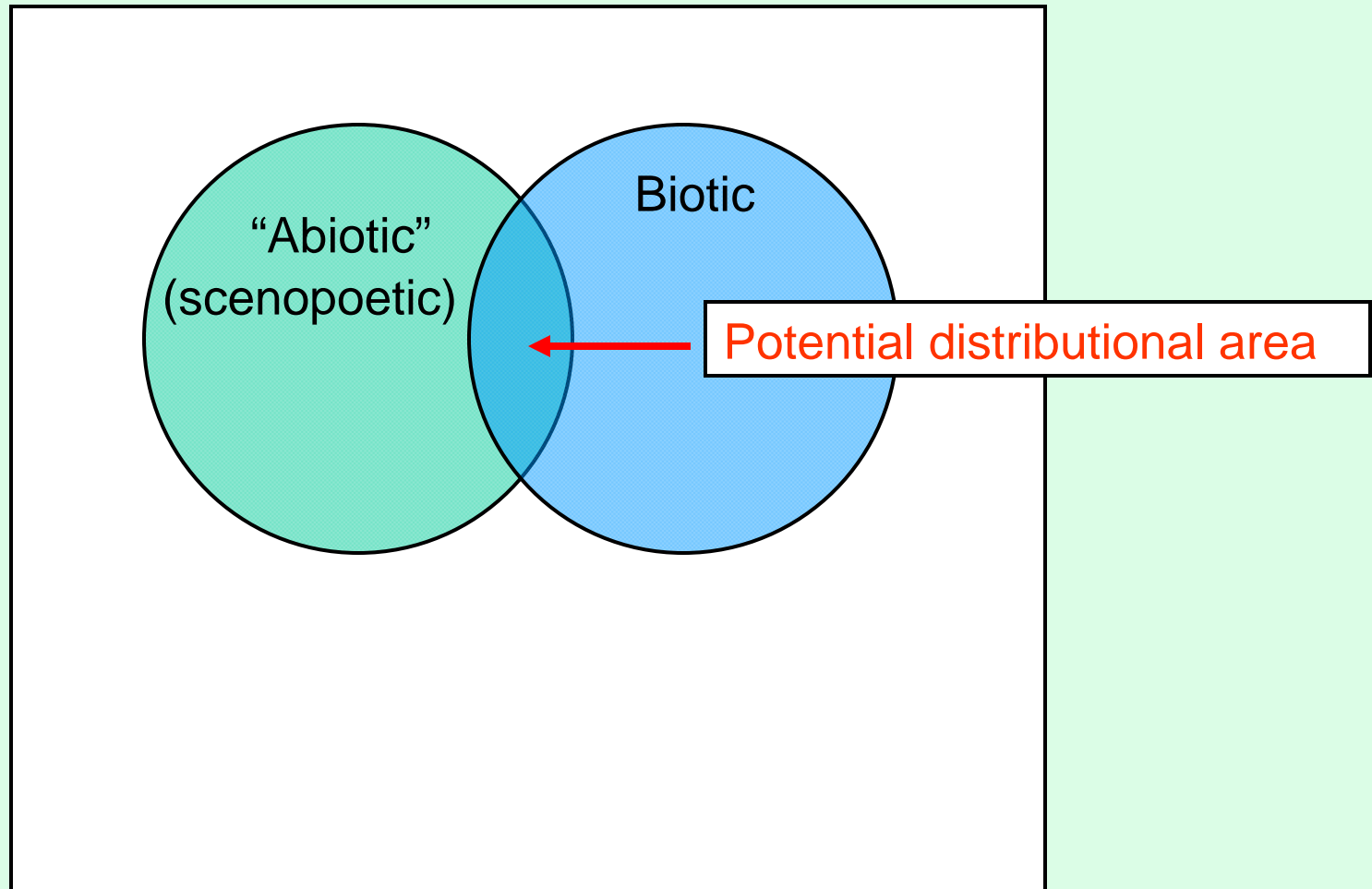


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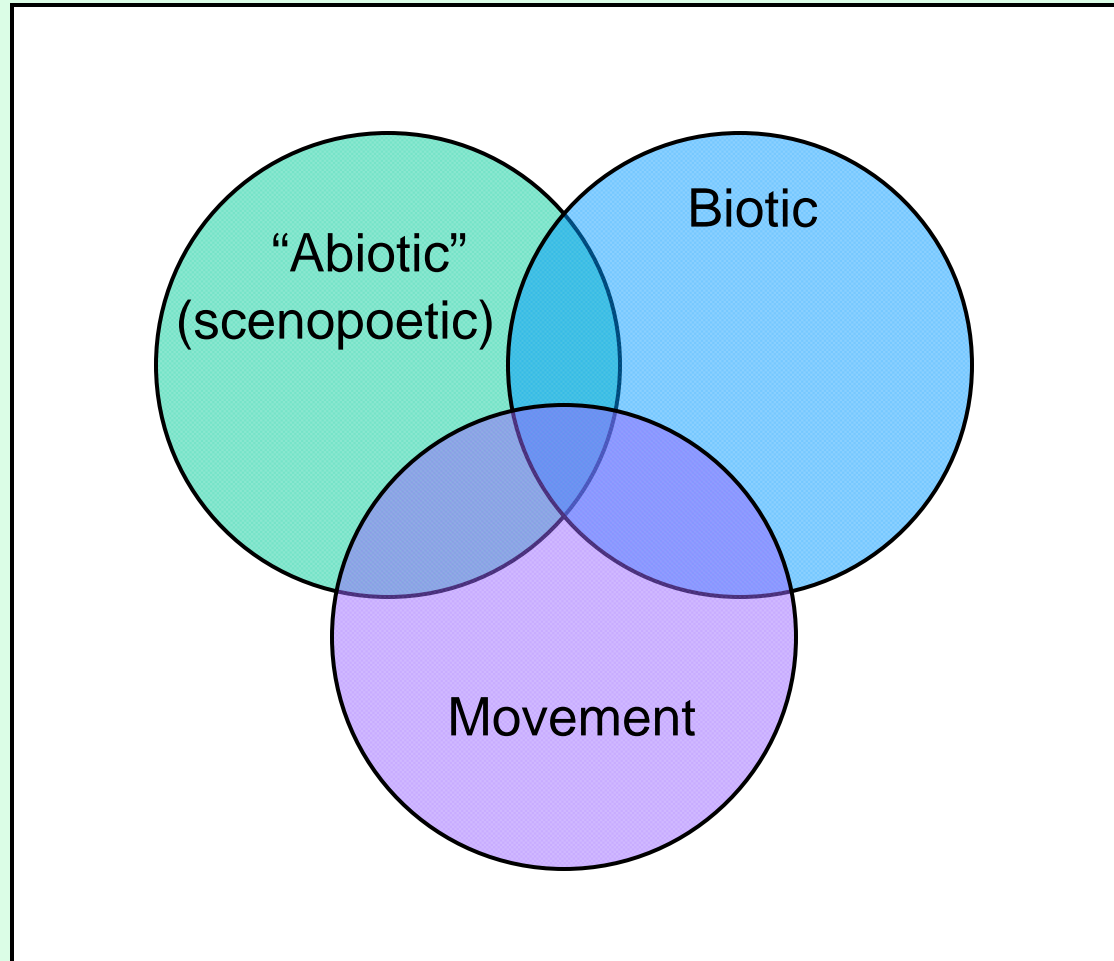




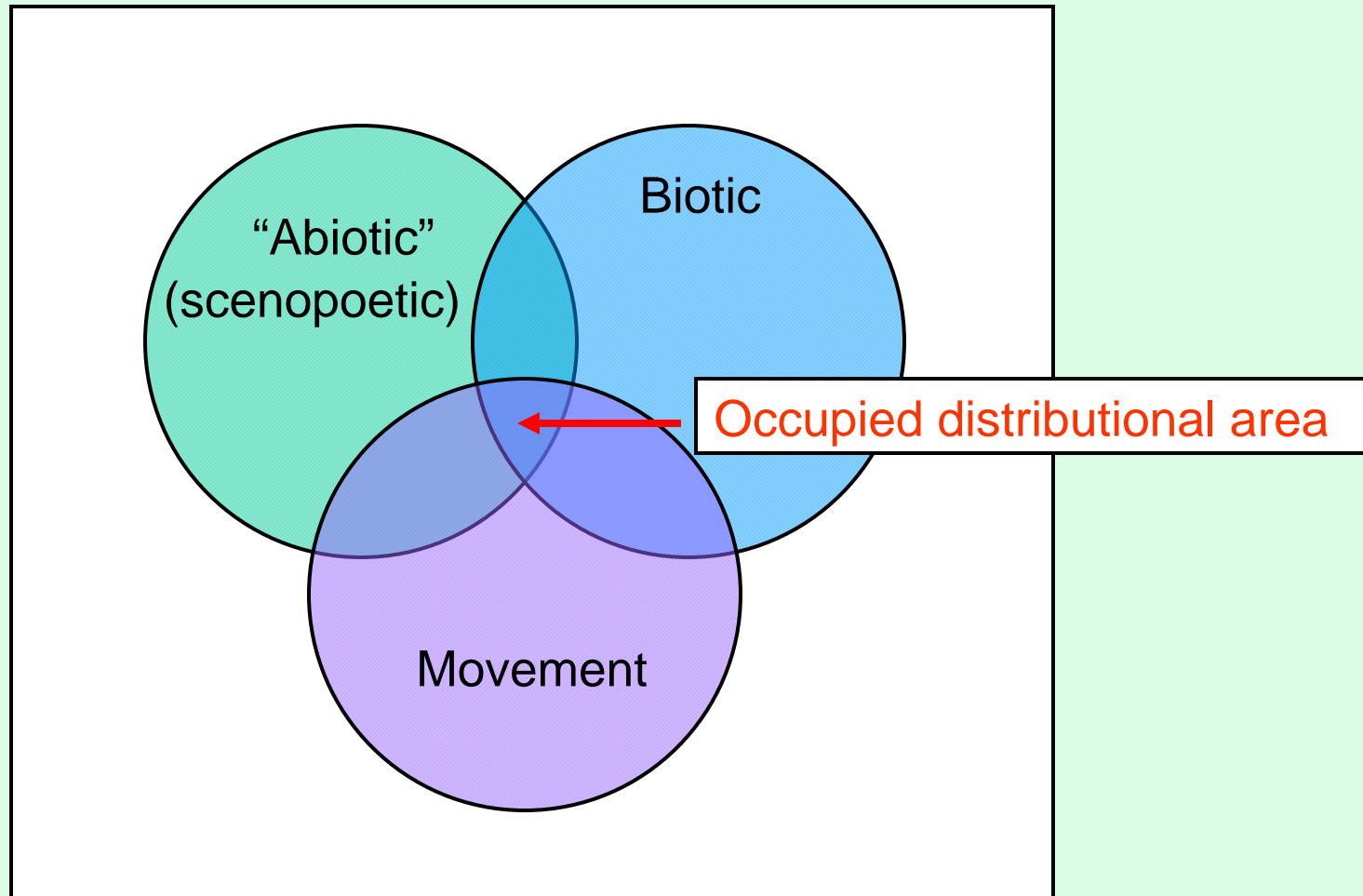
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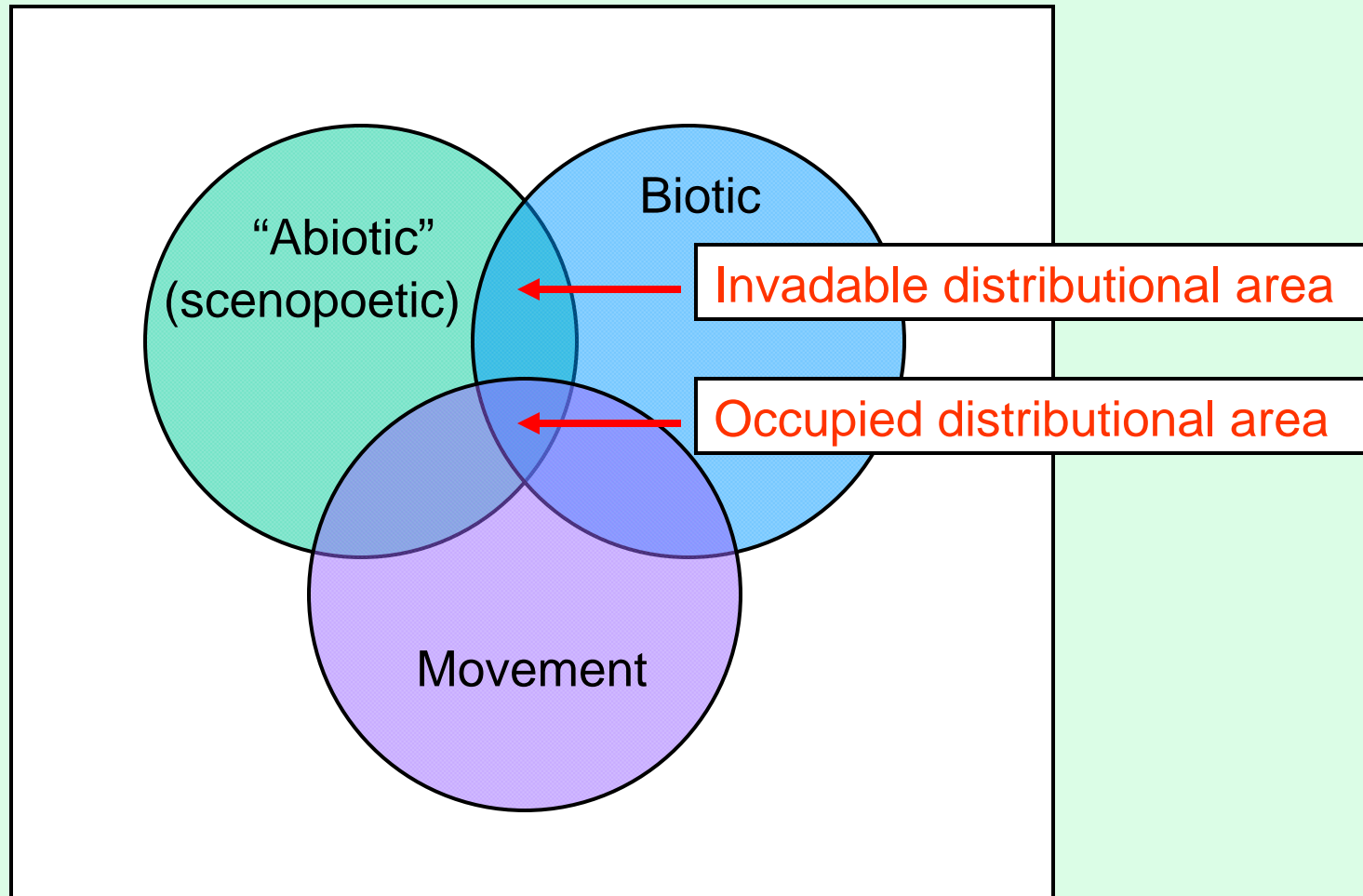
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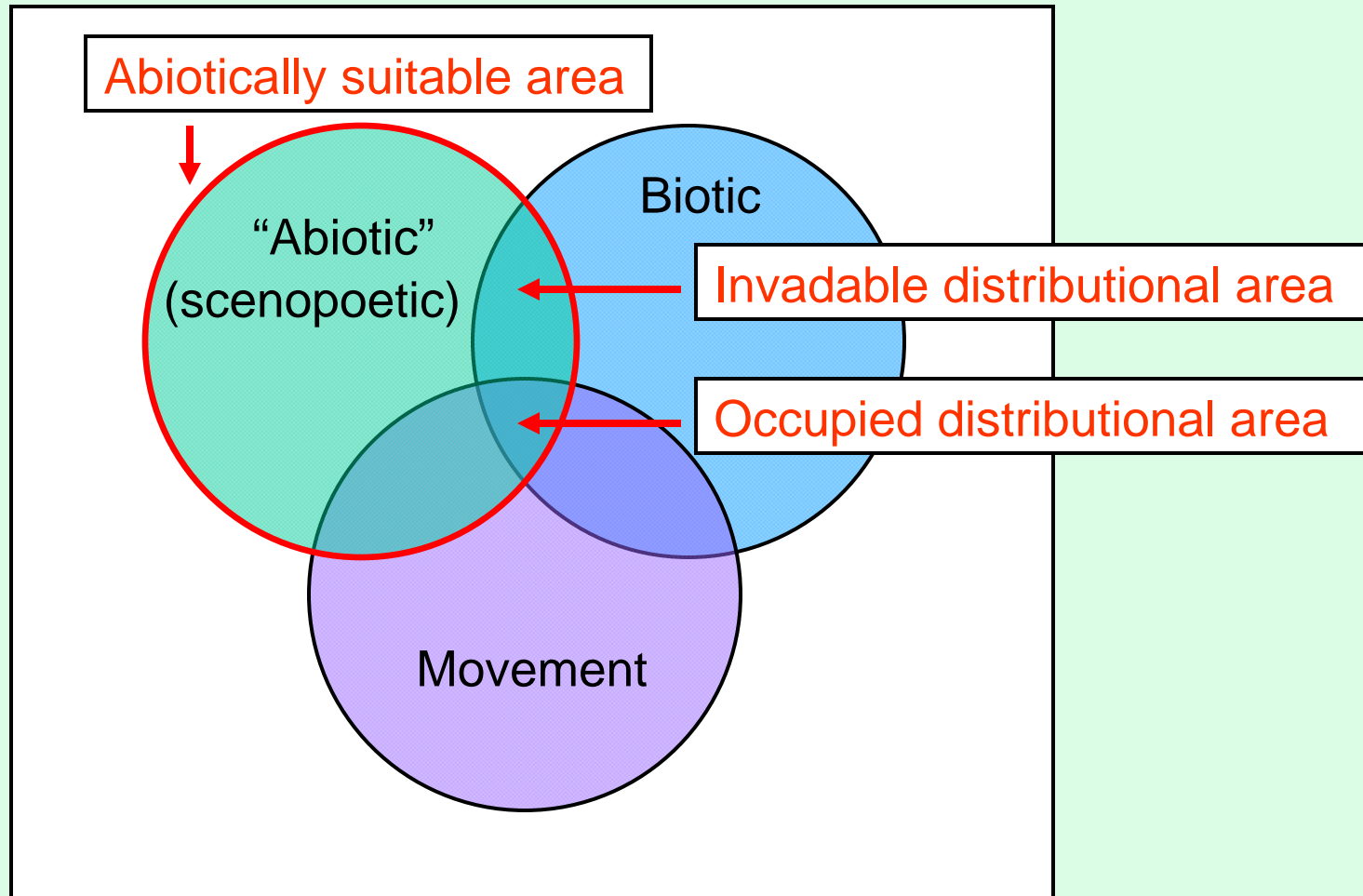
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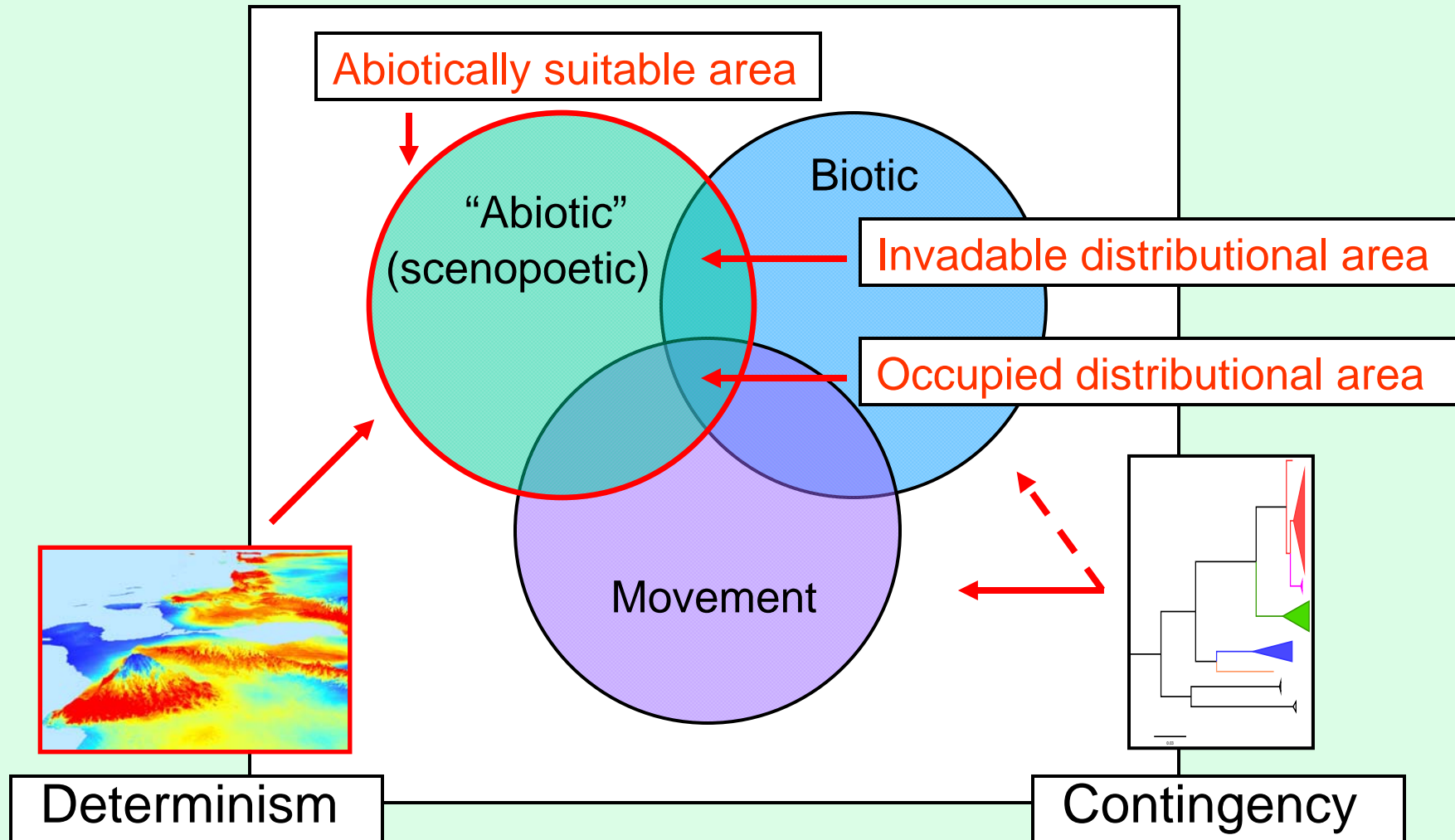
# Non-equilibrium distributions



# Non-equilibrium distributions



# Non-equilibrium distributions



# Beyond Hutchinson

Fundamental niche

Other (reduced) niche spaces

existing fundamental niche

biotically reduced niche

occupied niche

invadable niche

# Geographic areas and niche spaces

G

E



# Geographic areas and niche spaces

G

Abiotically suitable area

Potential distributional area

Invadable distributional area

Occupied distributional area

E

Existing fundamental niche

Biotically reduced niche

Invadable niche

Occupied niche

# Geographic areas and niche spaces

G

Abiotically suitable area

Potential distributional area

Invadable distributional area

Occupied distributional area

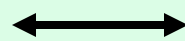
E

Existing fundamental niche

Biotically reduced niche

Invadable niche

Occupied niche



# Geographic areas and niche spaces

G

Abiotically suitable area

Potential distributional area

Invadable distributional area

Occupied distributional area



E

Existing fundamental niche

Biotically reduced niche

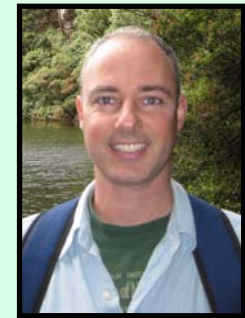
Invadable niche

Occupied niche

Thank you

NSF DEB-0717357 and DEB-1119915

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<http://web.sci.cuny.cuny.edu/~anderson>

