# Partitioning Diversity

# Diversity Indices

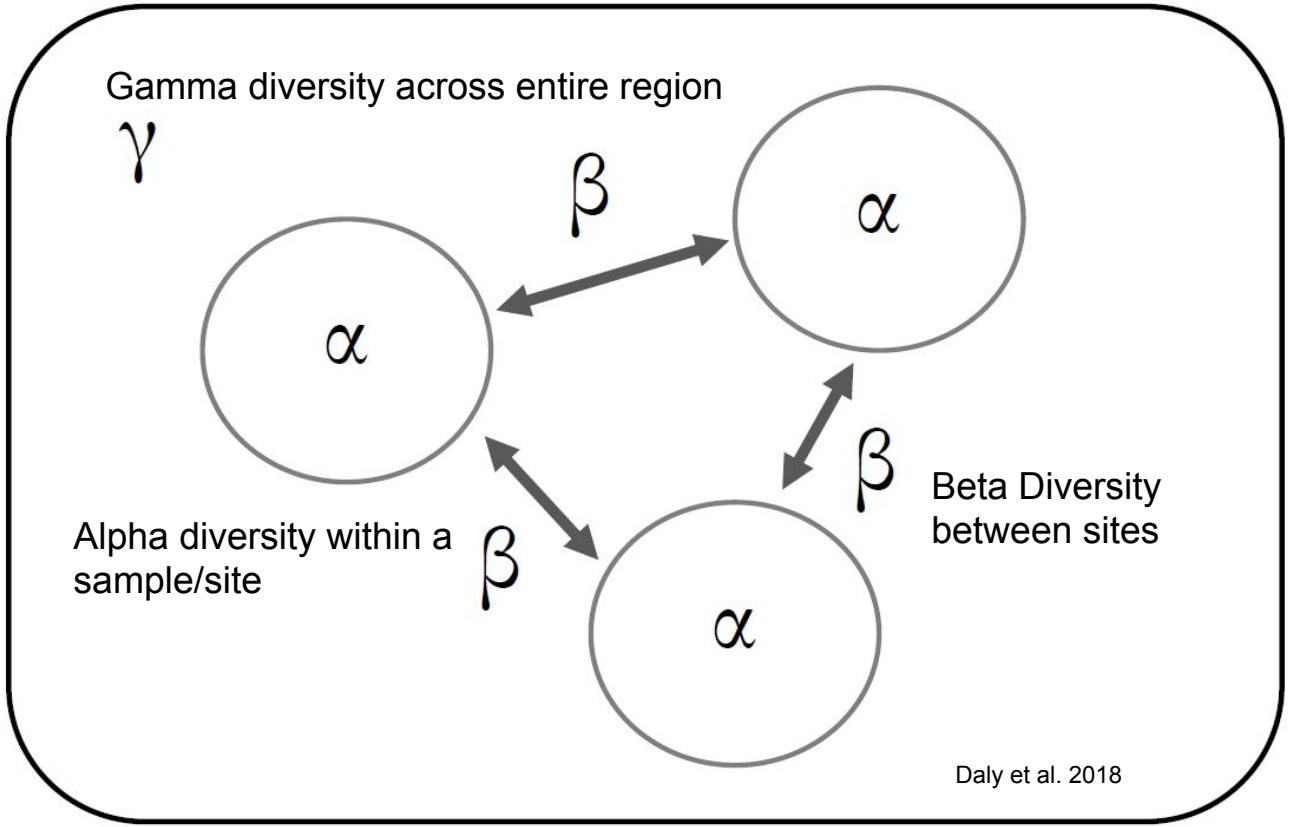
- Species richness
- Shannon-Wiener $H' = -\sum_{i=1}^{R} p \ln(p)$
- Simpson's $S_D = 1 - \sum_{i=1}^{R} p_i^2$

| | Insensitive to abundances | Use relative abundances | |
|---|---|---|---|
| Insensitive to relatedness | Species Richness | Simpson Index | Shannon Index |
| | generalize | generalize | generalize |
| Use relatedness data | Phylogenetic Diversity (Faith 1992) | Quadratic Diversity (Rao 1982) | Phylogenetic Entropy (this work) |

(Allen et al 2009)

# Levels of Diversity and Scaling

- What type of diversity measurement?
- How does beta link scales?
  - Additive $\bar{\alpha} + \beta = \gamma$
  - Multiplicative $\bar{\alpha}\beta = \gamma$
- Number and size of alpha samples?
- Interpretation?



# Strong Opinions and Many Methods

## Additive partitioning of a beta diversity index is controversial

Youhua Chen and Dénes Schmera

PNAS December 29, 2015 112 (52) E7161; first published December 18, 2015 https://doi.org/10.1073/pnas.1521798113

**This Letter has a Reply and related content. Please see:**

Reply to Chen and Schmera: Partitioning beta diversity into replacement and nestedness-resultant components is not controversial - December 18, 2015

Global biogeography of human infectious diseases - September 28, 2015

## Reply to Chen and Schmera: Partitioning beta diversity into replacement and nestedness-resultant components is not controversial

Kris A. Murray and Andrés Baselga

PNAS December 29, 2015 112 (52) E7162; first published December 18, 2015 https://doi.org/10.1073/pnas.1522279113

**This article has a Letter. Please see:**

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**See related content:**

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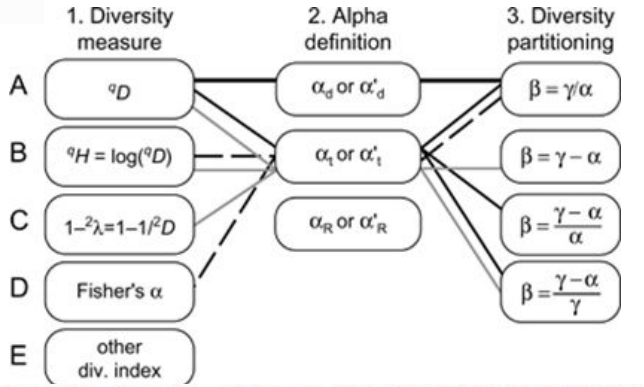
## Comments on separating components of beta diversity

D. Schmera & J. Podani

“Replacement” camp



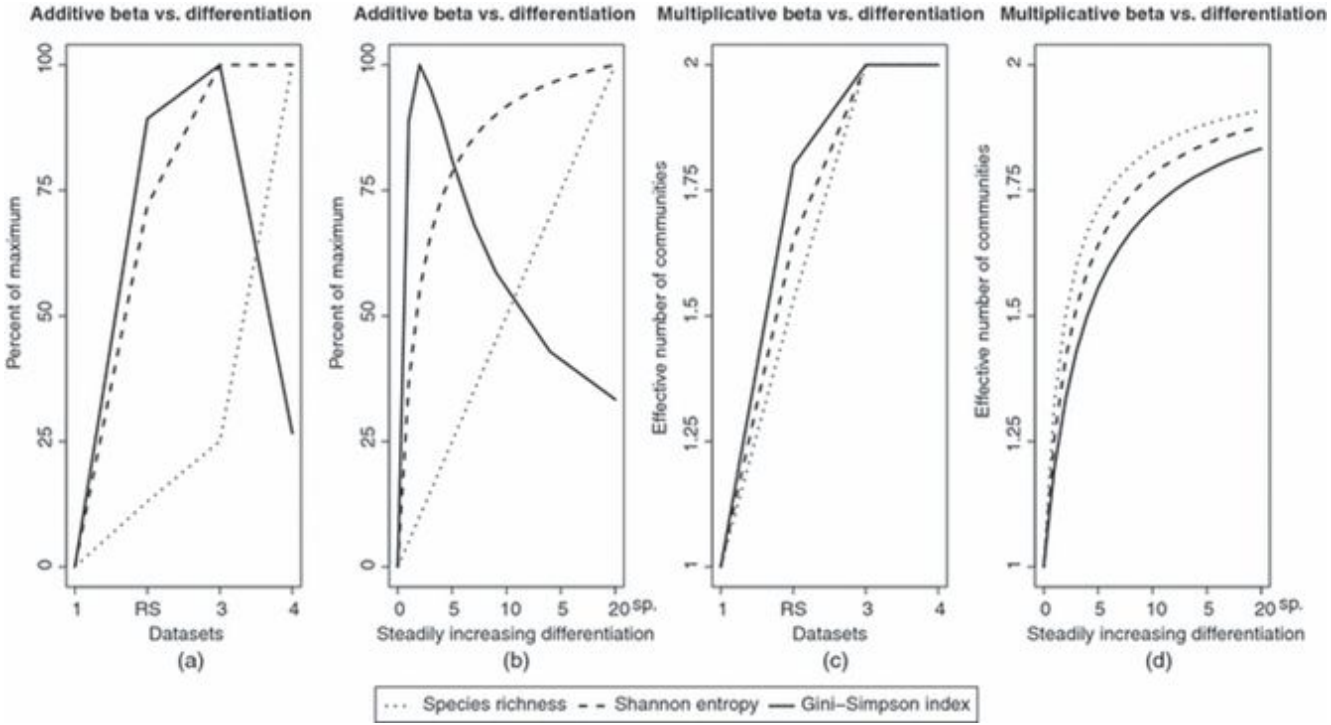

Ecography, Volume: 33, Issue: 1, Pages: 2-22, First published: 04 March 2010, DOI: (10.1111/j.1600-0587.2009.05880.x)

## Partitioning the turnover and nestedness components of beta diversity

Andrés Baselga

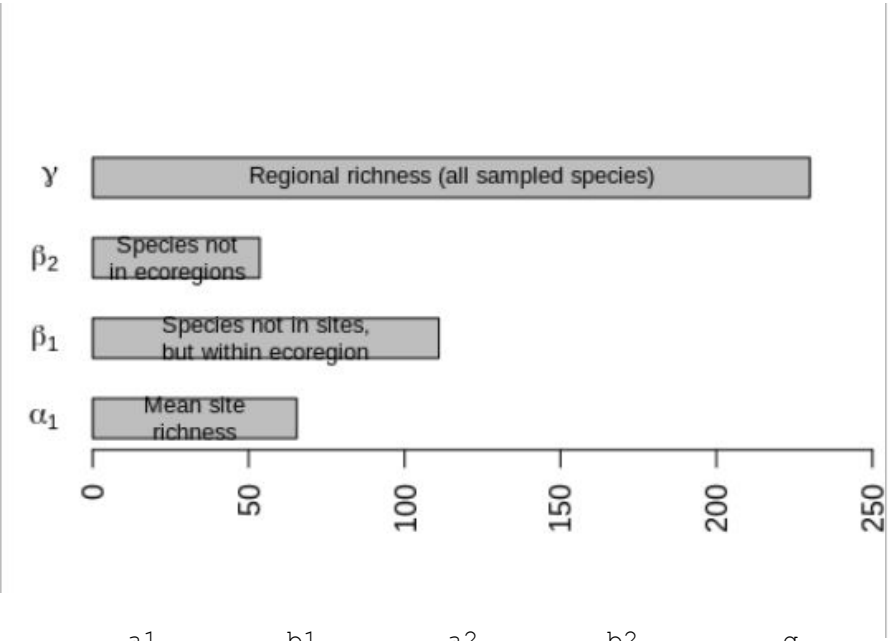
“Nestedness” camp

# Additive vs Multiplicative Example

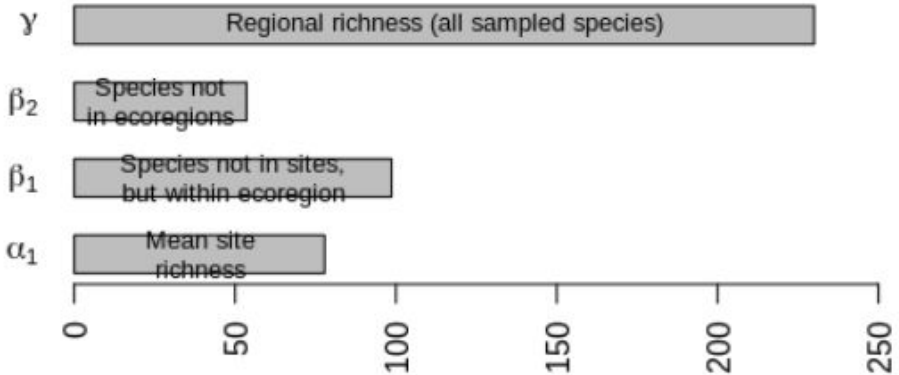



Diversity and Distributions, Volume: 16, Issue: 1, Pages: 65-76, First published: 18 January 2010, DOI: (10.1111/j.1472-4642.2009.00626.x)

# Partitioning Diversity Example

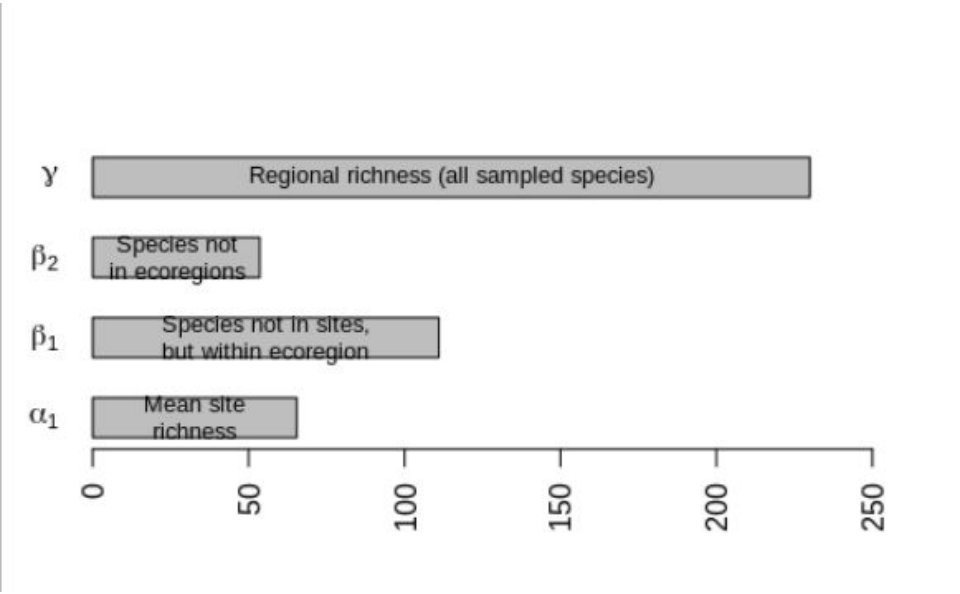



| a1 | b1 | a2 | b2 | g |
|---|---|---|---|---|
| 65.42857 | 111.00000 | 176.42857 | 53.57143 | 230.00000 |

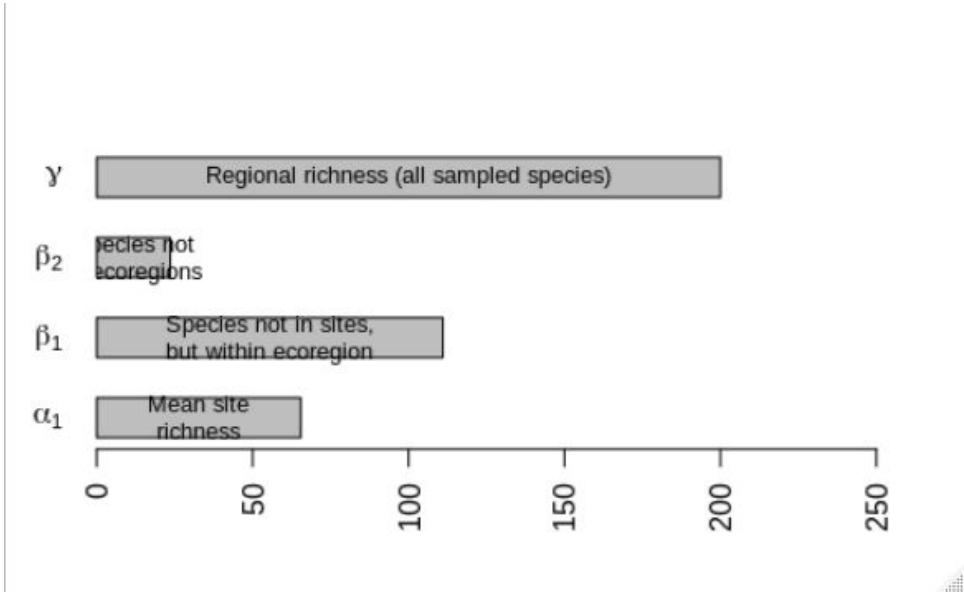



| a1 | b1 | a2 | b2 | g |
|---|---|---|---|---|
| 77.80952 | 98.61905 | 176.42857 | 53.57143 | 230.00000 |

# Partitioning Diversity Example



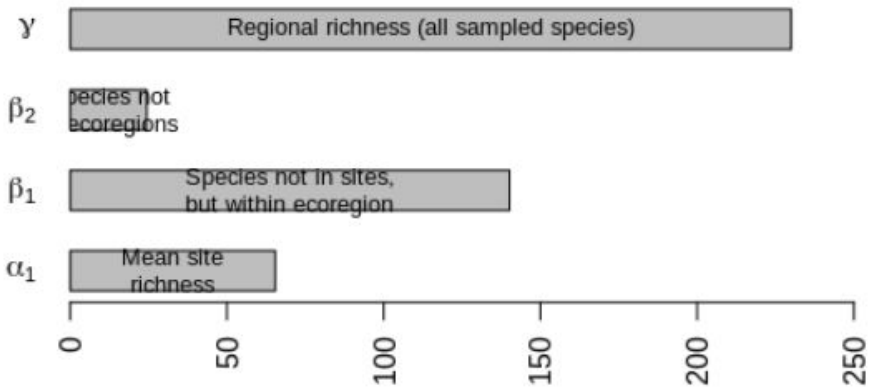

| a1 | b1 | a2 | b2 | g |
|---|---|---|---|---|
| 65.42857 | 111.00000 | 176.42857 | 53.57143 | 230.00000 |




| a1 | b1 | a2 | b2 | g |
|---|---|---|---|---|
| 65.42857 | 111.00000 | 176.42857 | 23.57143 | 200.00000 |

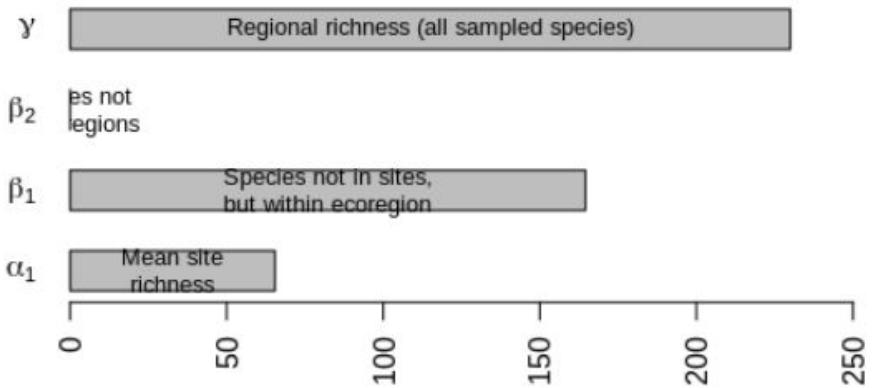
# Partitioning Diversity Example

NCT=230, WAP=173




| a1 | b1 | a2 | b2 | g |
|---|---|---|---|---|
| 65.42857 | 140.14286 | 205.57143 | 24.42857 | 230.00000 |

NCT=230, WAP=230




| a1 | b1 | a2 | b2 | g |
|---|---|---|---|---|
| 65.42857 | 164.57143 | 230.00000 | 0.00000 | 230.00000 |

# References

Daly AJ, Baetens JM, Baets B De. 2018. Ecological Diversity : Measuring the Unmeasurable. doi:10.3390/math6070119.

Tuomisto H. 2010. A diversity of beta diversities : straightening up a concept gone awry . Part 1 . Defining beta diversity as a function of alpha and gamma diversity. doi:10.1111/j.1600-0587.2009.05880.x.

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