BEEquations & test reasons

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1 Dissimilarity Measures

Metaweb: Regional pool of species and all interactions. (γ diversity)

Realisation: Local network drawn from regional metaweb (α diversity)

β diversity: Differences between two subsets/realisations/local networks

Whittaker's β diversity measure (Poisot et al., 2012)

The 'realisation membership' vetor, M, takes the form:

$$M = [c = \|A \notin B\|, b = \|B \notin A\|, a = \|A \cup B\|] \tag{1}$$

Basically:

- c is the number of items unique to realisation A
- b is the number of items unique to realisation B
- a is the number of items common to both realisations.
- items can refer to species, interactions, etc...

$$\boldsymbol{\beta_w}(M) = \frac{a+b+c}{(2a+b+c)/2} - 1 \tag{2}$$

$$\beta_{WN} = \beta_{ST} + \beta_{OS} \tag{3}$$

where:

- β_{WN}: Dissimilarity of interactions (β_{int} in CaraDonna et al. (2017))
- β_{ST}: Dissimilarity of interactions due to species turnover ($\beta_{WN} - \beta_{OS}$)
- β_{OS}: Dissimilarity of interactions established between species common to both realisations (interaction rewiring; β_{rw} in CaraDonna et al. (2017); extract common species of both networks, number of interactions common to both networks, a and unique to each, b & c)

β_S: Dissimilarity in the species composition of communities $\boldsymbol{\beta}$ ranges from 0 to 1.

A higher $\boldsymbol{\beta}$ reflects a higher difference between two realisations.

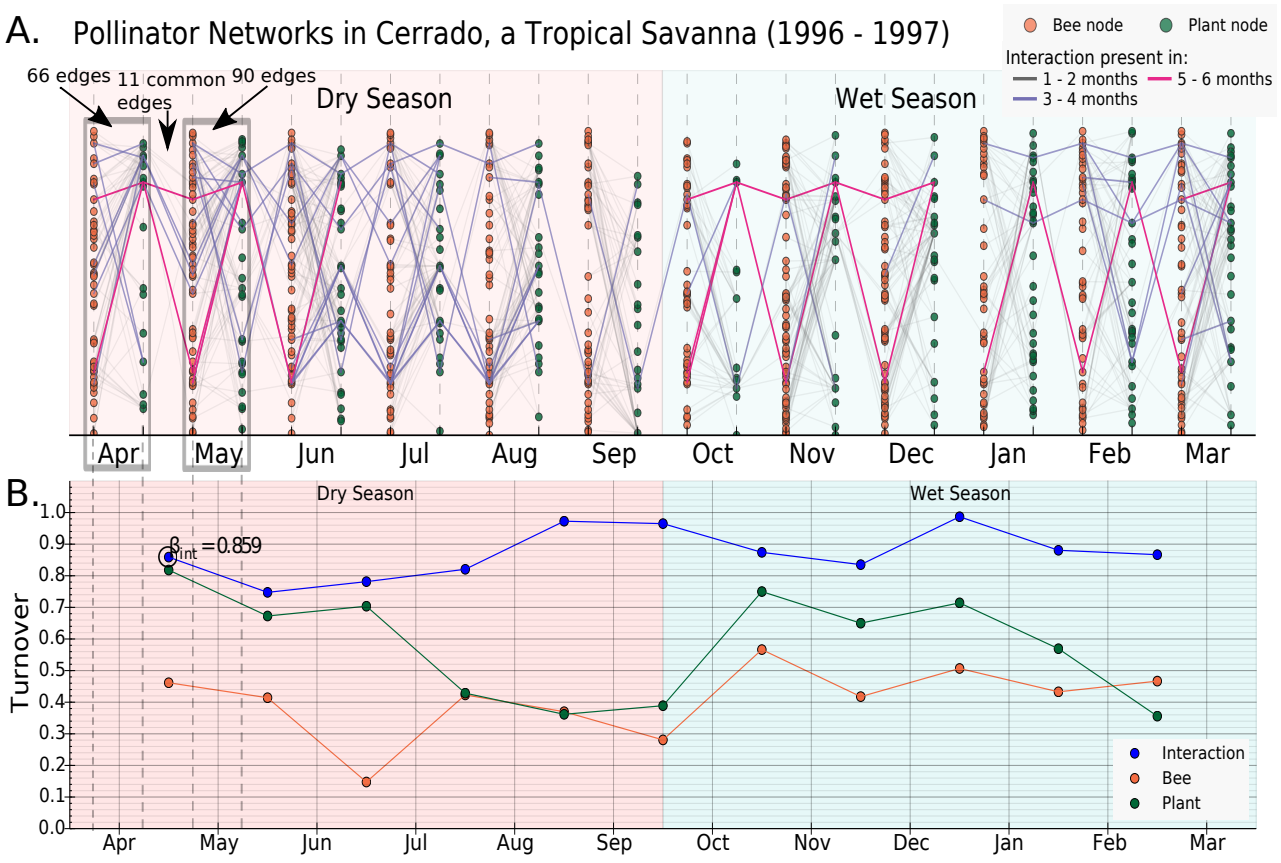

Figure 1: (A) Monthly bee pollinator networks from April 1996 to Mar 1997.

(B) Bee-flower interaction turnover and species turnover from April 1996 to Mar 1997.

Average monthly precipitation sum = 25.3 mm (Dry Season), 239.6mm (Wet Season)

For example, when comparing between April and May networks in Figure 1:

$$\beta_{WN} = \frac{11 + 55 + 79}{(2 \times 11 + 55 + 79)/2} - 1 \quad = 0.859 \tag{4}$$

$$\beta_{OS} = have to find list of common species, extract interactions between only common species than run turnover scrip \tag{5}$$

$$\beta_{ST} = \beta_{WN} - \beta_{OS} = 0.859 - \tag{6}$$

$$\tag{7}$$

Multi-site dissimilarity (Poisot et al., 2012)

A measure of global variability between the different realizations, assuming system is sampled enough, and metaweb a prozy of the regional pools of species and interactions.

Connectance is L/n^2, where L is number of interactions and n is number of species.

Nope, I don't understand. (Understand the idea but not the equations.)

2 Statistic test

2.1 Spearman's correlation coefficient

Non-parametric measure of rank correlation.

x vs. β_{WN}

How much x explains/correlates with β_{WN}.

How much x is responsible for interaction turnover. x vs. β_{OS}

How much x explains/correlates with β_{OS}.

How much x is responsible for interaction rewiring among common species.

x vs. β_{ST}

How much x explains/correlates with β_{ST}.

How much x is responsible for interaction turnover due to species turnover.

x vs. β_S How much x explains/correlates with β_S.

How much x is responsible for species turnover.

Random shuffling

Spearman coefficient compare with mean of distribution (of coefficients generated from Monte Carlo stimulation)

H_0: By random chance, x correlated with y.

H_a: Higher than mean-¿ how to determine how much higher, Not random, x probably a driving force of y. (What do you mean by systemic?)

What if it is lower than mean... play a smaller role than if random...? or not possible scenerio....?

Where x & y pairs:

- $\beta_{ST} \quad vs. \quad \beta_{WN}$
- $\beta_{OS} \quad vs. \quad \beta_{WN}$
- $\beta_S \quad vs. \quad \beta_{WN}$
- $\beta_S \quad vs. \quad \beta_{ST}$
- climate turnover vs. $\beta_S, \beta_{ST}, \beta_{OS}, \beta_{WN}$
- what about temperature turnover? only for shuffling species within seasons, within years, everything?
- also, shuffle Cerrado and BoaVentura separately right?

Random shuffling of interactions within months

Ignore climate turnover vs. β_S

Random shuffling of species within seasons

Random shuffling of species within year

Random shuffling of species across all

References

CaraDonna, P. J., Petry, W. K., Brennan, R. M., Cunningham, J. L., Bronstein, J. L., Waser, N. M. and Sanders, N. J. (2017). Interaction rewiring and the rapid turnover of plant-pollinator networks. Ecology Letters *20*, 385–394.

Poisot, T., Canard, E., Mouillot, D., Mouquet, N. and Gravel, D. (2012). The dissimilarity of species interaction networks.