Effective Community Diversity

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1 13 Sep 2013

Understanding the math.

Cik is correct but the notation is confusing. Try:

$\Pr(C_k) = \prod_{i=1}^{n} \Pr(x_i)$

$C_k = \{x_1, x_2, ..., x_n\}$, where,

$$x_i = \begin{cases} x = 0 & \text{if species } i \text{ is NOT in context } k \\ x = 1 & \text{if species } i \text{ is IN context } k \end{cases}$$

$\Pr(x_i) = x_i \Pr(x_i) + (1 - x_i)(1 - \Pr(x_i))$

$\Pr(x_i) = \frac{a_i}{\sum_{i=1}^{n} a_i}$, where a_i = species i's abundance

NOTE: the terms $x_i \Pr(x_i)$ and $(1-x_i)(1-\Pr(x_i))$ use x_i as an index that removes the first term if the species is not in context k and the second term if the species is in context k. Thus, the product vector includes either the probability that a species is present or that a species is absent depending on whether or not that species is in the given community context, k.

Understanding the logarithm in entropy.

Where $b^y = x$ $log_b x = y$, in other words the logarithm yields the length of the product vector of the base that yields x.

```
> x10 <- c(1,10,100,1000,10000,100000)
> x2 <- c(1,2,4,8,16,32)
> log(x10,base=10)

[1] 0 1 2 3 4 5

> log(x10,base=2)

[1]  0.000000  3.321928  6.643856  9.965784 13.287712 16.609640

> log(x2,base=10)

[1] 0.00000 0.30103 0.60206 0.90309 1.20412 1.50515

> log(x2,base=2)

[1] 0 1 2 3 4 5

>
```

2 03 Sep 2013

Theory Summary

- The important conceptual advance and practical implication of defining a species' effective community diversity is that the genetic analyses of relative few species may tell us much about the structure and evolution of much larger communities.

- Thus, even in a species-rich community, strong and/or frequent interactions between species can greatly reduce the effective diversity of the community.
- We conclude that a community genetics approach is evolutionarily and ecologically important whenever the effective community size for interacting species is small.

Approach:

1. assess the frequency of interactions among species as well as the consequences of these interactions from a fitness standpoint, and then,
2. identify the relative contribution of selection acting within and among species to the total opportunity for selection acting within a community context and finally,
3. introduce "effective community diversity" as a measure of the diversity of selective agents one species faces.

Math Summary

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NOTE: '...and even ecosystem processes such as nutrient cycling (Whitham et al. 2003; Wade 2003; Schweitzer et al. 2004, 2008).'

This seems to suggest that Ulanowicz's inkling that evolution plays an important role in ecosystem flow networks is true and warrants investigation.

3 30 Aug 2013

1. Review for potential use in dissertation

2. Go over math and understand

3. Compare to ENA math

4. Try to re-phrase in terms of information theory

5. Talk with Stuart about using in enaR

6. Program formulae into enaR and publish as v2.