Commonness and rarity of species: Does species' rank influence contribution to functional diversity?

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Rare Species

- Majority of species are rare
- Prone to extinction
- Functional impacts of their loss is unknown
- Importance under changing environmental conditions

How do rare species contribute to functional diversity?

Study Site

- Cedar Creek Ecosystem Science Reserve (LTER Network)
- 46 species with suitable trait data
 - 248 total
- Trait data collected in 2006

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Functional Trait Selection and Collection

- Plant Traits
 - Total plant mass
 - Root:Shoot
 - Leaf Mass per Area (LMA)
 - Percent Leaf Nitrogen (%N)
- Field Sampling
 - Six individuals of each species
 - Measurements completed near peak of vegetative growth

Defining Rarity

- Geographic range
 - Number of states and Canadian provinces the species occurs in (USDA PLANTS database)
- Habitat Specificity
 - Floristic Quality Assessment Index (FQAI)
- Mean Abundance
- Maximum Abundance

	Rare	Common
Geographic Range
Habitat Specificity
Abundance

Based on Rabinowitz 1981

Convex Hull Volume

- Trait values for each species plotted on separate axes
- Minimum multivariate trait space of a group of species
- Reflects community assembly and can be a proxy for potential ecosystem functioning

Cornwell et al. 2006

Rare and Common Species: Contributions to Convex Hull Volume

- Traits of rare species are redundant with those of common species (A)
- Rare and common species have similar traits (B)
- Rare species have different traits than common species (C)

Data Analysis

- 1) Convex hull methodology
 - 1) Total functional trait space volume
- 2) Remove and replace species, calculate change in hull volume
 - 2) Contribution to trait space
- 3) Species ranked from most common to most rare—regression performed on contribution to trait space and rarity rank

Mean Abundance

Maximum Abundance

Geographic Range

Habitat Specificity

Summary

- Negative relationship between functional diversity and maximum abundance
 - Trait distinctiveness
- Excluding maximum abundance, rare species equally as likely to contribute to functional trait space

Implications and Future Directions

- Consequences for ecosystem functioning?
 - Experimental communities
- Causes of rarity and commonness with respect to trait distinctness

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