Explanations for the observed pattern

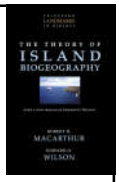
- **Disturbance Hypothesis** – smaller areas more frequently or intensely disturbed
- **Habitat Diversity Hypothesis** – Patchy habitat means habitat diversity increases with area (area is a correlate and not really important)
  - Areas of patches and measures of habitat diversity should be better predictors than area.
- **Equilibrium Hypothesis** – diversity a function of rates of extinction and colonization. Equilibrium of these will yield higher S in larger areas (larger populations reduce extinction, greater area increases colonization)

Species Area Relationship – power law

Equilibrium between extinction and immigration rates:

First documented on islands, theory should apply to any system.

Y-axis represents rate of **species turnover**



COMMUNITY ECOLOGY, Figure 2.15
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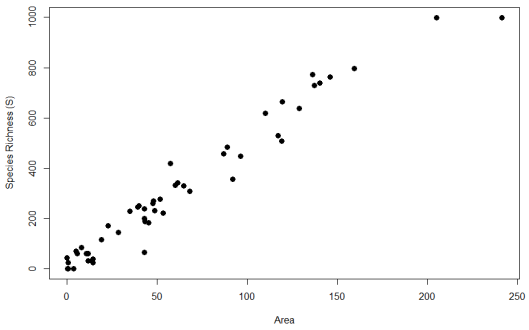
Simple Simulation of Island Diversity

- Simple model of random colonization to islands of various size from a single source with S=1000 species.



Natural Restoration of the Species-Area Relation for a Lizard after a Hurricane

Thomas W. Schoener; David A. Spiller; Jonathan B. Losos

Science, New Series, Vol. 294, No. 5546. (Nov. 16, 2001), pp. 1525-1528.

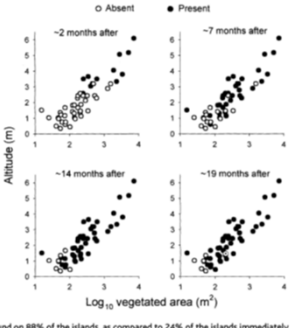
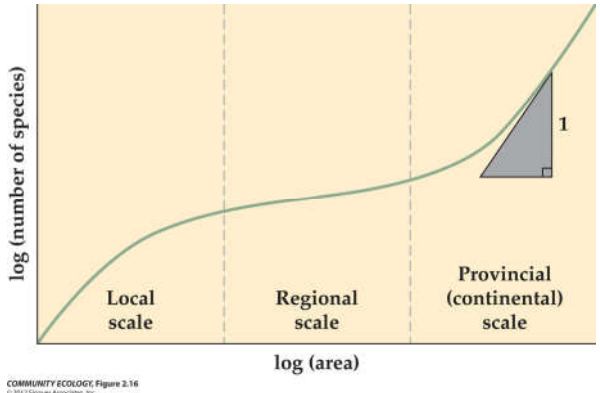


Fig. 3. Restoration of lizard distribution over the archipelago in relation to island area and altitude. Only islands found to naturally have *A. sagrei* before the hurricane are shown [see (*18*) for elaboration]. Adult or near-adult individuals were found on islands marked "present." Shortly after the hurricane (~2 months), such islands include most of the islands over 3 m high but are rather variable with respect to area. As time progressed, both lower and smaller islands were filled in, and area became a better and better predictor of which islands had lizard populations restored. At the end of the study, 19 months later, *A. sagrei* lizard populations that included adult or near-adult individuals were found on 88% of the islands, as compared to 24% of the islands immediately after the hurricane. The island marked with a cross in a circle (lower right panel) at ~19 months after the hurricane was the only island with a second species of lizard, the larger predatory *L. carinatus*. Sample sizes are as follows: ~2 months after the hurricane = 49 islands; on other dates = 50 islands.

Species Area Relationships Change With Scale



COMMUNITY ECOLOGY, Figure 2.16

Species-Time relationship

$$S = cT^{w}$$

- Where
  - **S**=# species
  - c=ecosystem constant
  - W= species-time relationship
  - T=time
- Systems with high diversity (S) tend to have low W
- Factors that increase diversity (S) also decrease turnover.

A comparison of the species–time relationship across ecosystems and taxonomic groups

Ethan P. White, Peter B. Adler, William K. Lauenroth, Richard A. Gill, David Greenberg, Dawn M. Kaufman, Andrew Rassweiler, James A. Rusak, Melinda D. Smith, John R. Steinbeck, Robert B. Waide and Jin Yao

OIKOS 112: 185–195, 2006

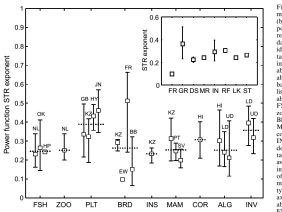
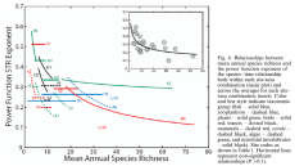
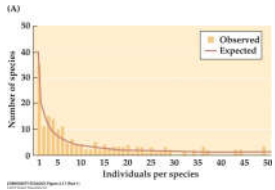


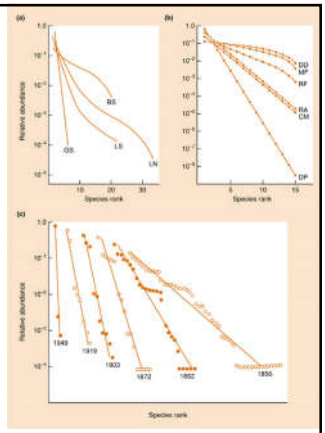
Fig. 3. Comparison of the means (squares) and ranges (bars) of the exponents of the power function species–time relationships for the different datasets grouped by taxa. Site identity within each taxonomic grouping is indicated by the two-letter abbreviation immediately above the maximum exponent bar and the abbreviations are listed in Table 1. Taxonomic abbreviations are as follows: FSH – fish, ZOO – zooplankton, PLT – plants, BRD – birds, INS – insects, MAM – mammals, COR – corals, ALG – algae, and INV – invertebrates. The dotted line within each taxonomic group indicates the average of the site means. The inset is the average and range of site-taxonomic group means grouped by ecosystem type (note the change in y-axis extent). Ecosystem type abbreviations are as follows: FR – forest, GR – grassland, DS – desert, MR – marine, IN – intertidal, RF – reef, LK – lake, and ST – stream.



Abundance Curves

- We have talked (numerous times) about the expectation that more individuals results in more species
- Not all species are equally abundant. Typically a hollow curve.





Abundance Curves – BCI Data