Biomass Collapse in Amazonian Forest Fragments (Laurance et al. 1997)

Unanticipated loss of carbon storage?

Species-Area Relation

$S = CA^z$

- $S$ is the number of species
- $C$ is a constant
- $z$ is the slope

$logS = zlogA + logC$

$z = 0.317 \pm 0.227$

Range: 0.2 – 0.4

Rare spp. extinct on islands → Steepens curve
Species-Area Relationships for Flowering Plants in England and North American Birds


Species-Area Relations of Four Major Vertebrate Taxa on the Same West Indian Islands.

FIGURE 6. Species-area relations of four major vertebrate taxa on the same West Indian islands. The relative differences in the observed z-values follow from taxon-specific colonization and extinction rates. They suggest that consequences of habitat loss and insularization depend on metabolic rate, body size and dispersal ability. Species-area curves fitted by linear regression are as follows: (a) $S = 3.14^{0.5}$, (b) $S = 1.4^{0.8}$, (c) $S = 6.14^{0.4}$, (d) $S = 1.4^{1.4}$, (e) Cuba, (f) Hispaniola, (g) Jamaica, (h) Puerto Rico, (i) St. Thomas Island, (j) St. Christopher, (k) Dominica, (l) St. Lucia, (m) St. Vincent, (n) Barbados, (o) Granada, (p) Antigua, (q) St. Kitts, (r) Barbuda, (s) Montserrat, (t) Anguilla, (u) St. Martin, (v) Mona. Recent Land Mammals include living and recently extinct native mammals. Many of the present mammal faunas include exotic species which have replaced native species. (Bird data from Bond, 1966, 1967; as compiled in Lack, 1976; reptile and amphibian data from Swartz and Thomas, 1976; mammal data from Varona, 1964).

Herps of The West Indies

Figure 19. The species-area curve for herpetofauna (amphibians plus reptiles) on islands in the West Indies on a log species-log area plot using data provided by Darlington (1957). (From MacArthur and Wilson, The Theory of Island Biogeography, © 1967 Princeton University Press. Figure is reprinted with permission of Princeton University Press).


The MacArthur and Wilson Equilibrium Model

Equilibrium model of a biota on a single island.

The MacArthur and Wilson Equilibrium Model – Distance and Area Effect

**Distance Effect**
- \( I_{near} \)
- \( I_{far} \)

**Area Effect**
- \( E_{small} \)
- \( E_{large} \)

*Figure 1* An island biota is in equilibrium in ecological time between immigration of new species and extinction of those already present. *(Left)* Distance effect; a near island has larger equilibrium number of species (\( S \)) and turnover rate (\( X \)). *(Right)* Area effect; a large island has larger \( S \) and smaller \( X \).

Distance and Area Effect Together

Mammals on Mountaintops


Birds on Satellite Islands of New Guinea

Examples of faunal collapse trajectories for large mammals in three East African national parks.

FIGURE 7. Examples of faunal collapse trajectories for large mammals in three East African national parks. Shaded area includes the probable range within which the trajectory will fall for each reserve. The severity of collapse depends on the initial number of species as well as reserve size. (From Soulé et al., 1979)

Biodiversity’s Basic Law (Rosensweig 2001)

log number of species

log area

Old province

New province

Loss of endemics

Loss of sink spp.

Loss of irreplaceables

SPARs
- Within a province
- Nearby islands
- Among provinces