Lecture summary:
- Species-area relationship.
- Habitat diversity.
- Equilibrium Theory.
- Corroboration & Prediction.
- Evolution in “islands.”

2. Species-area relationship:
- Islands contain fewer spp. than similar areas of mainland.
- Number of species on islands decreases as island area decreases.
  - Species-area relationship (Fig. 23.1): Curved on arithmetic axis scales (c).
  - Straight line on logarithmic scales (a), (b) & (d).
  - Also for other “islands” of habitat:
    - Lakes, mountain tops, forest gaps, or patches of the same plant species (Figs 23.2 & 23.3).
    - Is the low number of species on islands greater than would be expected in a similar area of mainland?
    - Is this related to the degree of isolation of the island?

3. Habitat diversity and species diversity:
- Lack (1969): larger islands contain more bird species than smaller islands because they contain more habitats.
  - Widely distributed plants live in a wide variety of habitats and so offer a wide variety of habitats to phytophagous insects (Fig. 23.4).
  - Plant "architecture" influences species diversity:
    - Structurally complex plants support more insect species than simpler plants (Figs. 19.2, 23.13, 23.14).
  - Habitat diversity is likely to be a better predictor of species diversity on mainlands because immigration is easier than between islands, and so extinctions would be masked.
  - Thus slopes of logarithmic species-area relationships should be steeper on islands with a lower y-axis S intercept because of higher rates of extinction and colonization:
    - E.g. Table 21.1 and Fig. 21.14.
4. MacArthur & Wilson's (1967) equilibrium theory of island biogeography:

- Number of species on an island is determined by a dynamic balance between immigration and extinction (Fig. 21.11).

- This theory predicts:
  - (1) Number of species on an island becomes constant with time.
  - (2) Constant number should be a result of a continual turnover of spp.
    - Some going extinct, some immigrating.
  - (3) Large islands should support more species than small islands.
  - (4) Species number should decline with increasing island remoteness.
    - As well as Fig. 23.17 for limits to colonization for different bird groups.

5. Corroboration for both habitat diversity and island area as predictors of species diversity:

- Habitat diversity may be a better predictor of herbivorous beetle species diversity than island area (Fig. 23.10).
- But for birds the opposite was true.
  - Island area predicted species diversity, but habitat diversity did not.
- Experimental reduction of island area without affecting habitat diversity resulted in loss of species (Fig. 21.13).
- Island remoteness also influences species diversity on islands of the same size (Figs. 21.15 & 21.16).
  - But this must also be a product of species mobility (e.g. birds vs mammals, or birds vs fern spores).

6. Evolution & island communities:

- Temporal components of species diversity are also very important because species evolve.
- The diversity of cichlid fishes in the African rift lakes is highest in lakes isolated the longest.
  - Phytophagous arthropod diversity is highest on native trees than on introduced trees in Britain and South Africa (Fig. 21.21).
- In conclusion, species diversity is influenced by:
  - Habitat diversity and spatial isolation.
  - Rates of immigration, colonization & extinction (turnover).
  - Temporal isolation and evolution.
Figure 23.1 (3rd ed.): Species-area relationships for (a) Hawaiian birds, (b) vascular plants of the Azores, (c) amphibians and reptiles of W. Indian islands, (d) birds of the Solomon Islands.

Figure 23.2 (3rd ed.): Species-area relationships for (a) boreal mammals on mountain "islands", (b) breeding birds in IL woodlots, (c) invertebrates in clumps of mussels, (d) fish in desert springs.

Figure 23.3 (3rd ed.): Species-area curve for plants in different sized sample areas in England.
Figure 23.4 (3rd ed.): Species-area relationships for phytophagous insects on host plants (a) cynipid gall wasps on oaks, (b) insect pests on cacao.

Figure 19.2: Different degrees of niche saturation in communities of herbivorous insect feeding guilds on bracken in (a) England, (b) Papua New Guinea, and (c) New Mexico.

Figure 23.13 (3rd ed.): Species-area relationships for herbivorous insects on bracken.
Figure 23.14 (3rd ed.): Influence of plant "architecture" on species-area relationships (a) British Rosaceae, (b) Opuntia cactus species in N & S America.

Table 23.1: Values of the slope, r, of species-area relation log(S) = log(A) + log(r) for: a) ants in the tropics, b) reptiles in the tropics, c) plants in the tropics, d) mammals in the New World, e) birds in the New World. (After Diamond, 1973; Smith, 1975; Connell, 1978; Brodie, 1979.)

Table 21.1: Species-area relationships for (a) ponerine ants in islands of Molucca & Melanesia compared with New Guinea, (b) reptiles on islands off S. Australia compared with mainland.

Figure 21.14: Species-area relationships for (a) ponerine ants in islands of Molucca & Melanesia compared with New Guinea, (b) reptiles on islands off S. Australia compared with mainland.
Figure 21.11: MacArthur & Wilson’s (1976) equilibrium theory of island biogeography (a) immigration rates against resident species, (b) extinction rates against resident species, (c) equilibria between immigration & extinction rates.

Figure 23.15 (3rd ed.): Species accumulation curves (a, b, c) and rates of immigration and extinction of plant, bird and butterfly species (d, e, f) on Rakata Island after the eruption of Krakatau in 1883.

Figure 21.18: Immigration and extinction rates of breeding birds in a British wood (av. spp = 32).
Figure 23.17 (3rd ed.): Eastern limits of families and subfamilies of land and freshwater breeding birds found in New Guinea.

Figure 23.6 (3rd ed.): Species richness of (a) herbivorous (O) & predatory (▲) insects on the Canary Islands and (b) birds on islands off W Australia against area and habitat complexity.

Figure 21.13: Effect of experimental reduction in mangrove island size on number of arthropod species.
Figure 21.15: Number of resident, lowland bird species (as proportion of spp on islands close to New Guinea) on islands more than 500 km from New Guinea.

Figure 21.16: Effect of distance on species-area relationships (a) land birds more (▲) or less (●) than 300 km from a mainland (b) breeding birds (▼●) and ferns (○▿) in Azores and Channel Islands, respectively.

Figure 23.21 (3rd ed.): Relative species richness of phytophagous arthropods on 3 introduced (I) or native (N) tree species in Britain and South Africa.