Lecture 4

Island Physics summary and Long distance dispersal

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Outline

Summary of Island Physics

1. Island classification
    - Continental (shelf) vs. Oceanic.
    - High vs. Low.
2. Three ways to form oceanic island volcanoes.
    - Mid-oceanic ridges – where plates diverge.
    - Island arcs – where plates converge.
    - Linear chains – intra-plate hotspot.
3. From high to low island – Coral reef growth on top of sinking volcanic rock.
    - Fringing reef → Barrier reef → Atoll.
4. Sea level changes – Repeated glaciations.
    - Land bridges to continental islands.
    - Oceanic islands exposed and flooded repeatedly.
    - Post-glacial rebound.
5. Island climates – Latitude and altitude/elevation.
    - Reduced temperature fluctuation, relative to latitude.
    - Wider range of climatic conditions on high islands (elevation zones, rain shadow).
    - Low islands relatively dry.

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The natural laboratory paradigm in light of island physics

1. Small area and discrete.
2. “Simple” biotas.
3. **Numerous and varied.**
4. **“Accelerated time”.**
5. **“Telescoping” of environmental variability.**

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   On the same **high** island, cloud forests and deserts – very humid vs. very dry environments, elevation zones.

Outline

Long distance dispersal to islands

- Migration to oceanic islands is via **long-distance dispersal** (הפצה ארוכת טווח).
- Governed by probability.
- Means of dispersal identified by Carlquist (1974):
  - Air flotation – very small seeds, insects, spiderlings etc.
  - Flight and island hopping – birds.
  - Birds – seeds/eggs (e.g., of insects or landsnails)/individuals attached to feathers, in mud on feet, or carried internally (ingested seeds).
  - Oceanic drift / sea flotation – resistance to seawater; e.g., coconut.
  - Rafting – seeds and animals resistant to desiccation (e.g., lizards, or landsnails).
- "Stepping stones" – islands in a chain or ancient, now vanished, islands – may have aided dispersal to remote islands.

Island biology in a (coco)nutshell

Island Physics

- Isolation
- Small area
- Young age
-

Island Biodiversity

- Species poor
- Disharmony
- High Endemicity
-

Insular Evolution

- "Untypical" creatures
- Adaptive radiation
-

Long distance dispersal to islands

1. Some groups of animals and plants are more suited to long distance dispersal than others.

2. Actual arrival on island is ultimately a **probabilistic** event.

- " A means of transport does not need to be frequent to be operative. " (Carlquist 1974, p.69)
- " . . . occasional means of transport having been largely efficient in the long course of time, . . . " (Darwin 1859 1974, p.384)

- $\Rightarrow$ Many different ways (some very strange, bizarre and improbable), by which to arrive on oceanic islands.

- $\Rightarrow$ Over long geological/evolutionary time even a rare event **may** happen once or twice (or not – probabilistic occurrence).