LECTURE 8
Dispersal, Colonization, and Invasion

I. Introduction
II. Some Definitions
III. Dispersal
IV. Colonization, seasonal migrations, and irruptions
V. Diffusion versus jump dispersal
VI. Barriers, corridors, filters, stepping stones, and sweepstakes
VII. Biological Invasion
II. Some Definitions

- Propagule
- Colonization
- Invasion

![Marram grass (Ammophila arenaria)](image1)

III. Dispersal

Dispersal: The movement of an organism away from its point of origin.

- Intra-range (or ecological) dispersal
- Extra-range (or biogeographical) dispersal
- Active Dispersal
- Passive Dispersal

![Cattle egret (Bubulcus ibis)](image2)
III. Dispersal

Passive Dispersal Classification:

- Anemochores (wind)
- Hydrochores (water)
- Zoochores (animals)
  - Anthropochores (humans)

Ribwort
(Plantago lanceolata)

III. Dispersal

Anemochory versus zoochory

North American beech tree
(Fagus grandiflora)
IV. Colonization, Seasonal Migrations, and Irruptions

More Definitions:
- Colonization
- Seasonal Migrations
- Irruptions

Demographic Patterns of Colonization:

Exponential Growth:
\[
\frac{dN}{dt} = rN
\]

Logistic Growth:
\[
\frac{dN}{dt} = rN \left( \frac{K - N}{K} \right)
\]
### IV. Colonization, Seasonal Migrations, and Irruptions

#### Table 8.1: Post Glacial Population Growth Rates (as Expressed as Doubling Time) of Some Tree Genera at Various Sites in North America

<table>
<thead>
<tr>
<th>Tree Genus</th>
<th>Doubling Time (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fir (Abies)</td>
<td>408</td>
</tr>
<tr>
<td>Pine (Pinus)</td>
<td>80-1100</td>
</tr>
<tr>
<td>Douglas fir (Pseudotsuga)</td>
<td>52-365</td>
</tr>
<tr>
<td>Hemlock (Tsuga)</td>
<td>31-239</td>
</tr>
<tr>
<td>Beech (Fagus)</td>
<td>124-444</td>
</tr>
</tbody>
</table>

**Successful Colonization Characteristics:**
- Rapid population growth rate
- Ability to survive and reproduce in a wide range of environmental conditions
- Ability to colonize disturbed sites

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### IV. Colonization, Seasonal Migrations, and Irruptions

**The Supertramp:**

Eurasian dandelion

*(Taraxacum officinale)*
V. Diffusion versus Jump Dispersal

**Diffusion**: Expansion of the range of a species along a discrete front.

**Jump Dispersal**: The dispersal of a species across a geographic range not previously occupied by the species.
VI. Barriers, corridors, filters, stepping stones, and sweepstakes

• Barriers

• Corridors

(Duck Pass, Mammoth Lakes)
VI. Barriers, corridors, filters, stepping stones, and sweepstakes

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Stepping Stones

Sweepstakes

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VII. Recent Invasions By Exotic Species

Alien
- A species that has been introduced to a part of the world to which it is not native
- Also referred to as invasive, exotic or simply introduced species
- Invasive species are species that reproduce in large numbers and spread over a considerable area causing damage to natural communities

Native
- An indigenous species that occurs wild in a given region
VII. Recent Invasions By Exotic Species

- Alteration of ecosystem processes such as nutrient cycling, intensity and frequency of fire, hydrological cycles, sediment deposition, and erosion (D'Antonio and Vitousek 1992, Vitousek 1992).
- Habitat dominance and displacement of native species (Elliot 1994).
- Hybridizing with native species potentially eliminating native genotypes (Bossard et al. 2000, Dark et al. 1999).
- Promotion of non-native animals (Vitousek and Walker 1989).
VII. Recent Invasions By Exotic Species

- Introductions began early on during human evolution (domestication of agricultural species)
- Became more widespread with European colonization and exploration in the late fifteenth century
- Enhanced after WWII, world became much more of a global marketplace
- California history with invasive species (particularly plants)

Brown tree snake (Boiga irregularis) on Guam

- Extinctions and loss of species diversity from Guam
- Safety and health of Pacific Island residents and tourists
- Economic damages from the Brown Treesnake
- Impacts on military from the Brown Treesnake
VII. Recent Invasions By Exotic Species

Red Fire Ant (Solenopsis invicta)

- Infests 10-15 million acres in California alone (in 56 of the 58 counties), and is still spreading.
- Damage from YST in the U.S. is estimated to be many millions of dollars.
- Dominates native plants reducing biodiversity and causes rare plant species to go extinct
- Significantly depletes soil moisture reserves in grasslands.
- Interferes with grazing, lowers yield and forage quality of rangelands, thus increasing the cost of managing livestock.

http://www.invasivespecies.gov/profiles/bts.shtml

Yellow Star Thistle (Centaurea stoltiliatis)

- Infests 10-15 million acres in California alone (in 56 of the 58 counties), and is still spreading.
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