

# Lecture 11

## A Lesson of Ecology

Natural systems are maintained and constrained by processing energy.

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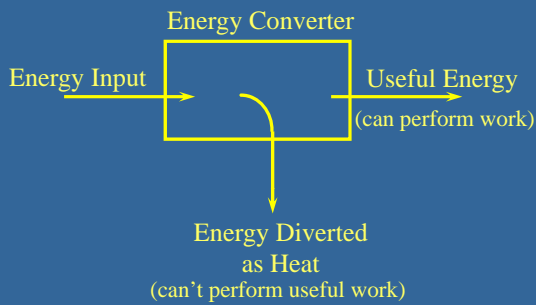
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Note: The first law of thermodynamics is met.  
 $E_{input} = Diverted\ E + Useful\ E$

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## Species in an ecosystem are divided into trophic levels

- Trophic levels are determined by the main source of nutrition for a species.
- Trophic levels are given names:

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## Trophic levels

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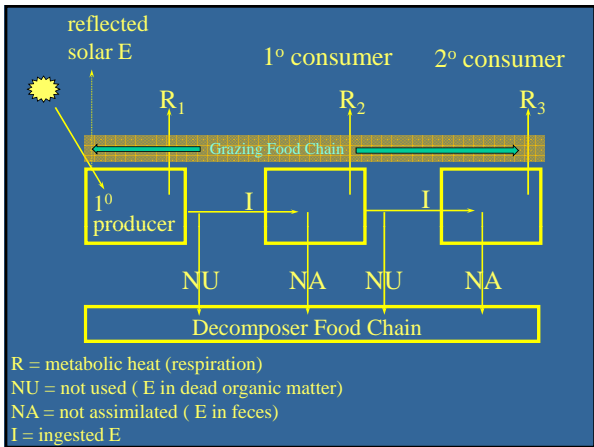
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## Flow of energy through a food chain

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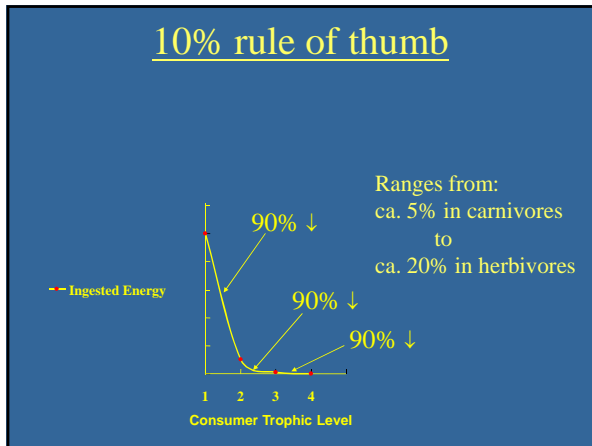
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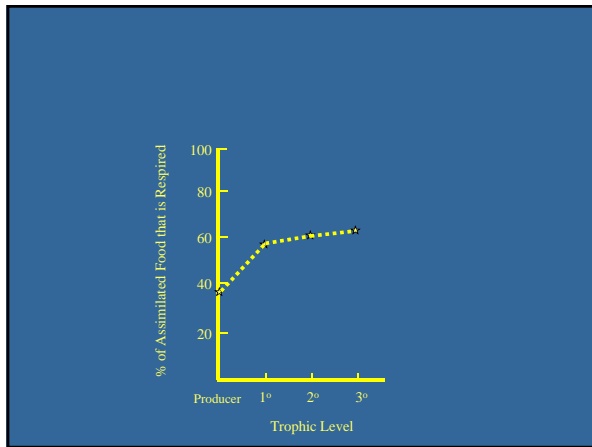
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### There are limits to the length of food chains !

One thing seems certain, however: one cannot take literally the well-known jingle by Jonathan Swift, or the whimsical diagram of Hegner:

Big fleas have little fleas  
Upon their backs to bite 'em  
And little fleas have lesser fleas  
And so, ad infinitum.

From Robert Hegner as found in Odum 1971

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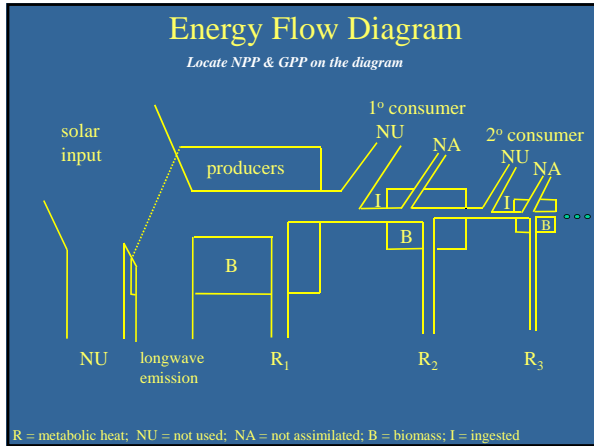
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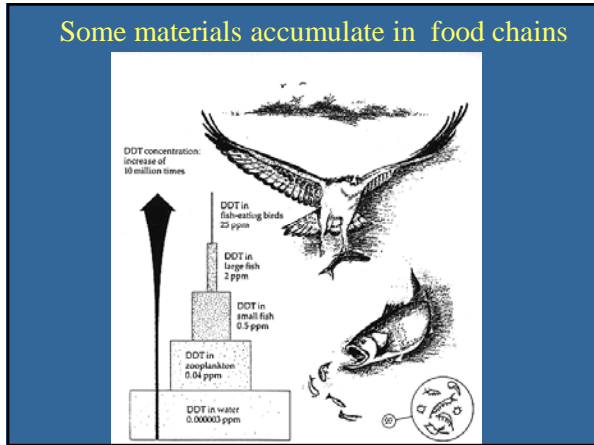
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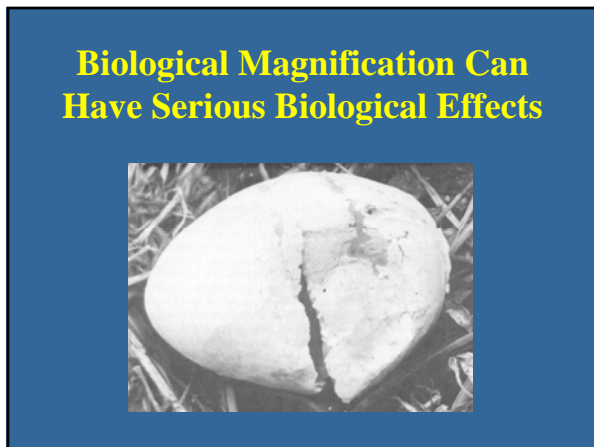
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## Communities vary in species diversity

- Species
- Species Diversity

Species richness

Equitability

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## Communities vary in species diversity

Patterns -

Latitudinal gradients -

Size effect -

Distance effect -

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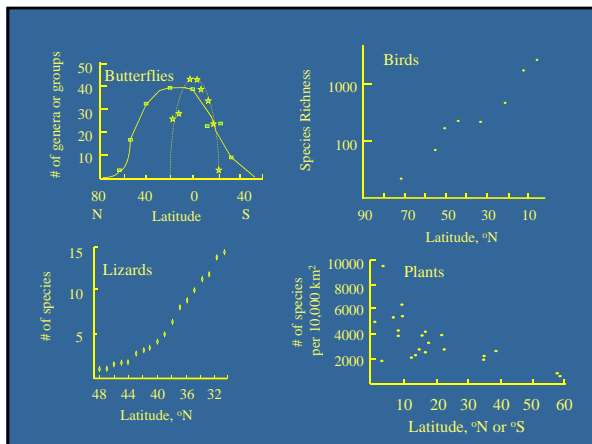
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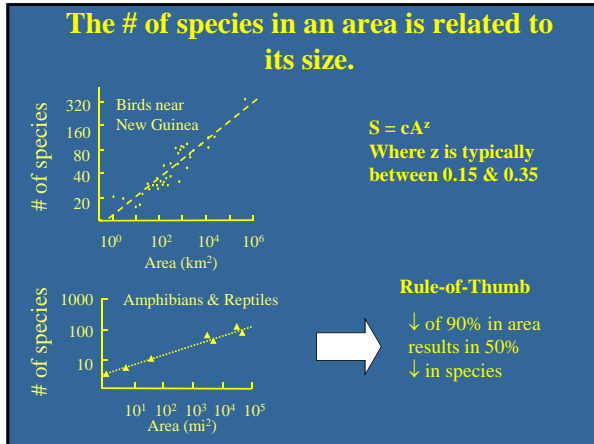
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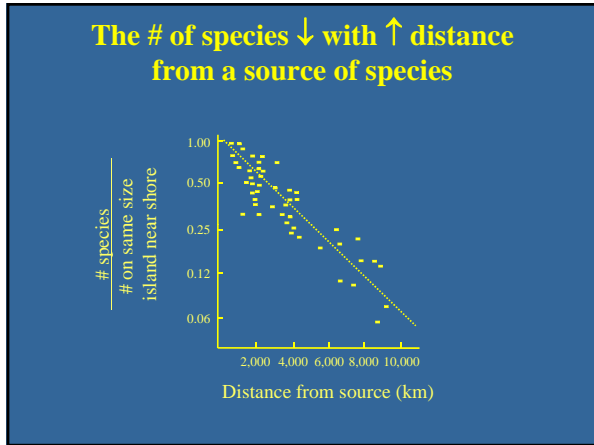
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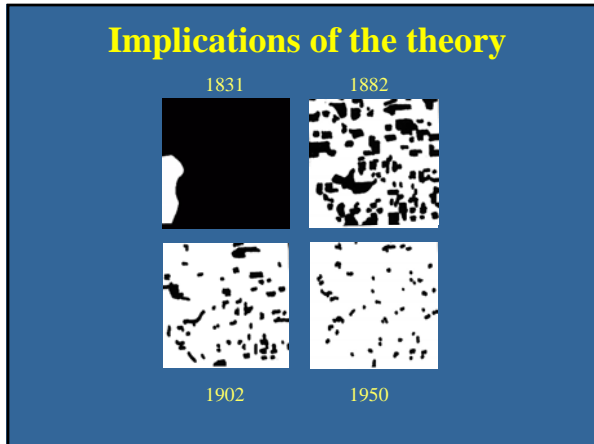
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**A Lesson of Ecology**

**Good and Bad Places Exist for Every Species**

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**Organisms have their own role in a community**

Ecological Niche - defined many ways.

In its broadest sense ...

Niche =

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## The competitive exclusion principle

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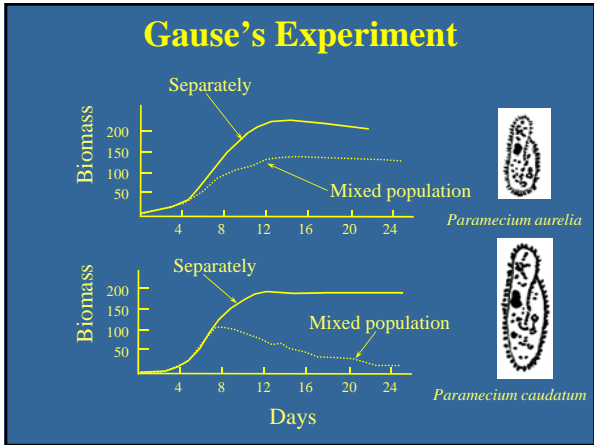
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### Reduced niche overlap can allow coexistence

- Behavioral Acclimation  
Green anole lizard forced to move to branches by introduction of Brown lizard.
- Character Displacement  
Through evolution, 2 closely related species tend to be more distinct when they are sympatric than when they are allopatric.

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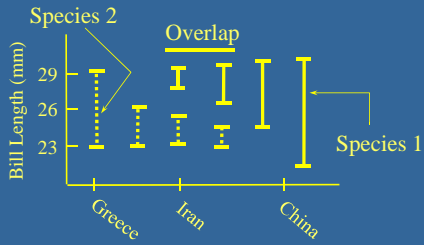
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## Examples of Character Displacement



Two species of Asian nuthatches of the same genera.

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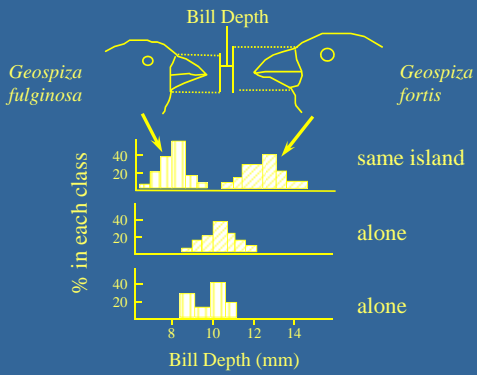
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## Darwin's Finches



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## Communities Can Recover From Disturbance

Succession -

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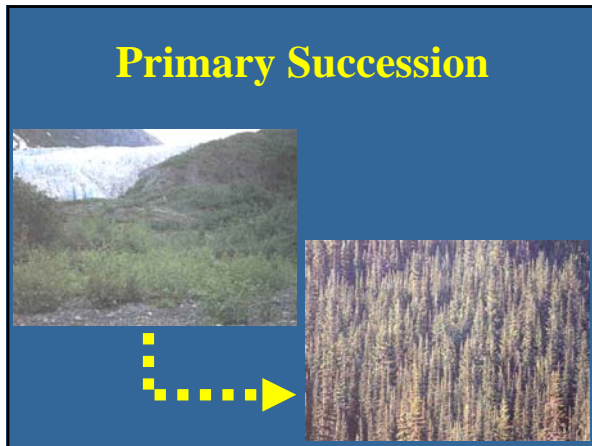
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## Primary Succession



The diagram shows a landscape with a glacier on the left and a forest on the right. A yellow dashed arrow points from the glacier area towards the forest, indicating the progression of primary succession over time.

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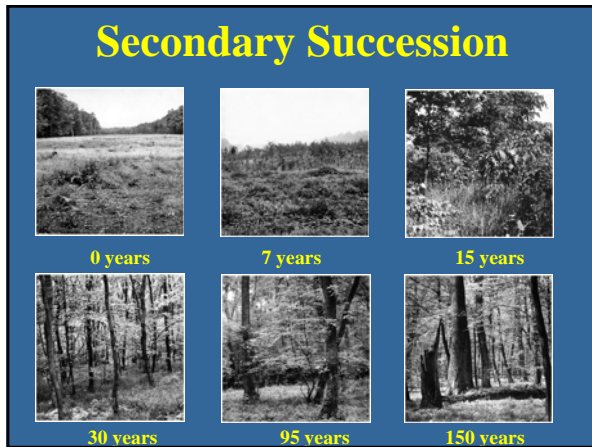
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## Secondary Succession



A series of six black and white photographs showing the stages of secondary succession at different time intervals: 0 years (open field), 7 years (grass and small plants), 15 years (taller grasses), 30 years (young trees), 95 years (mature trees), and 150 years (old-growth forest).

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## Communities Don't Always Recover From Disturbance



Two photographs showing a landscape. The left photo shows a road and a single tree in a field with mountains in the background. The right photo shows a similar landscape but with a different vegetation composition, illustrating that communities do not always recover from disturbance.

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