

# Community Ecology

Duccio Rocchini

Full Professor

Alma Mater Studiorum Università di Bologna

<https://www.unibo.it/sitoweb/duccio.rocchini>



# Summary

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- **Relationships among species**
- Species diversity (biodiversity)
- Food webs
- Ecological succession

# Overview: A Sense of Community

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- A biological **community** is an assemblage of populations of various species living close enough for potential interaction. **All life / all populations in an area.**
- Ecologists call relationships *between species* in a community **interspecific interactions**.
- Interspecific interactions can affect the survival and reproduction of each species. **Effects can be positive (+), negative (-), or no effect (0).**
- Examples: 1. competition, 2. predation, 3. herbivory, and 4. symbiosis (4a. parasitism, 4b. mutualism, 4c. commensalism).

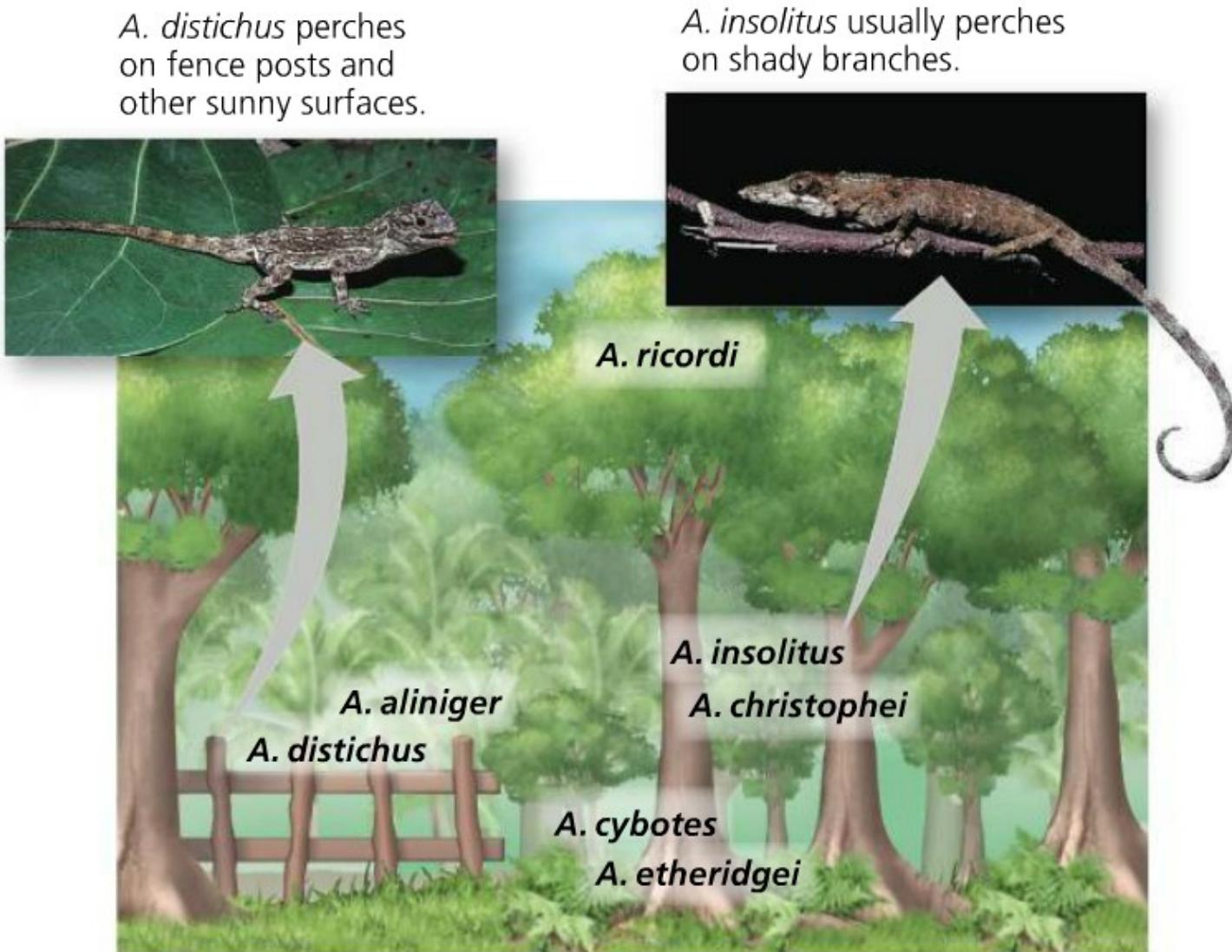
# **1. COMPETITION - Ecological Niches**

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- ***The total of a species' use of biotic and abiotic resources is called the species' ecological niche.***
- An ecological niche can also be thought of as **an organism's ecological role**.
- Ecologically similar species **can coexist** in a community if there are one or more significant **differences in their niches**.
- **Resource partitioning** is differentiation of ecological niches; enables similar species to coexist in a community.

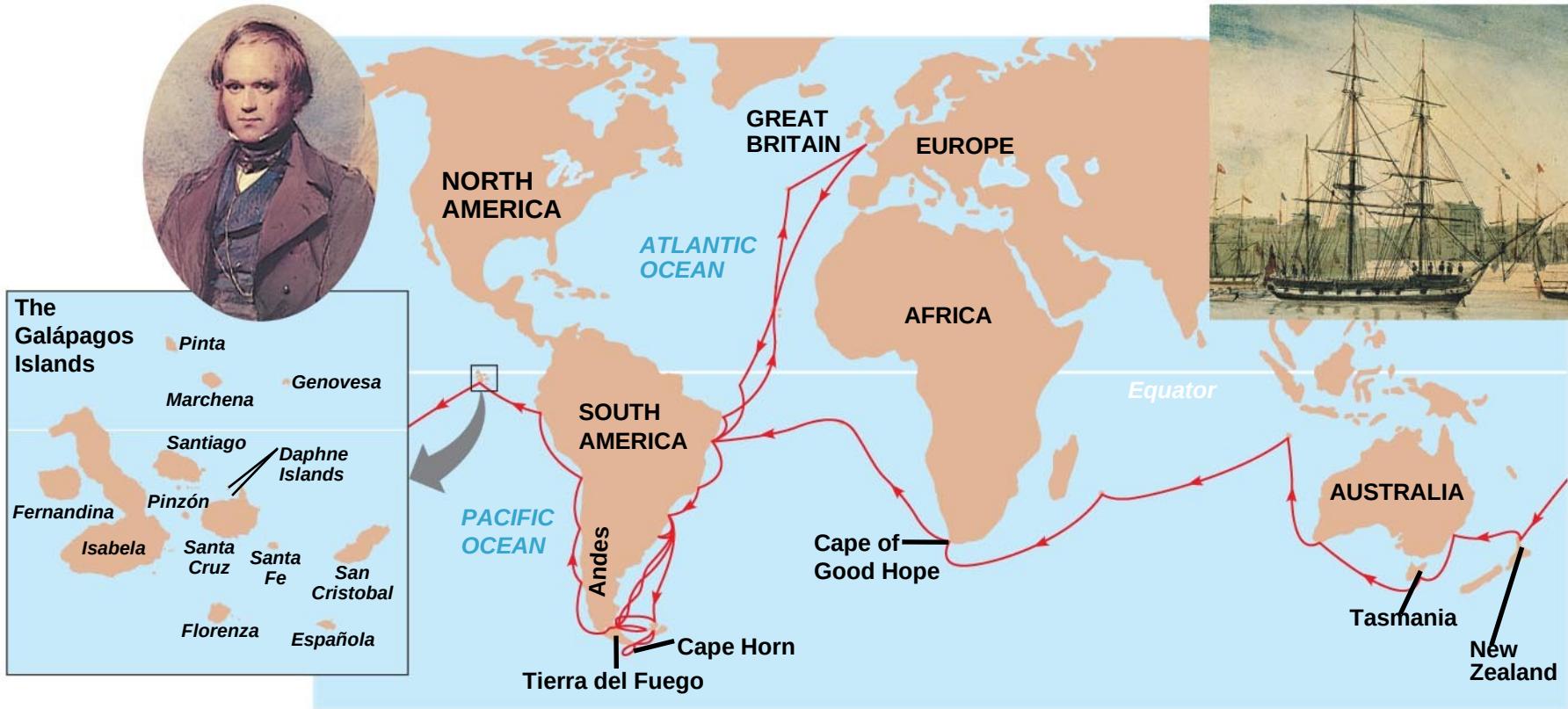
**Resource partitioning** is differentiation of ecological niches, enabling similar species to coexist in a community

### Anolis



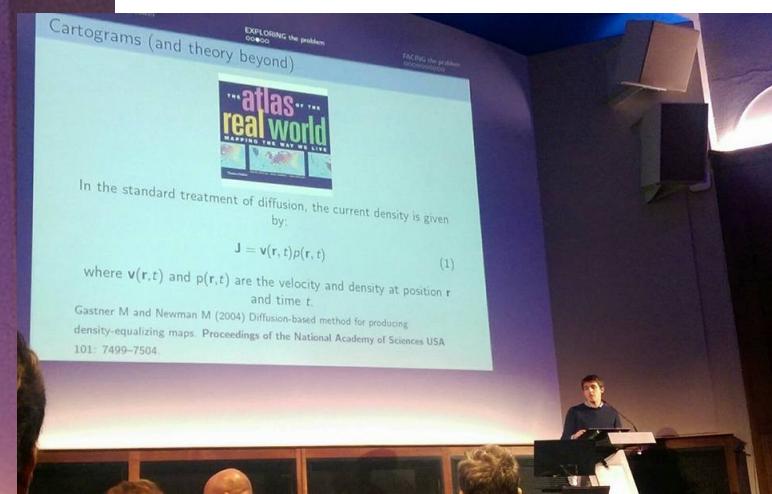
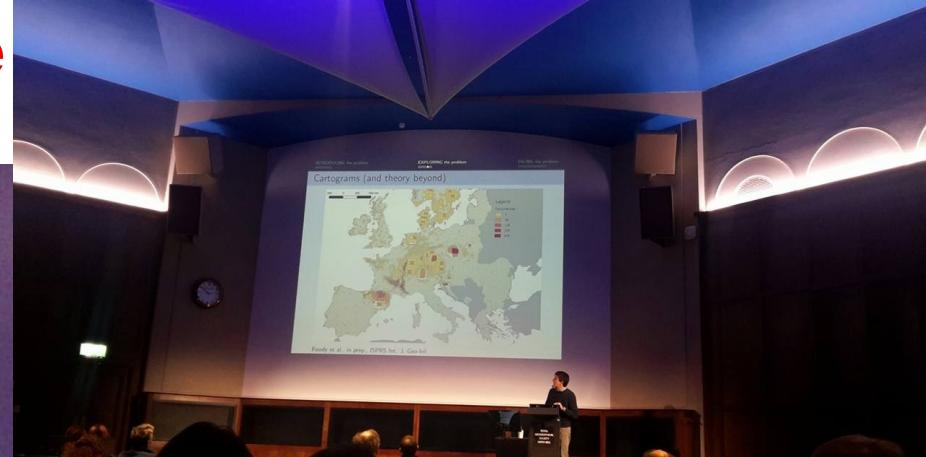
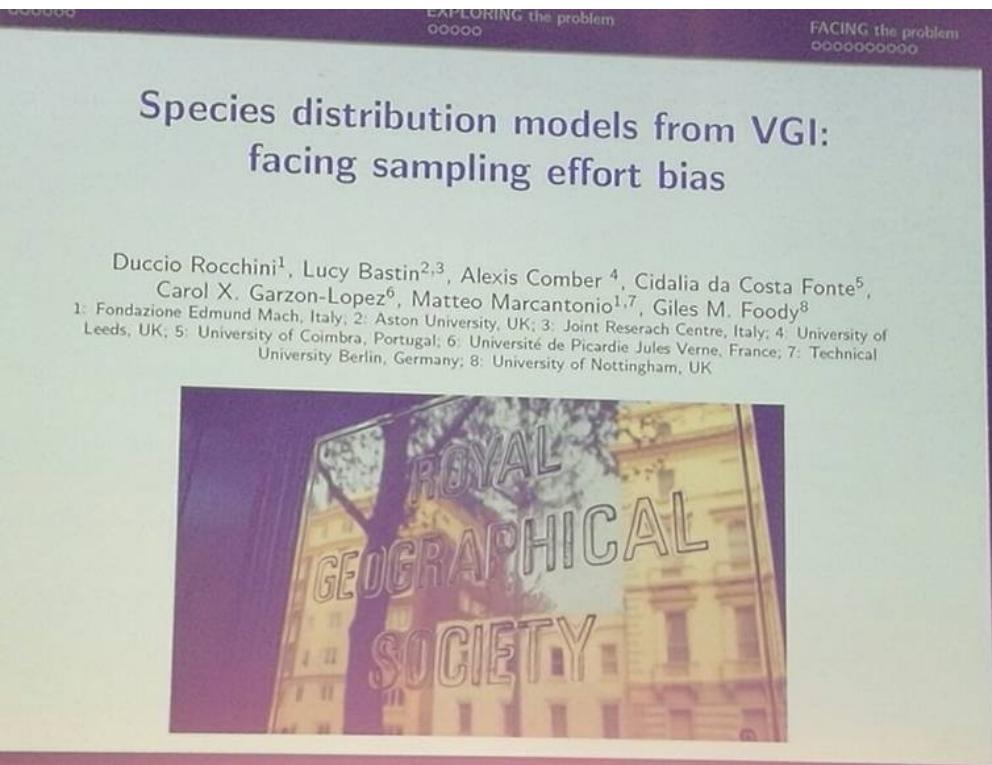
**▲ Figure 54.2 Resource partitioning among Dominican Republic lizards.** Seven species of *Anolis* lizards live in close proximity, and all feed on insects and other small arthropods. However, competition for food is reduced because each lizard species has a different preferred perch, thus occupying a distinct niche.

# Darwin's Voyage on the Beagle



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# Darwin's Voyage on the Beagle



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- In **1844**, **Darwin** wrote an essay on the origin of species and **natural selection** but did not introduce his theory publicly.
  - In June **1858**, Darwin received a manuscript from **Alfred Wallace**, who had developed a theory of natural selection **similar** to Darwin's.
  - Darwin **quickly finished** ***The Origin of Species*** and published it the next year.

## *Interspecific => Competition Between Species: Can Lead to Resource Partitioning*

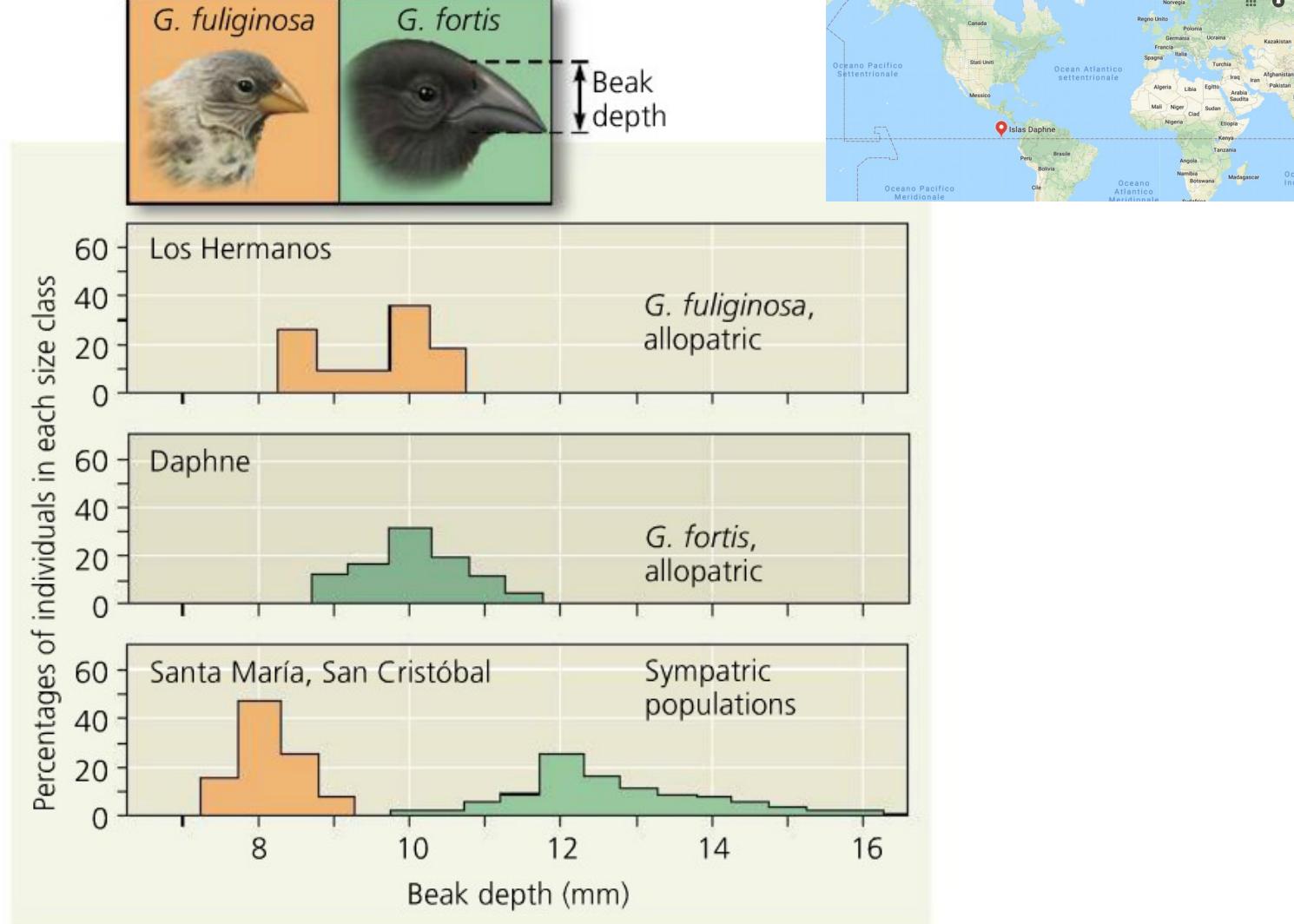
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- As a result of **interspecific competition**, a species' fundamental niche may differ from its **realized niche** --> the niche it occupies after **resource partitioning**.

# Character displacement:

Indirect  
Evidence  
of Past  
Competition

*Geospiza fortis*



**▲ Figure 54.4 Character displacement: indirect evidence of past competition.** Allopatric populations of *Geospiza fuliginosa* and *Geospiza fortis* on Los Hermanos and Daphne Islands have similar beak morphologies (top two graphs) and presumably eat similarly sized seeds. However, where the two species are sympatric on Santa María and San Cristóbal, *G. fuliginosa* has a shallower, smaller beak and *G. fortis* a deeper, larger one (bottom graph), adaptations that favor eating different-sized seeds.

## 2. Predation

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- **Predation** (+/– interaction) refers to interaction where one species, the predator, kills and eats the other, the prey.
- Prey display various **defensive adaptations**: such as **behavior** and **coloration**.

# *Prey: Coloration Defensive Adaptations*

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- Animals also have ***morphological*** and ***physiological defense adaptations***:
- ***Cryptic coloration*** = *camouflage*, makes prey difficult to spot.
- ***Aposematic coloration:*** Animals with effective chemical defense / ***poison*** / often exhibit ***bright warning coloration***. Predators are particularly cautious in dealing with prey that display such coloration.

(a) ***Cryptic coloration***

- ▶ *Hyla arenicolor*  
(rocky plateau areas of southern United States.)



(b) ***Aposematic coloration***

- ▶ *Oophaga pumilio*  
(Costa Rica- tropics)



# Additional cryptics...



## **Mimicry = “Look-alikes” Defense**

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- In some cases, a prey species may gain significant **protection** by mimicking the appearance of another species:
- In **Batesian mimicry**, a harmless species mimics an unpalatable or harmful model... **One is a “pretender.”**
- In **Müllerian mimicry**, **two or more unpalatable species resemble each other...**

# Batesian mimicry

*Deilephila elpenor*



# *Müllerian mimicry*



*Nomada succincta*



*Vespula germanica*



### 3. Herbivory: *Herbivores = Plant Predators*

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- **Herbivory** (+/- interaction) refers to an interaction in which an herbivore eats parts of a plant or alga.
- It has led to evolution of *plant defenses against herbivores: chemical defenses*

## 4. Symbiosis: + +      + 0      + -

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- **Symbiosis** is a *dependency relationship* where two or more species live in direct and intimate contact with one another. The relationship is generally based one or some combination of the following **benefits**:
- *Nutrition (food, water)*
- *Protection*
- *Reproduction*

## 4a. *Parasitism* + -

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- In **parasitism** (+/- interaction), one organism, the **parasite**, derives nourishment from another organism, its **host**, which is harmed in the process.
- **Endoparasites** = parasites that live within the body of their host.
- **Ectoparasites** = parasites that live on the external surface of a host.
- Many parasites have a complex life cycle involving a number of hosts.
- Some parasites change the behavior of the host to increase their own fitness (reproduce more offspring).

## 4b. Mutualism + +

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- Mutualistic symbiosis, or **mutualism** (+/+ interaction), is an interspecific interaction that **benefits both species**.
- A mutualism can be:
  - **Obligate** = *MUST* where one species cannot survive without the other.



- **Facultative** = *OPTIONAL* where both species can survive alone

<https://www.youtube.com/watch?v=7kXQLJnlrg>

## *4c. Commensalism + 0*

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- In **commensalism** (+/0 interaction), one species benefits and the other is apparently unaffected.

[https://www.youtube.com/watch?v=lrE05fvMx\\_o](https://www.youtube.com/watch?v=lrE05fvMx_o)



# community structure

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- Two fundamental features of community structure = **species diversity** and **feeding relationships**.

# Summary

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- Relationships among species
- **Species diversity (biodiversity)**
- Food webs
- Ecological succession

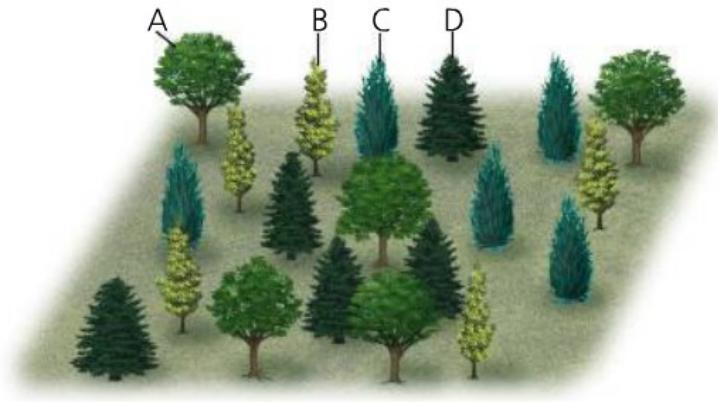
# Species Diversity

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- **Species diversity** of a community is the **variety of organisms** that make up the community.
- It has two components: species richness and relative abundance.
- **Species richness** is the total number of different species in the community.
- **Relative abundance** is the proportion each species represents of the total individuals in the community.

# Which forest is more diverse?

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**Community 1**

A: 25% B: 25% C: 25% D: 25%



**Community 2**

A: 80% B: 5% C: 5% D: 10%

# Trophic Structure = a key factor in community dynamics

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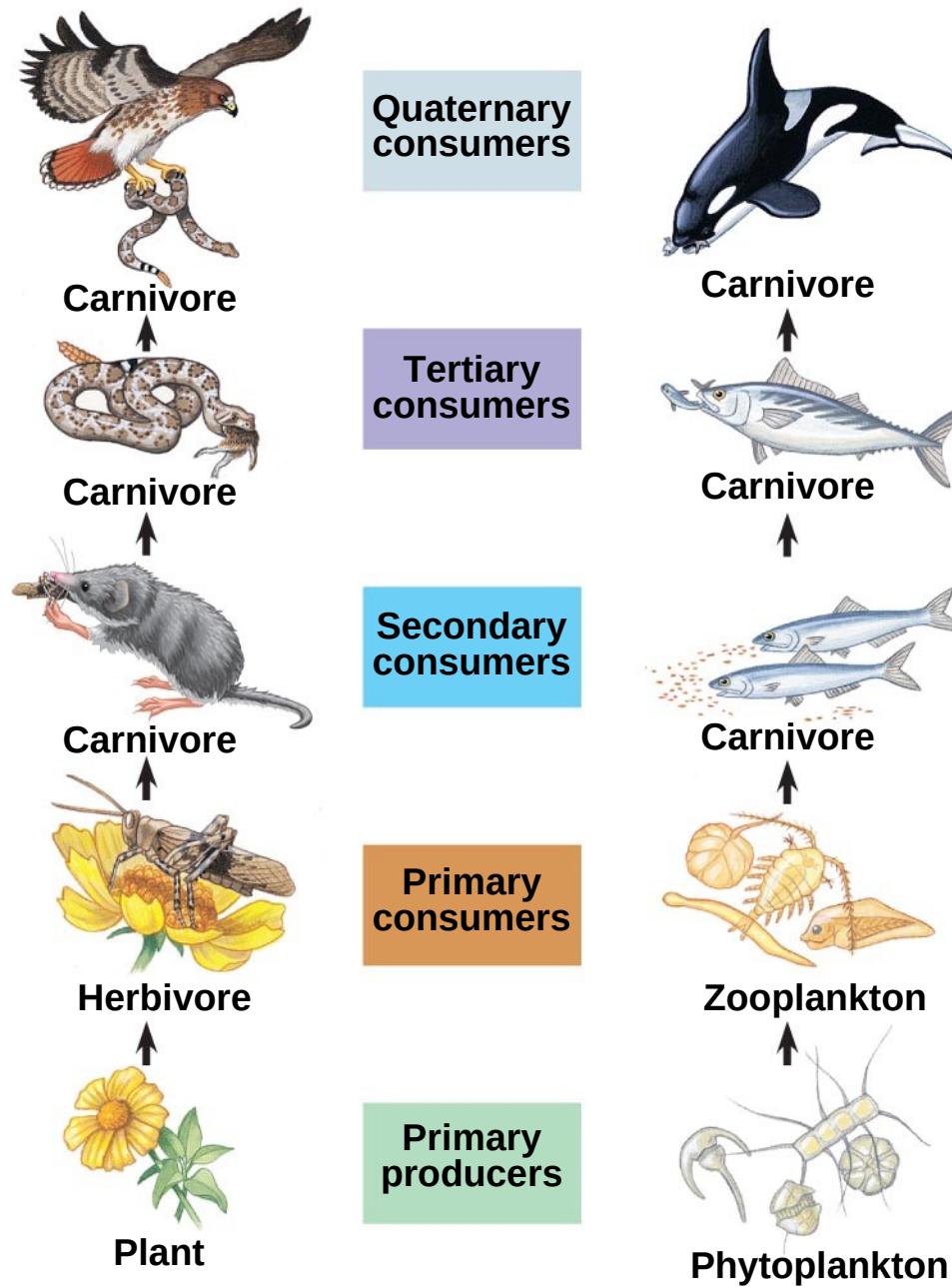
- **Trophic structure** is the feeding relationships between organisms in a community.
- **Food chains** link trophic levels from producers to top carnivores.
- A **food web** is a branching food chain with complex trophic interactions.
- Species may play a role at more than one trophic level.
- Food chains in a food web are usually only a few links long. WHY?

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# Terrestrial and Marine Food Chains

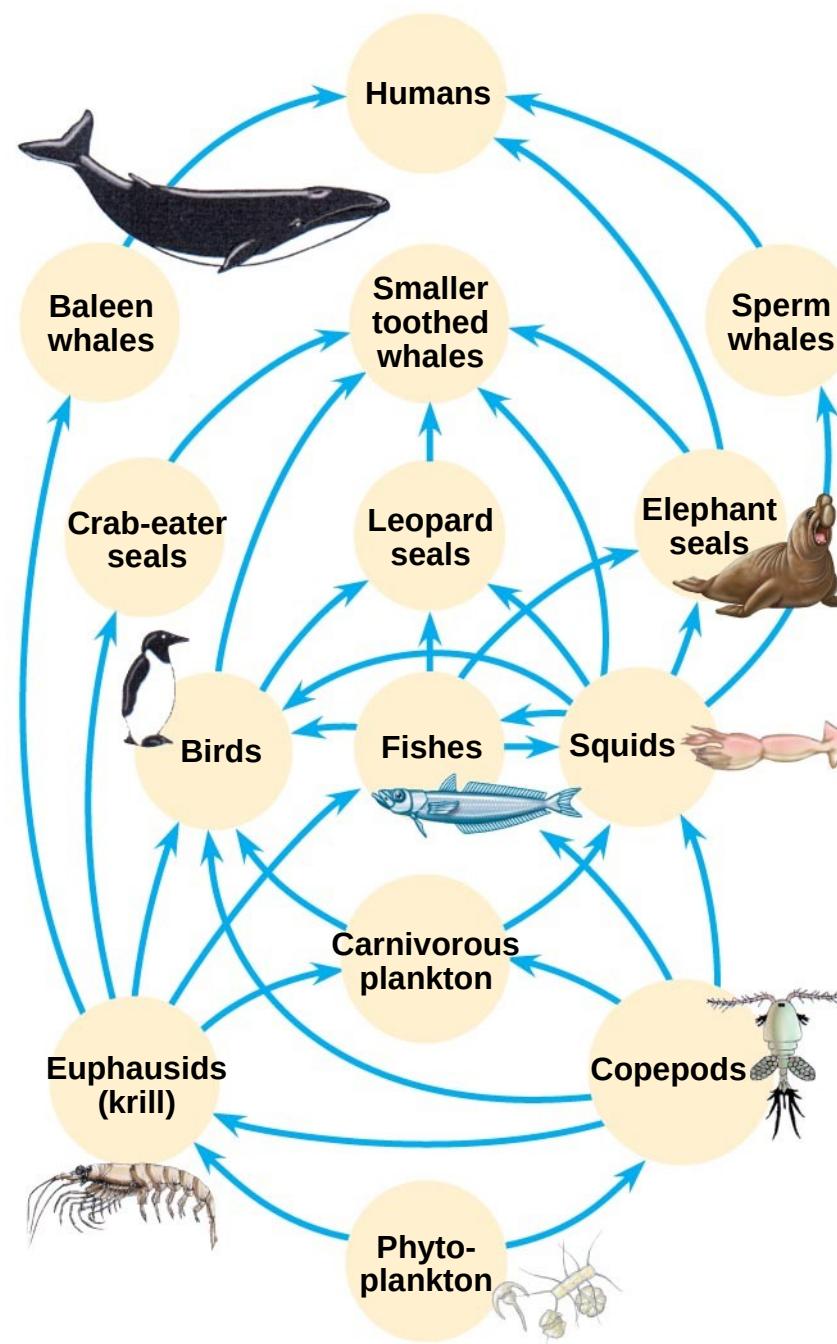


A **terrestrial** food chain

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A **marine** food chain

# An Antarctic Marine Food Web



# *Species with a Large Impact*

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- Certain species have a very large impact on community structure. Such species are *highly abundant* OR play a key *role* in community dynamics.
- ***Dominant species*** = those that are most abundant or have the *highest biomass*.
- **Biomass** is the total mass of all individuals in a population.

# Summary

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- **Ecological succession**

# Ecological Succession

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***Ecological succession*** is the *sequence of community and ecosystem changes* after a disturbance, over time.

- ***Primary succession*** occurs where *no soil* exists when succession begins. *Pioneer organisms*, such as *lichen*, are the foundation of the community and *soil building*.
- ***Secondary succession*** begins in an area where *soil remains* after a disturbance / *disaster* such as fire or field abandonment.



① **Pioneer stage = soil builders / fireweed  
(camenerio, *Epilobium angustifolium*) dominant**



2

## *Secondary succession* grass



3

***Secondary succession : tree***



**4 Climax Community STABLE**

# Disturbance

The large-scale fire in Yellowstone National Park in 1988 demonstrated that communities can often respond very rapidly to a massive disturbance.



**(a) Soon after fire**

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**(b) One year after fire**

# Human Disturbance

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- Humans have the greatest impact on biological communities worldwide. **Human disturbance** to communities **usually reduces species diversity**.
- Humans also prevent some naturally occurring disturbances, which can be important to community structure.









