

# RESOURCE PARTITIONING IN ANIMALS



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# Fundamental questions in animal distribution

- **What determines the distribution, abundance and diversity of organisms?**
- **What makes a community or ecosystem functional?**
- **What happens if an organism is removed or introduced to an established ecosystem?**
- **What are the factors that can cause change in an ecosystem?**

# Resources for an animal?

A **resource** is a substance or object in the environment required by an organism for normal **growth**, **maintenance**, and **reproduction**.

- **Food** (food type, food size, diet time and season aspects)
- **Water**
- **Territory** (macrohabitat, microhabitat)
- **Mate**

Resources are often **limited in a habitat**, and many species may compete to get them.

Resources can be consumed by one organism and, hence, become **unavailable to another organisms**.

In **interspecies competition**, two species use the same limited resource. Competition has a **negative effect** on both of the species (**-/- interaction**).

# The niche concept

- Describes the relational position of a species or population in an ecosystem. **Defines the place and role of each species in its ecosystem.**
- Includes how a population **responds** to the **abundance of its resources** and **enemies** (e. g., by **growing when resources are abundant, and predators, parasites and pathogens are scarce**) and how it **affects** those factors (e. g., by **reducing the abundance of resources through consumption and contributing to the population growth of enemies by falling prey to them**).
- The **abiotic or physical environment is also part of the niche because it influences how populations affect, and are affected by, resources and enemies.**

- The description of a niche may include **descriptions of the organism's life history, habitat, and place in the food chain.**
- The **type and number of variables** comprising the dimensions of an environmental niche **vary from one species to another** [and] the **relative importance** of particular environmental variables for a species may vary according to the geographic and biotic contexts.
- The **majority of species exist in a standard ecological niche**, **sharing behaviours, adaptations, and functional traits** similar to the other closely related species within the same broad **taxonomic** class.

# The niche concept....

An organisms niche is the *ecological role* that it performs in the environment.

Niche usually contains roles such as **trophic levels (producer vs. consumers), decomposer, symbiotic relationships, and the like.**

A niche has two components:

**Distributional component** - A **habitat** a species occupies as a **function of its physiological and behavioural attributes.**

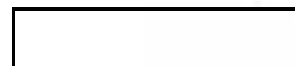
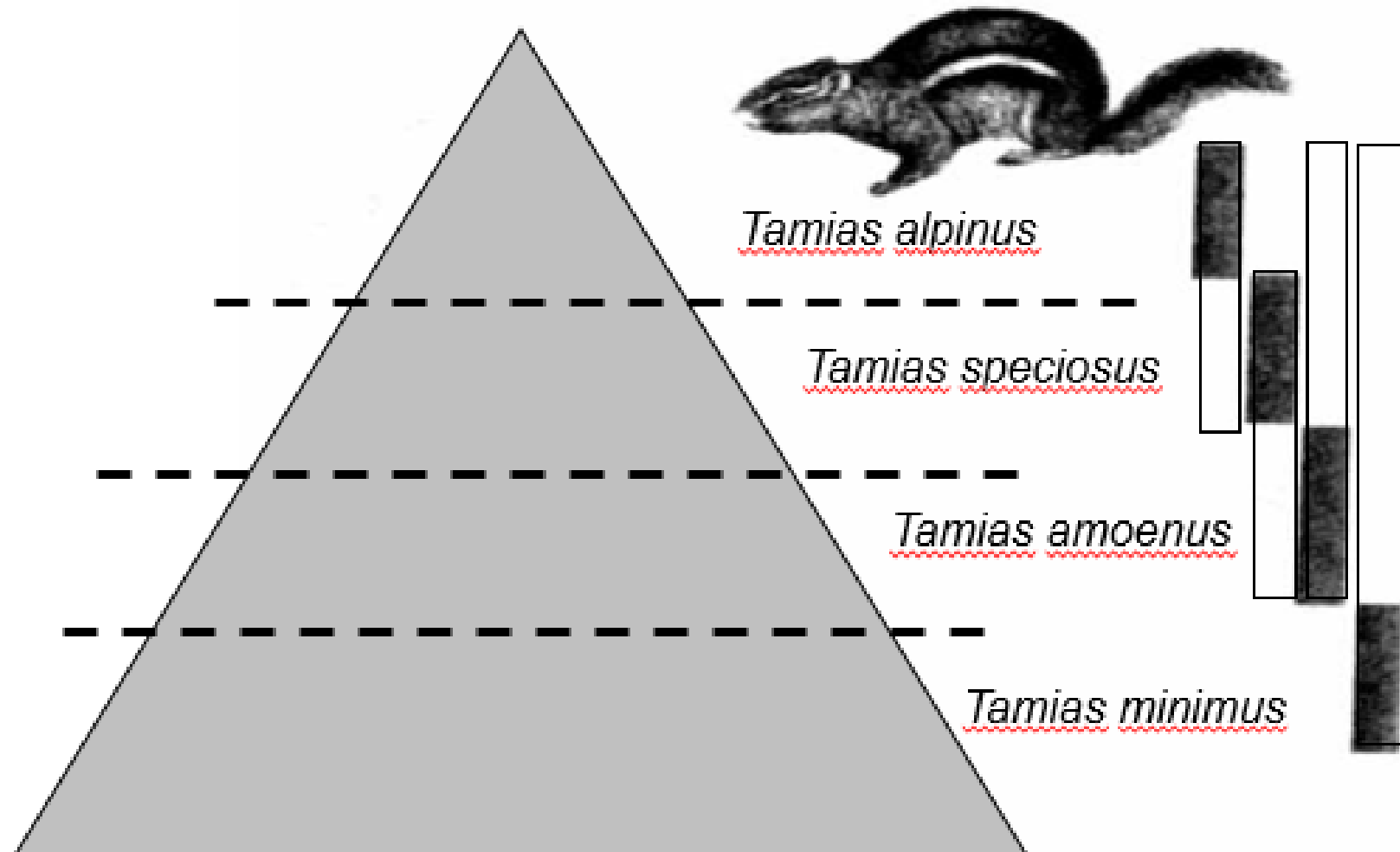
**Functional component** – A species role in the community in terms of its **trophic level.**

- **Most ecologists include both in the definition and consider a niche to be all adaptations of a species to a particular environment.**

## Two types:

1. **Fundamental niche** – All the potential resources that a species can use in its environment.  
**Requires the absence of competition.**
2. **Realized niche** – Some habitats and resources are not available because competitors occupy them.  
**This is what the species actually uses**

Pretend this is a mountain



Fundamental niches



Realized niches



# The principle of competitive exclusion

“Two species requiring approximately the same resources are not likely to remain long evenly balanced in numbers in the same habitat.”

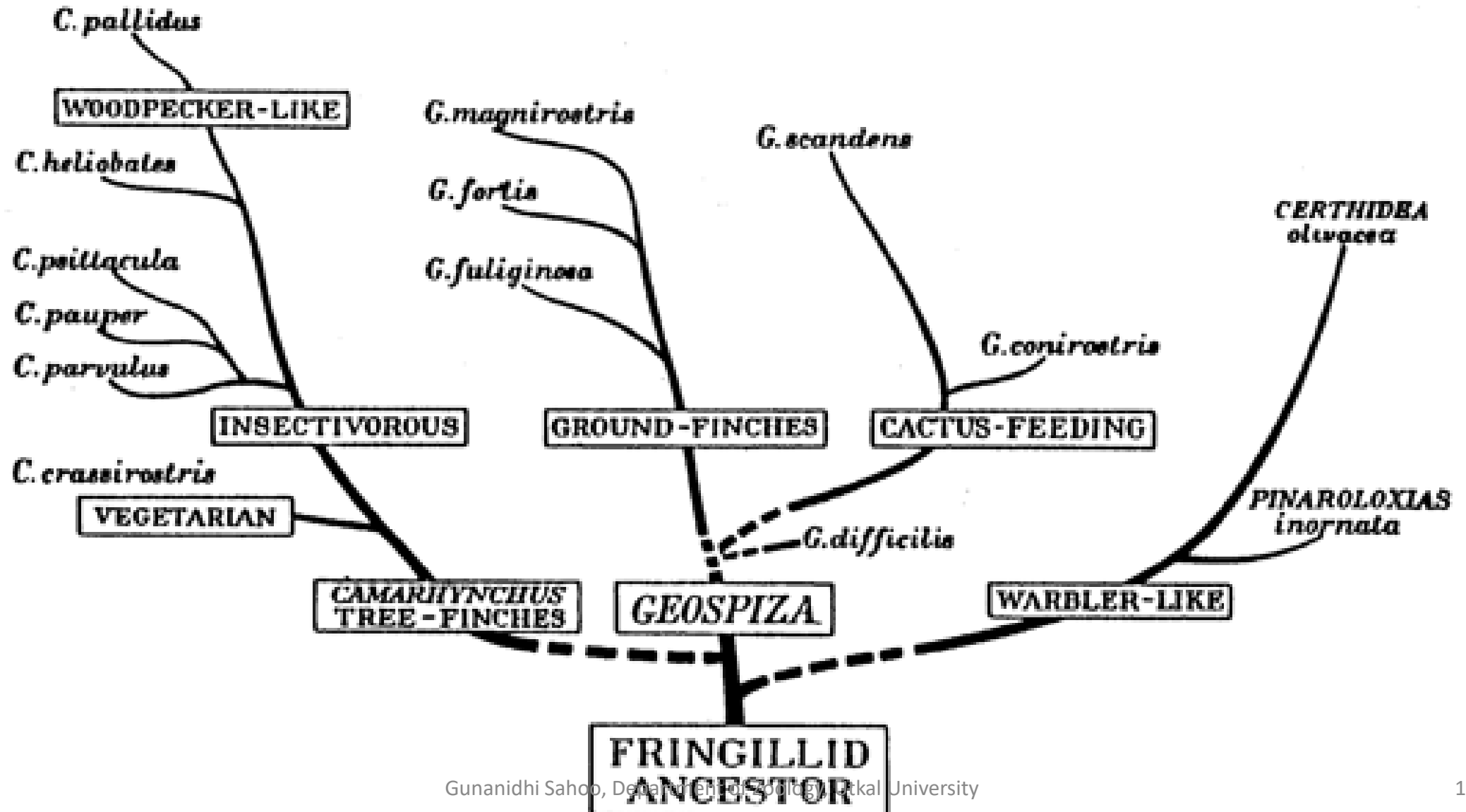
J. Grinnell (1915)

Also known as “**Gause’s principle**” after mathematical formulation by Gause in 1930.

**Consequence:** the loser is excluded, at least **locally**, **unless.....**

- There are refuges from competition; the potential loser hangs on in marginal habitats; or
- The loser can re-immigrate from elsewhere; or
- Disturbances in the environment prevent the winner from gaining a complete monopoly.

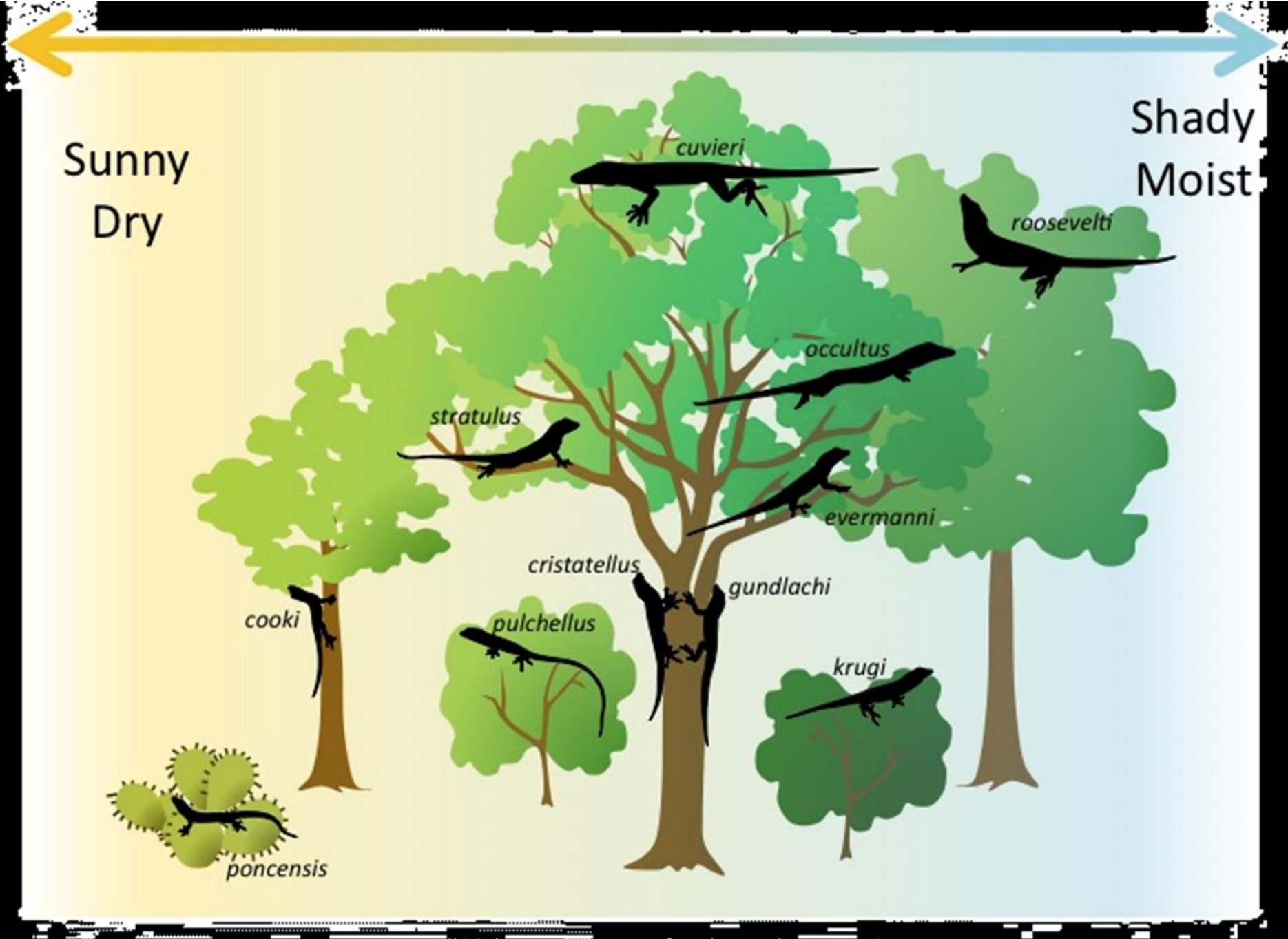
# Galapagos finches: opportunistic evolution



# What is Resource partitioning?

(Term coined by Schoene, 1965)

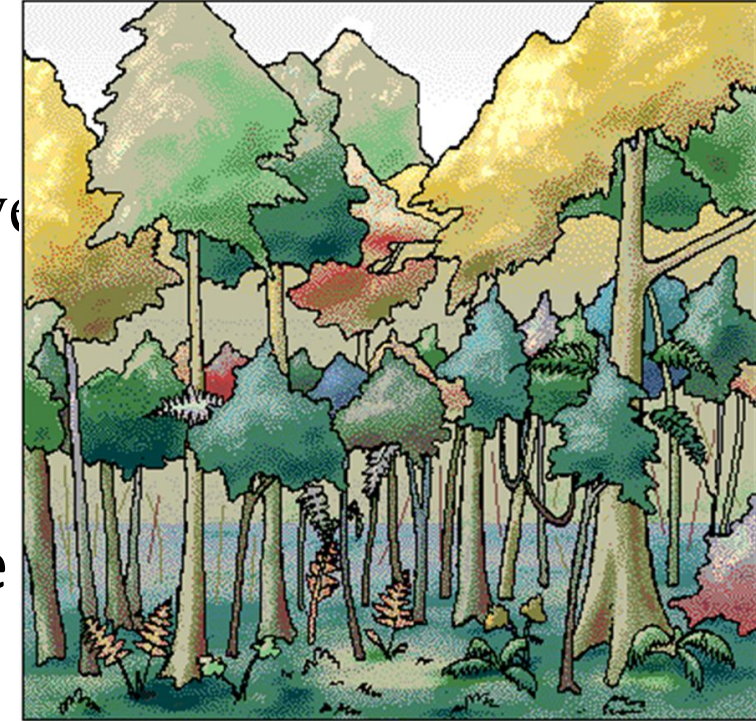
- When two or more similar species coexist, **each species only uses part of the available resources**. This is called resource partitioning (**species sharing resources**).
- Competitive exclusion may be avoided if one or both of the competing species **evolves to use a different resource**, **occupy a different area of the habitat**, or **feed during a different time of day**. The result of this kind of evolution is that two similar species use largely **non-overlapping resources** and thus have different niches. This is called **resource partitioning**, and it helps the species coexist because there is **less direct competition between them**.
- The **anole lizards** found on the island of Puerto Rico are a good example of resource partitioning. In this group, natural selection has led to the evolution of different species that make use of different resources. **Each species lives in its own preferred habitat**, which is defined by type and height of vegetation (trees, shrubs, cactus, etc.), sunlight, and moisture, among other factors.



**Animals** use different kinds and sizes of food, feed at different times, or forage in different areas or have different sized predators, etc.

**Plants** require *different proportions of nutrients* or have *different tolerances for light and shade*.

Different species of plants **grow to different heights** or **have roots that are different lengths** so they divide the resources, accessing them in slightly different ways.



**Each species exploits a portion of the resources unavailable to others. This results differences among co-occurring species that would not be expected purely by chance.**




## Examples:

- Dayan in Tel Aviv University examined the possible resource partitioning in a group of coexisting species of wild cats.

They vary in the size of **canine teeth** in **different species and in different sexes**, so the **size of prey species selected**. This avoids overlap of the species in food requirement.

- The microhabitat parameters of **stream dweller amphibian larvae** are **water depth and velocity** and **rock size, roughness, and slope** with depth and velocity being the most important.

- Surface feeders
- Benthic feeders
- Column feeders (No. of strata in the column)



**Size of the prey  
in each case**

**Resource-partitioning patterns** result from **three categories of causes**:

**1. Competition**

**2. Predation**

**3. Factors that operate independently of interspecific interactions, such as physiological constraints.**

Several studies have revealed that **two or more mechanisms interact in complex ways**. **In no case does a single factor, for example competition, ever act alone.**