

Community

In ecology, a **community** is an assemblage of populations of **different species** living together in the same geographical area at the same time and interacting with one another.

For example, a pond community includes populations of algae, aquatic plants, zooplankton, insects, fishes, frogs, bacteria, fungi and other organisms living and interacting within the pond.

Community Structure

Community structure refers to the **composition, organization and arrangement of different populations within an ecological community**. It describes which species are present, their relative abundance, their spatial distribution, and how they interact with one another. The structure of a community is influenced by both **biotic factors**, such as competition and predation, and **abiotic factors**, such as temperature, light, moisture, soil and nutrients.

Species Richness and Species Evenness

Species richness and **species evenness** are the two major components used to describe **species diversity** in an ecological community.

1. Species Richness

Species richness is the **total number of different species present in a particular community or area**.

It considers only the **number of species** and does not take into account how many individuals of each species are present.

Example:

- Community A contains 10 species.
- Community B contains 20 species.

Community B has **greater species richness**.

Species richness is influenced by area, climate, habitat diversity, productivity, disturbance, and geographical location.

2. Species Evenness

Species evenness refers to the **degree of similarity in the relative abundance of different species in a community**.

A community has **high evenness** when different species have approximately equal numbers of individuals. It has **low evenness** when one or a few species are very abundant while the others are represented by only a few individuals.

Example:

Suppose two communities each contain four species:

Species	Community A	Community B
A	25	85
B	25	5
C	25	5
D	25	5

Both communities have the **same species richness (4 species)**. However, Community A has **high species evenness**, while Community B has **low species evenness** because one species dominates.

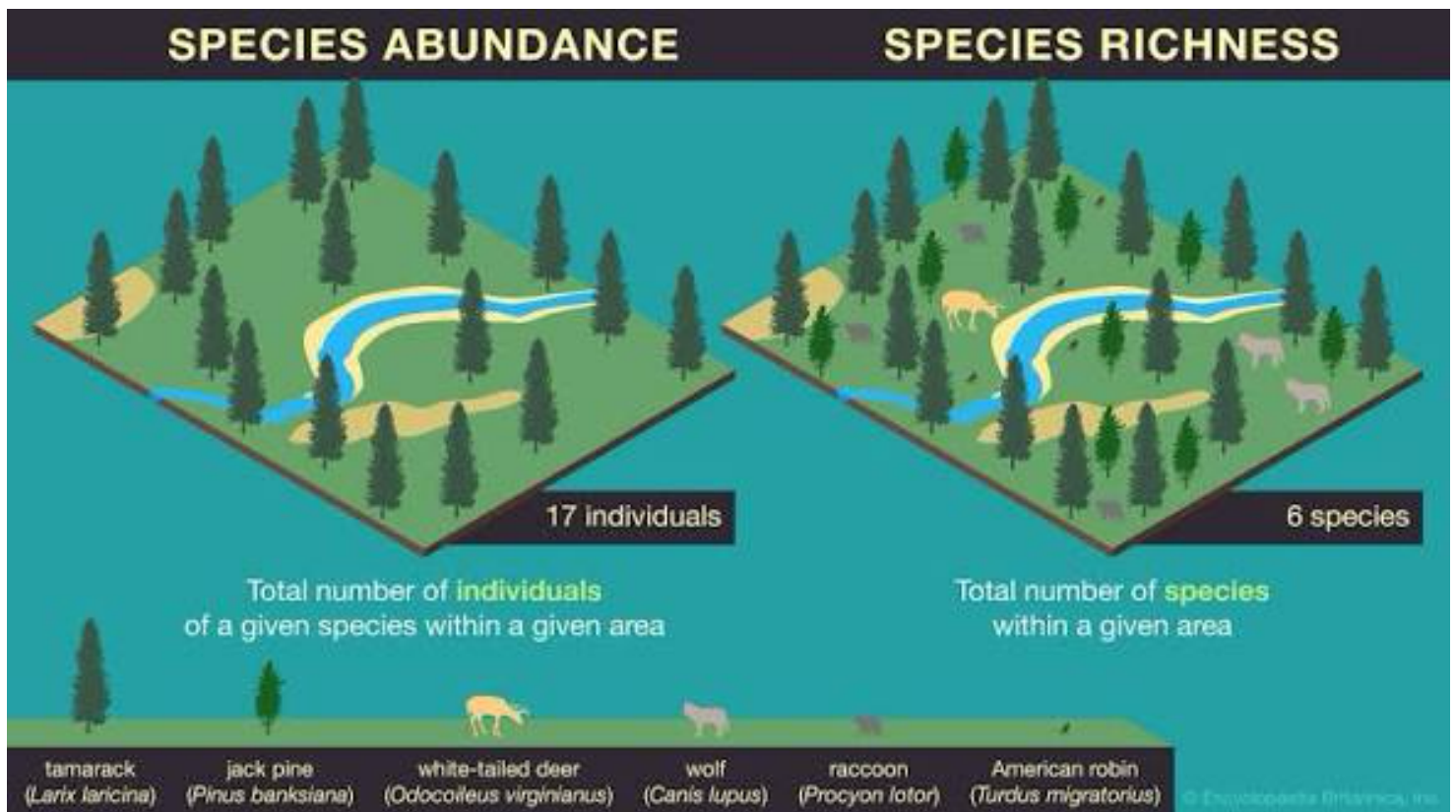
Relationship with Species Diversity

Species diversity = Species richness + Species evenness

Therefore, a community is considered highly diverse when it contains **many species (high richness)** and the individuals are **relatively evenly distributed among those species (high evenness)**.

Richness = "How many species?"

Evenness = "How equally are individuals distributed among the species?"



Dominant Species

Definition

A **dominant species** is a species that has a **major influence on the structure, appearance, and functioning of a community** because of its high abundance, biomass, percentage cover, size, or ecological influence.

In simple words, the species that **contributes most strongly to the character of a community** is called the **dominant species**.

For example, in a **sal forest**, *Shorea robusta* (sal) may form most of the tree cover and biomass and therefore acts as the dominant plant species.

Characteristics of Dominant Species

1. High abundance

A dominant species may occur in greater numbers than other species in the community.

2. High biomass

Sometimes dominance is determined by biomass rather than number. For example, a few large trees may contribute much more biomass than thousands of small herbs or insects.

3. Greater percentage cover

In plant communities, dominance is often expressed in terms of the area covered by a particular species. A grass species covering most of a grassland can therefore be considered dominant.

4. Determines community appearance

Dominant species often determine the **physiognomy or general appearance** of a community. Trees characterize forests, while grasses characterize grasslands.

5. Influences other organisms

Dominant species can modify environmental conditions such as **light, temperature, moisture, soil characteristics, shelter and food availability**, thereby affecting other species.

Examples

Community	Example of dominant species	Basis of dominance
Sal forest	<i>Shorea robusta</i>	High biomass and canopy cover
Pine forest	<i>Pinus</i> spp.	High abundance and canopy cover
Mangrove forest	<i>Avicennia</i> or <i>Rhizophora</i> spp.	Abundance/vegetation cover

Grassland	One or more abundant grass species	High ground cover
Phytoplankton community	A highly abundant algal species	Numerical abundance/biomass

How is Dominance Determined?

Dominance can be measured using different parameters depending on the community:

Density → number of individuals of a species per unit area.

Frequency → how frequently a species occurs in the sampling units.

Abundance → number of individuals of a species in the sampling units where it occurs.

Biomass → total mass of the organisms belonging to a species.

Percentage cover → proportion of an area occupied or covered by a species.

In vegetation studies, **Importance Value Index (IVI)** is commonly used to estimate the ecological importance or dominance of plant species:

$$[\text{Relative Density} + \text{Relative Frequency} + \text{Relative Dominance}]$$

A species with a **high IVI** is considered particularly important in determining the structure of that plant community.

Dominant Species vs Keystone Species

These two terms should **not be confused**.

A **dominant species** usually has a large influence because it is **abundant, has high biomass, or occupies considerable space**. A **keystone species**, in contrast, can have a disproportionately large ecological effect **even when it is not abundant**.

Ecological Importance

Dominant species are important because they can determine the **physical structure of the habitat, availability of resources, microclimate, distribution of other species, and overall functioning of the ecosystem**. A major change in a dominant species can therefore substantially alter the entire community.

Species Diversity

Definition

Species diversity refers to the **variety of species present in a community and their relative abundance**. It describes not only **how many different species are present**, but also **how evenly individuals are distributed among those species**.

Thus:

Species diversity = Species richness + Species evenness

Species Abundance

Definition

Species abundance refers to the **number of individuals of a particular species present in a community or within a specified area**.

In simple words:

Species abundance tells us "how many individuals of a species are present?"

For example, if a grassland contains **80 individuals of species A, 40 of species B and 10 of species C**, species A is the most abundant among these species.

Types of Abundance

1. Absolute Abundance

Absolute abundance is the actual number of individuals of a particular species recorded in a defined area or sample.

Example:

If 50 individuals of *Species A* are found in a study plot, its recorded abundance is **50 individuals** for that sampled area.

2. Relative Abundance

Relative abundance expresses the abundance of a species as a **proportion or percentage of the total individuals of all species in the community**.

Relative abundance=Total number of individuals of all speciesNumber of individuals of a species
×100

Example: Suppose a community contains:

Species	Number of individuals
Species A	50
Species B	30
Species C	20
Total	100

Relative abundance of Species A:

$$10050 \times 100 = 50\%$$

Similarly, Species B = **30%** and Species C = **20%**.

Thus, **Species A is the most abundant species** in this community.

Abundance in Quadrat Studies

In vegetation ecology, the term **abundance** is also used more specifically to indicate the **average number of individuals of a species per quadrat in which that species actually occurs**.

Abundance = $\frac{\text{Number of quadrats in which the species occurs}}{\text{Total number of individuals of a species in all quadrats}}$

For example, if **40 individuals** of a plant species are recorded and the species occurs in **5 quadrats**:

$$\text{Abundance} = \frac{40}{5} = 8$$

So, its abundance is **8 individuals per occupied quadrat**.

Abundance vs Density

These terms are often confused.

- **Density** = average number of individuals per **all quadrats sampled**.
- **Abundance** = average number of individuals per **quadrats in which the species occurs**.

Vertical Stratification in a Community

Definition

Vertical stratification is the **vertical arrangement of organisms in a community into distinct layers or strata at different heights or depths**.

It is especially prominent in **forest communities**, where plants of different heights form different layers. Animals also occupy these layers according to the availability of food, shelter, light and suitable environmental conditions.

In simple words: Vertical stratification means the division of a community into different layers from **top to bottom**.

Vertical Stratification in a Forest

A well-developed forest community can generally be divided into the following strata:

1. Emergent Layer

This is the **uppermost layer**, formed by a few very tall trees extending above the general canopy.

These trees receive maximum sunlight and are exposed to strong winds.

2. Canopy Layer

The canopy is formed by the **crowns of tall, mature trees**. It receives abundant sunlight and forms a more or less continuous cover over the forest. Many birds, insects, epiphytes and arboreal animals are associated with this layer.

3. Understory or Small-Tree Layer

This layer occurs **below the main canopy** and consists of young trees and smaller shade-tolerant trees. It receives less light than the canopy.

4. Shrub Layer

The shrub layer consists mainly of **shrubs and woody plants of relatively short height**. Light intensity and temperature are generally lower here than in the upper layers.

5. Herb Layer

This layer contains **herbs, grasses, seedlings, ferns and other small plants** growing close to the ground.

6. Forest-Floor or Ground Layer

It is the **lowest layer** and contains fallen leaves, dead plant material, fungi and decomposing organic matter. Decomposers such as **bacteria and fungi** play an important role in nutrient recycling in this layer.

Simple Representation

TOP



Emergent layer — tallest trees



Canopy layer — crowns of mature trees



Understory — smaller/young trees



Shrub layer — shrubs



Herb layer — herbs, grasses, ferns



Forest floor — litter and decomposers



GROUND

Why Does Vertical Stratification Occur?

Vertical stratification develops because environmental conditions change from the top to the bottom of a community. Important factors include **light intensity, temperature, humidity, availability of nutrients, space and competition**.

For example, in a forest, sunlight is strongest at the canopy and decreases toward the forest floor. Consequently, shade-tolerant plants are more common in the lower strata.

Importance of Vertical Stratification

Vertical stratification allows different species to **occupy different ecological niches and utilize available resources at different levels**. This can reduce direct competition for resources such as light and space and allows a large number of organisms to coexist within the same community. It also creates different **microhabitats**. For example, canopy-dwelling birds and insects experience environmental conditions different from those experienced by organisms living on the forest floor.

Vertical Stratification in Aquatic Communities

Stratification is not restricted to forests. In aquatic ecosystems, organisms may also be vertically distributed according to **light penetration, temperature, oxygen concentration and water depth**. For example, phytoplankton are generally concentrated in illuminated surface waters where sufficient light is available for photosynthesis.