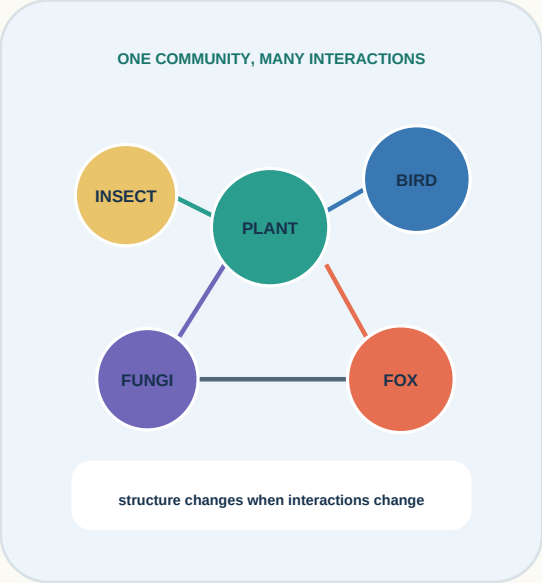
AP BIOLOGY | UNIT 8

TOPIC 8.5

Community Ecology

A community is shaped by which species are present, how abundant they are, and how their interactions change access to energy and matter.



THE COMMUNITY-STRUCTURE CHAIN

SPECIES → which are present

ABUNDANCE → how many of each

INTERACTIONS → who affects whom

STRUCTURE → community pattern

BY THE END, YOU SHOULD BE ABLE TO...

1. Describe community structure using species composition and diversity.
2. Calculate and interpret Simpson's Diversity Index.
3. Compare species interactions and predict community-level effects.

CENTRAL IDEA

Community structure is dynamic. Interactions alter survival, reproduction, and resource use, so a change in one population can affect many others.

1 Measure community structure with composition and diversity

Species identities and relative abundances provide different, complementary information about a community.

SPECIES COMPOSITION

Which species are present. Two communities can have the same number of species but different identities.

SPECIES DIVERSITY

Includes species richness and relative abundance. Greater evenness generally increases diversity.

SIMPSON'S DIVERSITY INDEX

$$D = 1 - \text{sum } (n / N)^2$$

n	N	D
individuals in one species	total individuals sampled	closer to 1 means greater diversity

SAME RICHNESS, DIFFERENT EVENNESS

COMMUNITY A: EVEN



S1: 5 | S2: 5 | S3: 5 | S4: 5

D = 0.75

Four species share abundance equally, so diversity is relatively high.

COMMUNITY B: DOMINATED



S1: 17 | S2: 1 | S3: 1 | S4: 1

D = 0.27

One species dominates even though richness is still four.

CALCULATION CHECK

Community A	**1 - 4(5/20)^2 = 1 - 4(0.0625) = 0.75**
Community B	**1 - [(17/20)^2 + 3(1/20)^2] = 0.27**

2 Interactions change survival, reproduction, and resource access

The sign pair shows the effect on species 1 and species 2: benefit (+), harm (-), or little effect (0).

COMPETITION	- / -	Both species spend energy and receive fewer limited resources.
PREDATION	+ / -	The predator gains energy; the prey is killed and consumed.
PARASITISM	+ / -	The parasite benefits while reducing host fitness.
MUTUALISM	+ / +	Both species gain a fitness benefit from the relationship.
COMMENSALISM	+ / 0	One species benefits; the other has little measurable effect.

TROPHIC CASCADE

A change at one trophic level can indirectly affect organisms at other levels.

PREDATORS	increase
HERBIVORES	decrease
PRODUCERS	increase

NICHE PARTITIONING

Species reduce direct competition by using a resource in different places, at different times, or in different ways.

FROM INTERACTION TO COMMUNITY CHANGE

INTERACTION changes access → **FITNESS** survival + reproduction → **ABUNDANCE** population sizes shift → **STRUCTURE** community changes

PREDICTION RULE

When one population changes, trace the direct interaction first, then follow indirect effects through the food web. State the direction of each change and the biological reason.