

Energy Flow in Ecosystems

The Solar Engine:
Unidirectional Transfer
& The 10% Law

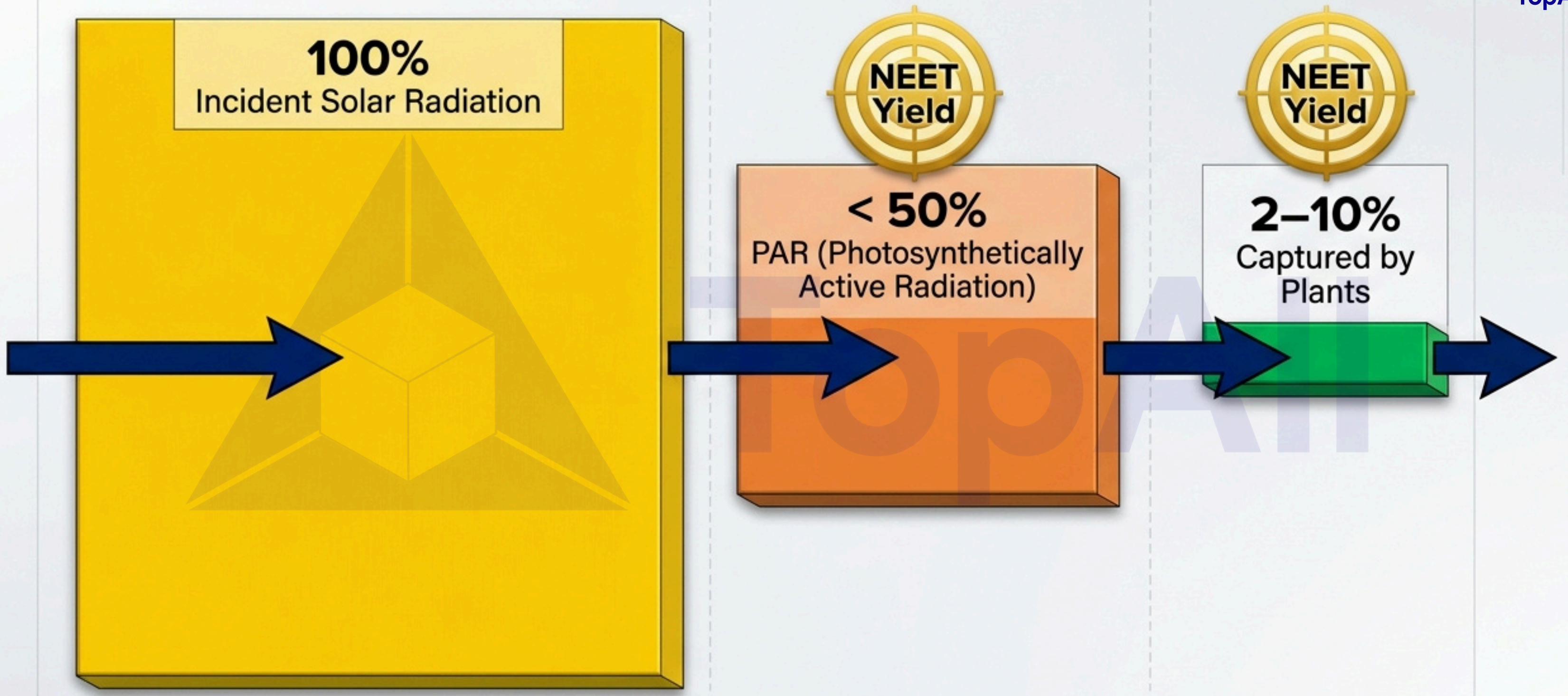
CLASS 12 BIOLOGY / NEET HIGH-YIELD REVIEW



NEET Yield

Except for the deep sea hydro-thermal ecosystem, the sun is the only source of energy for all ecosystems on Earth.

The Solar Funnel: Filtering the Sun's Energy



This incredibly small fraction of captured energy (2-10% of PAR) sustains the entire living world.

The Biological Actors

1st Law of Thermodynamics: Energy cannot be created.
Energy flow is strictly unidirectional from sun → producers → consumers.

Ecosystem



Producers

Green plants, phytoplankton, algae.
They fix radiant energy into simple inorganic materials.

Consumers

Primary (Herbivores)

Secondary (Primary Carnivores)

Tertiary (Secondary Carnivores)

2nd Law of Thermodynamics:
Ecosystems require a constant supply of energy to counteract the universal tendency toward disorderliness.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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Pathways of Energy: GFC vs. DFC

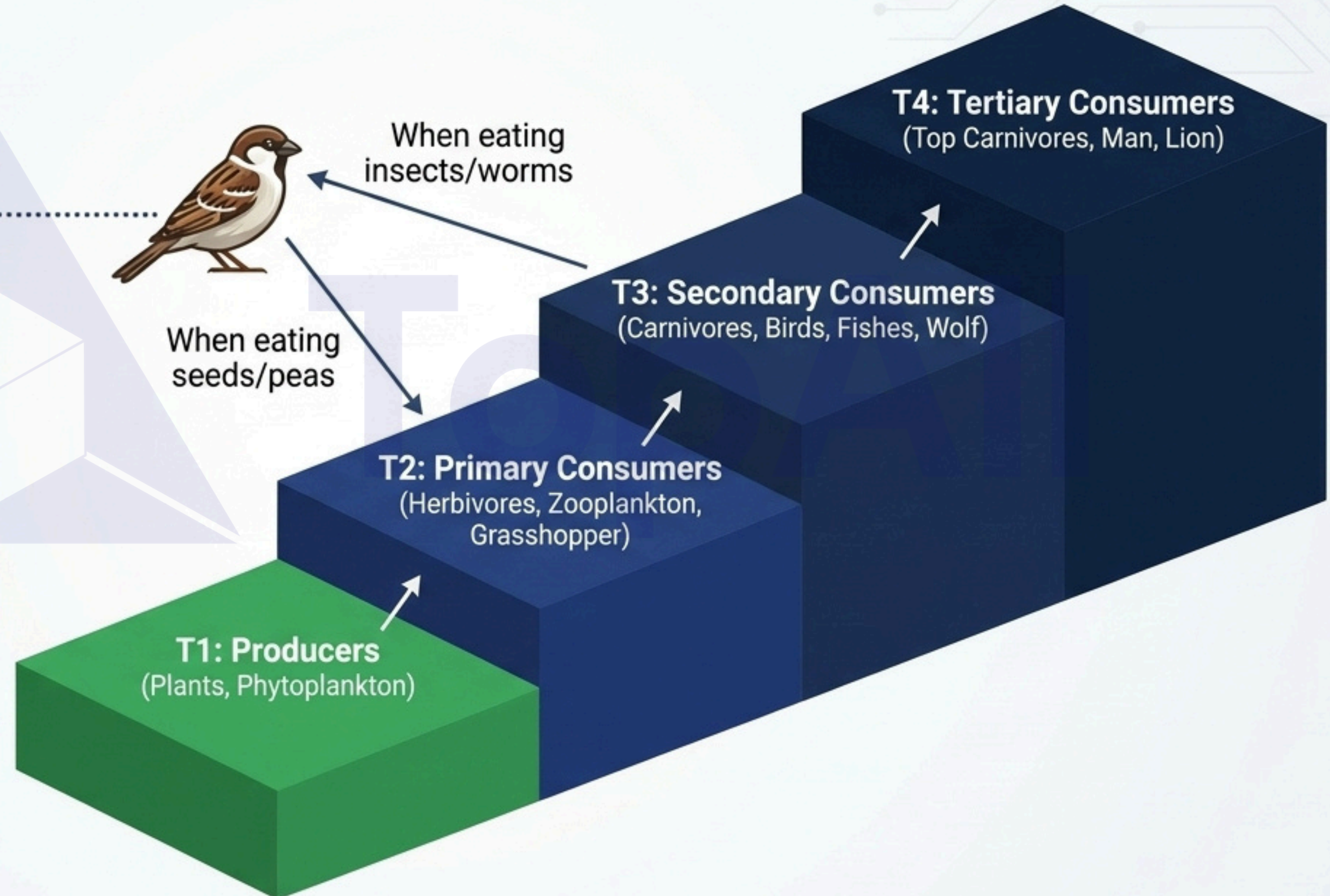
	GFC (Grazing Food Chain)	DFC (Detritus Food Chain)
Starting Point	Living plants (Producers)	Dead organic matter (Detritus)
Dominant Ecosystem	Major conduit for energy flow in Aquatic ecosystems.	Major conduit for energy flow in Terrestrial ecosystems.
Key Actors	Herbivores and Carnivores.	Decomposers / Saprotrophs (fungi & bacteria that secrete digestive enzymes to breakdown waste).

The Food Web Connection: Food chains are not isolated. Organisms of DFC are prey to GFC animals, and omnivores (e.g., cockroaches, crows) naturally interconnect these chains into a complex web.

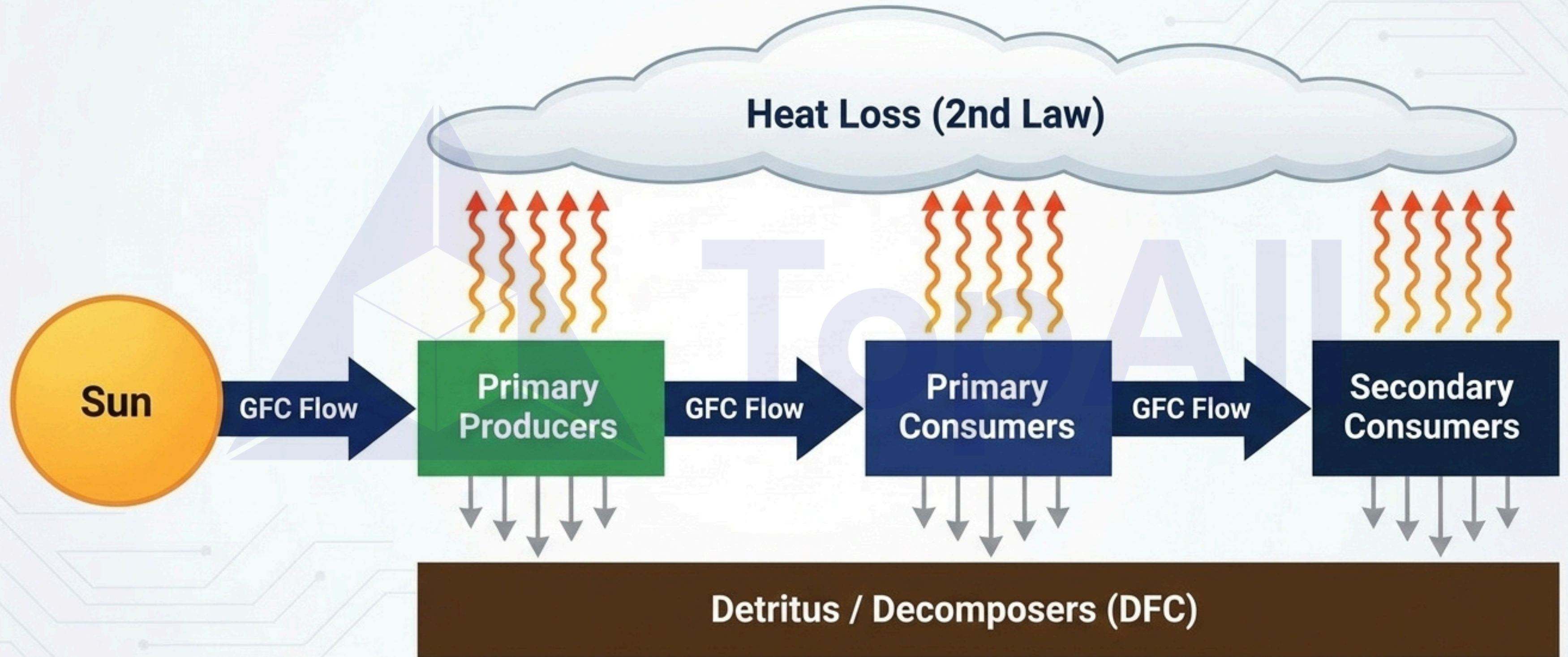
Trophic Levels: A Functional Hierarchy

 **NEET Yield**

Crucial Distinction:
A trophic level represents a FUNCTIONAL level, not a species. A species can occupy multiple levels simultaneously.



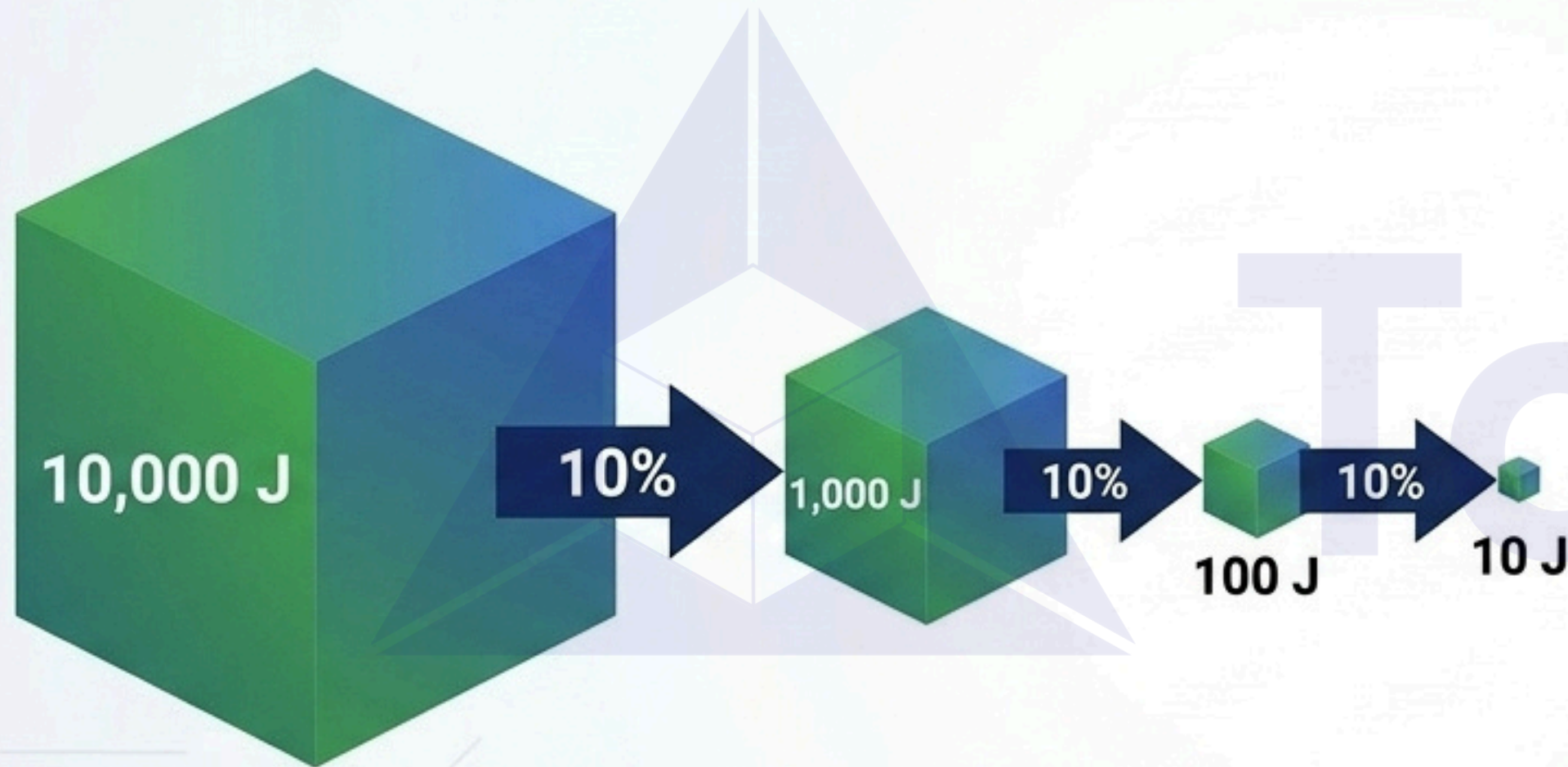
The Ecosystem Energy Map



No energy trapped in an organism remains forever. It is either passed to the next consumer via the GFC, or the organism dies, initiating the DFC.

The 10% Law & Standing Crop

The 10% Law



Only 10% of energy is transferred to each successive trophic level from the lower trophic level. This severely restricts the number of possible trophic levels in a grazing food chain.

Standing Crop



NEET Yield



Standing Crop

The mass of living material (*biomass*) at a particular time at a specific trophic level.

Crucial Note: Measurement in terms of **Dry Weight** is much more accurate as it removes water content variability.

NEET Synthesis: Must-Know Facts

- ★ **Flow is Absolute:** Energy flow is strictly unidirectional.
 - ★ **The 10% Limit:** Only 10% of energy passes to the next trophic level.
 - ★ **Solar Metrics:** PAR is <50% of incident radiation; Plants capture only 2–10% of PAR.
 - ★ **Ecosystem Dominance:** GFC dominates aquatic ecosystems; DFC dominates terrestrial ecosystems.
 - ★ **Saprotrophs:** DFC is driven by heterotrophic decomposers (fungi/bacteria) that secrete external digestive enzymes.
 - ★ **Functional Levels:** Trophic levels classify nutrition source, not strict species identity.
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