ECOSYSTEM

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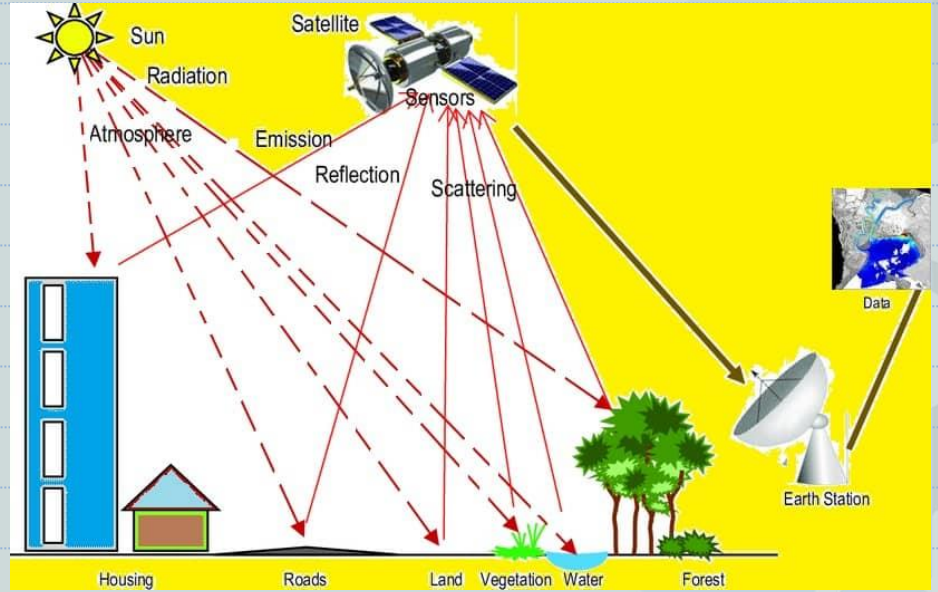
Table 28: The ranking of ecosystems based on NPP: B ratios (kilograms of dry matter produced per year per kilogram of standing crop)

Rank	Ecosystem	P/B rato
1	Oceans	42
2	Continental shelf	36
3	Upwelling zones	25
4	Pond and lakes	8.2
5	Estuary	1.8
6	Algal beds and reefs	1.0
7	Cultivated land	0.59
8	Temperate grassland	0.31
9	Tundra and alpine	0.21
10	Tropical grassland	0.18
11	Desert shurb	0.10
12	Tropical rain forest	0.045
13	Tropical seasonal forest	0.042
14	Temperate decidous forest	0.040
15	Boreal forest	0.040
16	Temperate evergreen forest	0.036

Production rate ↑ / Biomass ↓ =

NPP

Estimating Primary Production from Satellite Data



Visible Red (VIR)

Near-infrared (NIR)

Normalized Difference Vegetation Index (NDVI)

$$NDVI = \frac{NIR - VIR}{NIR + VIR}$$

-1 :Value means aquatic region

0 :Value means less dense vegetation

+1 :Value means dense vegetation

A researcher collected information from four forest using sensors to assess their green cover. Observed average spectral values from each of the forest are given in the table below:

Forest	spectral value	
	NIR	VIS
A	0.50	0.08
B	0.04	0.30
C	0.50	0.20
D	0.60	0.20

The forest cover in the order of highest to lowest is

(1) A>C>B>D

(2) A>D>C>B

(3) B>C>D>A

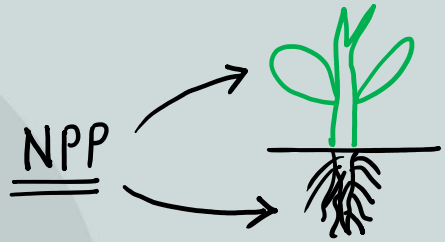
(4) D>A>B>C

$$NDVI = \frac{NIR - VIS}{NIR + VIS}$$

Allocation of NPP to Roots

Table 29: Root: shoot ratio for different ecosystems

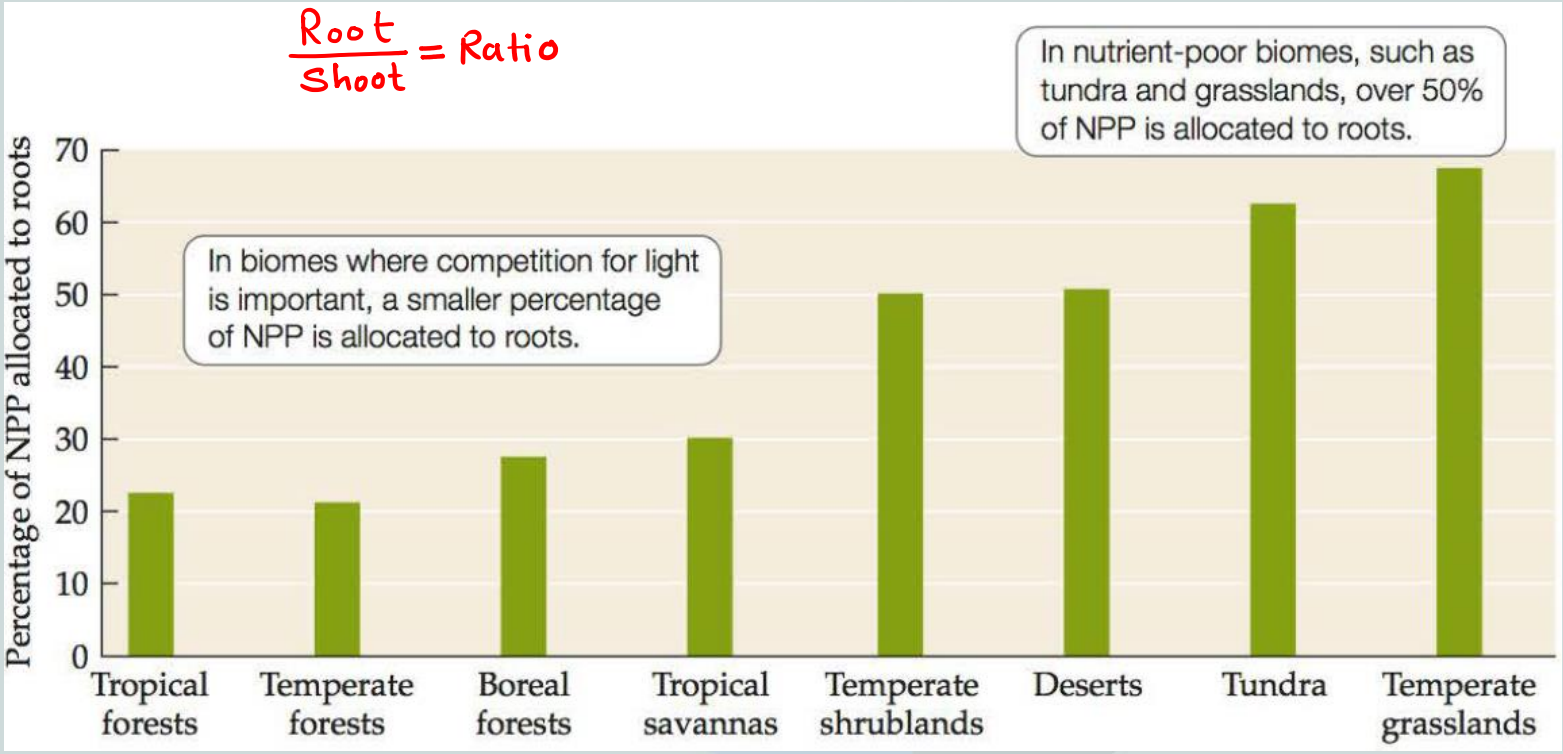
Rank	Ecosystem	Root/Shoot ratio
1 ✓	Temperate grassland	4.5
2 ✓	Tropical grassland	1.8
3 ✓	Tropical dry forest	0.6
4 ✓	Temperate coniferous	0.4
5 ✓	Tropical wet forest	0.2



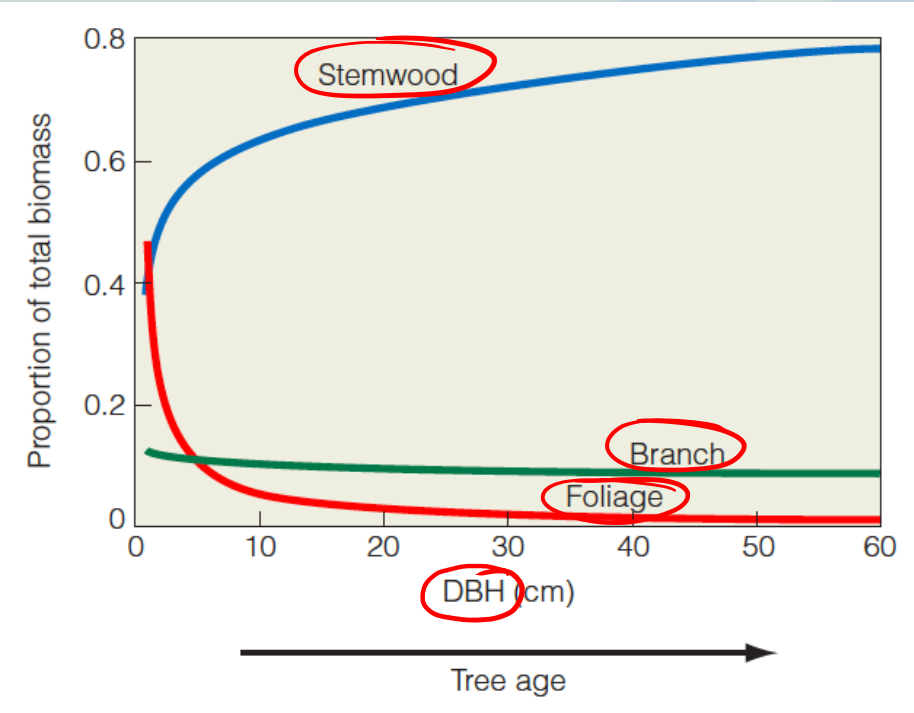
$\frac{\text{Root}}{\text{Shoot}} =$

- Water availibility ↑

Root / Shoot = Ratio



Changes in the proportion of biomass in foliage (leaves), branch, and stemwood (bole) for white oak trees (Quercus alba) as a function of tree size (diameter of the trunk at 1.5 m above the ground, or DBH).



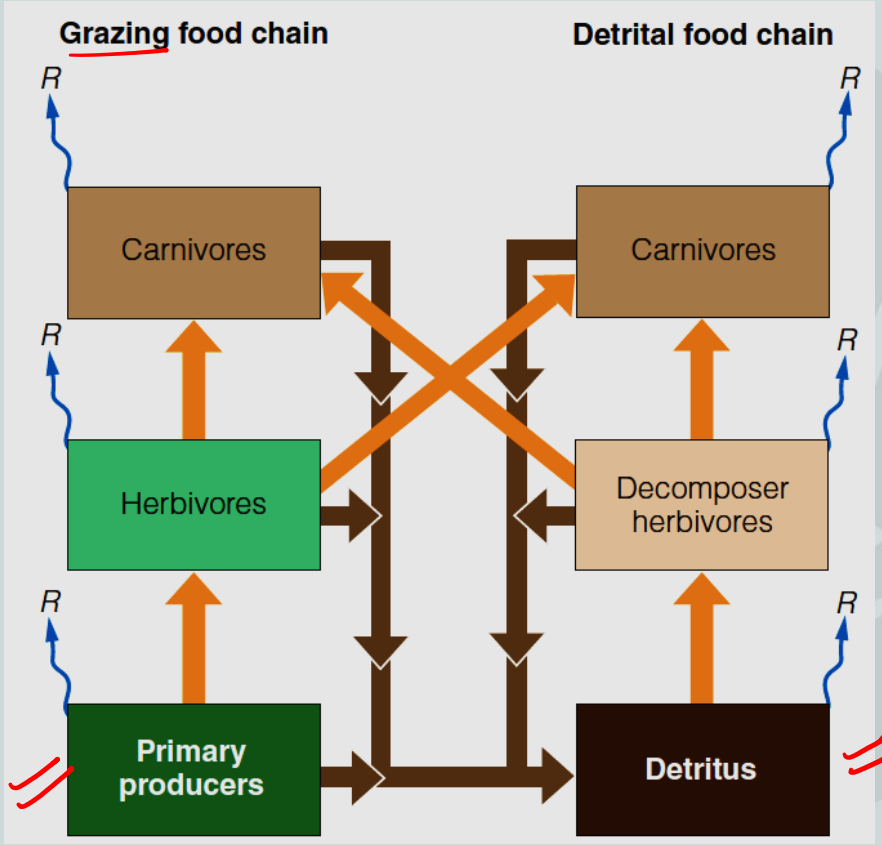


II. Transfer

1. Food Chain: A linear depiction of energy flow showing the feeding links of organisms on others, usually in a series beginning with plants and ending with the largest carnivores.

Grazing food chain:
Food chain in which primary producers (green plants) are eaten by grazing herbivores, with subsequent energy transfers to other trophic levels.

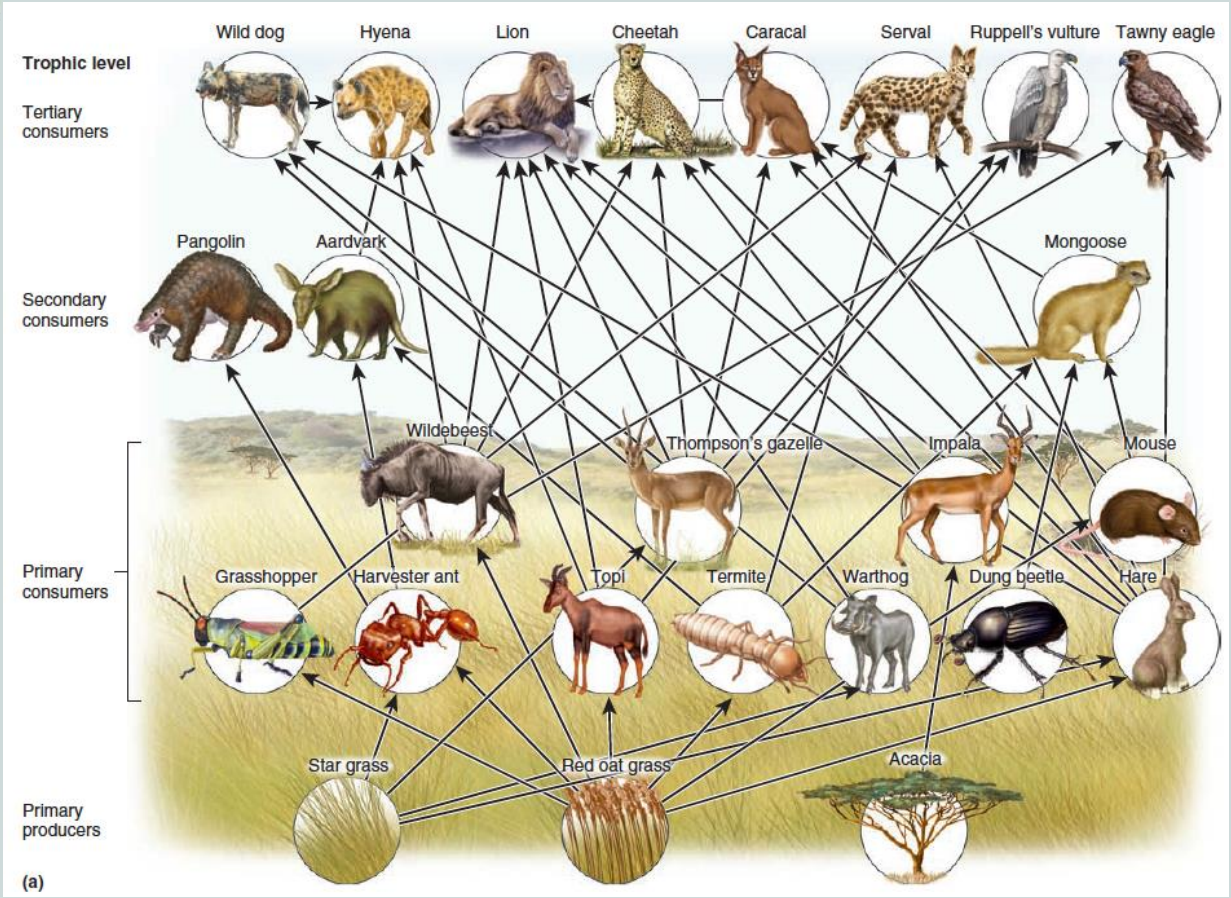
Detrital food chain: Food chain in which detritivores consume detritus or litter, mostly from plants, with subsequent transfer of energy to various trophic levels; ties into the grazing food chain; compare grazing food chain.


Grazing food chain
Detrital food chain
R
Carnivores
Herbivores
Primary producers
Carnivores
Decomposer herbivores
Detritus

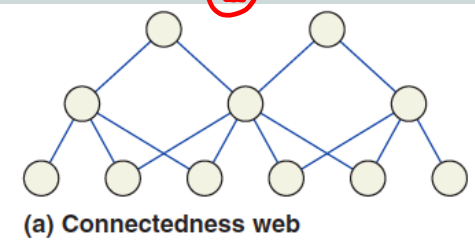
Food web: A complex model of interconnected food chains in which there are multiple links between species.

Characteristics of food web:

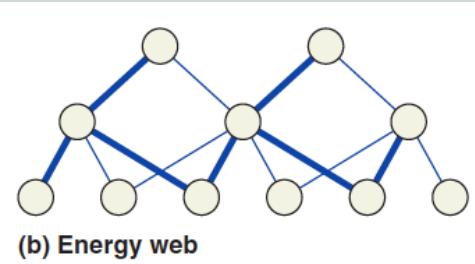
- Represent overall structure of community, energy & nutrient flow
- Complexity
- Multiple Trophic Levels
- Biodiversity
- Connectance and Linkage Density
- Trophic Cascades
- Top-Down and Bottom-Up Control
- Spatial and Temporal Variability
- Ecosystem Resilience
- Modeling and Study
- Interactions


Trophic level
Tertiary consumers
Secondary consumers
Primary consumers
Primary producers
Wild dog
Hyena
Lion
Cheetah
Caracal
Serval
Ruppell's vulture
Tawny eagle
Pangolin
Aardvark
Mongoose
Wildebeest
Thompson's gazelle
Impala
Mouse
Grasshopper
Harvester ant
Topi
Termite
Warthog
Dung beetle
Hare
Star grass
Red oat grass
Acacia
(a)

1

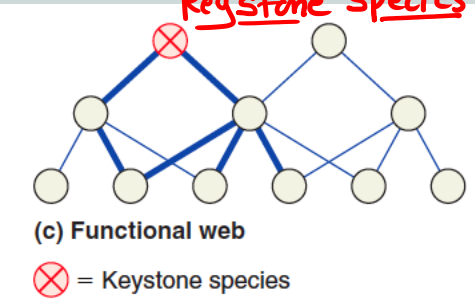


all possible links, regardless of importance

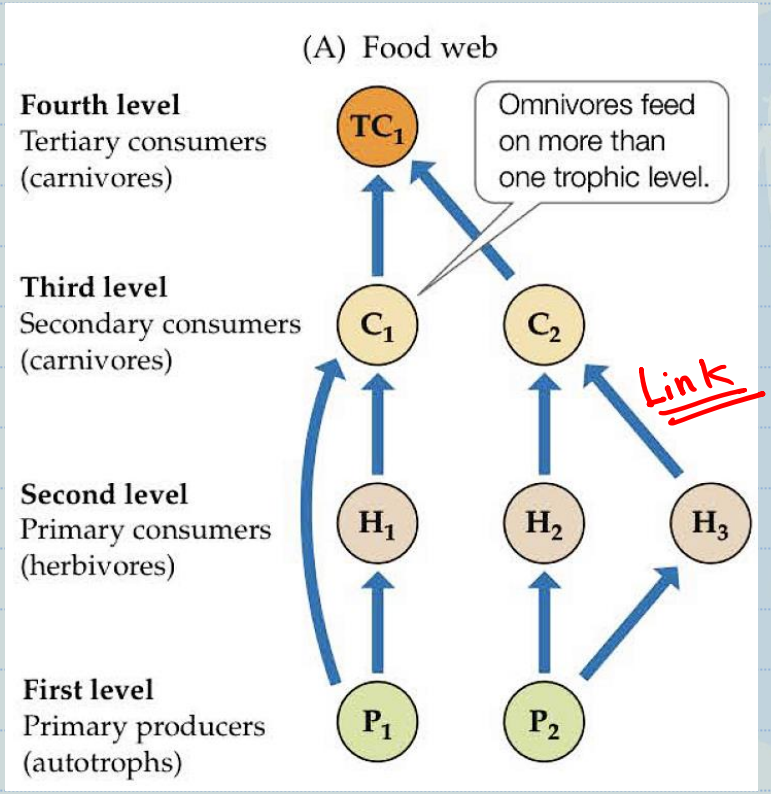


emphasizing the links that process the most energy

"Keystone Species"



emphasize the most important links in the food web



P : Producer

H : Herbivore

C : Carnivore

TC : Top Carnivore

⟶ : Feeding relationship

Imp.

1. **Connectance (C) :** number of actual links in a food web divided by the number of possible links.

$$C = L / S^2$$

L = Actual links

S = Number of species

S^2 = Possible links

2. **Linkage density:** average number of links per species in the web.

$$LD = L / S$$

Sample Question :

Ecosystem I

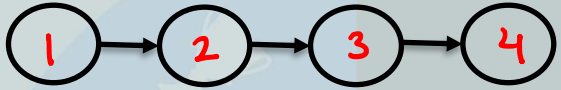


L = 2
S = 3

C = L/S^2 = 0.22

LD = L/S = 0.61

Ecosystem II

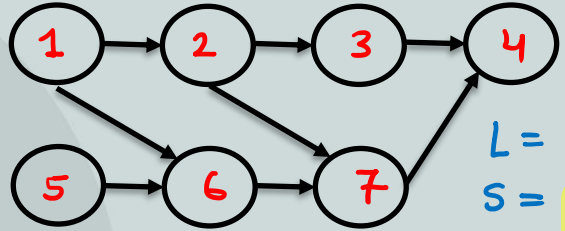


L = 3
S = 4

C = 0.18

LD = 0.75

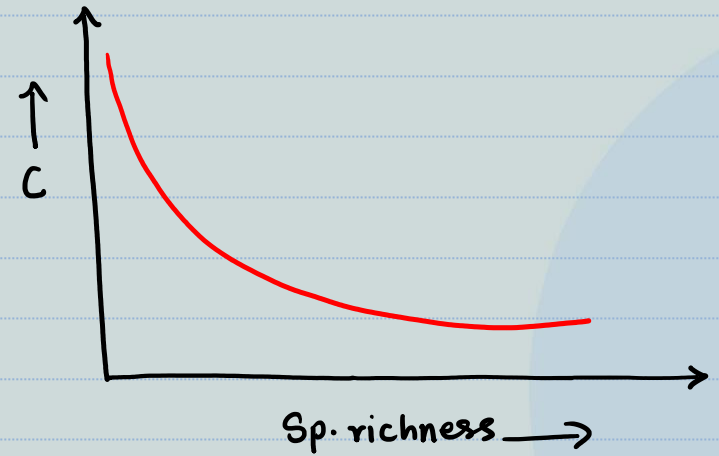
Ecosystem III

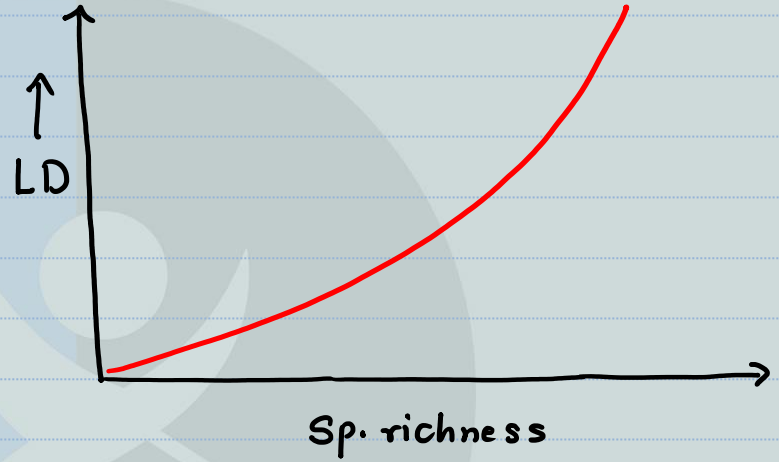


L = 8
S = 7

C = 0.16

LD = 1.14





$$C = \frac{1}{\text{Species richness}}$$

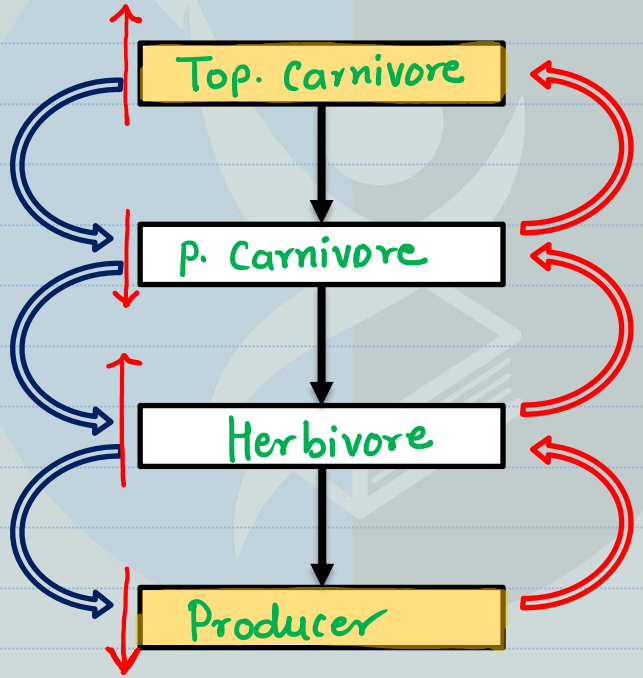
$$LD = \text{Species richness}$$

Trophic cascade / Trophic dynamics

The idea that in a food web, each trophic level strongly influences the one below it so that in the end, top predators influence the density of primary producers.

Top - down control

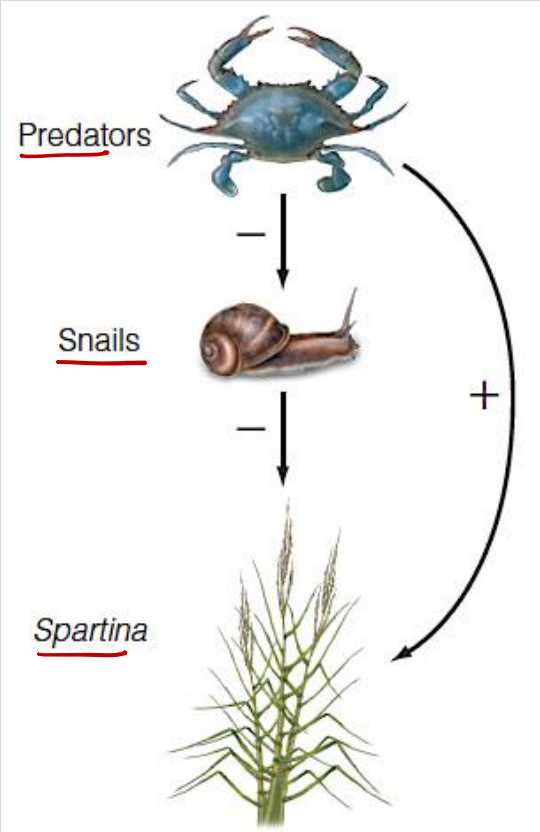
- Upper trophic level Regulate lower trophic level.

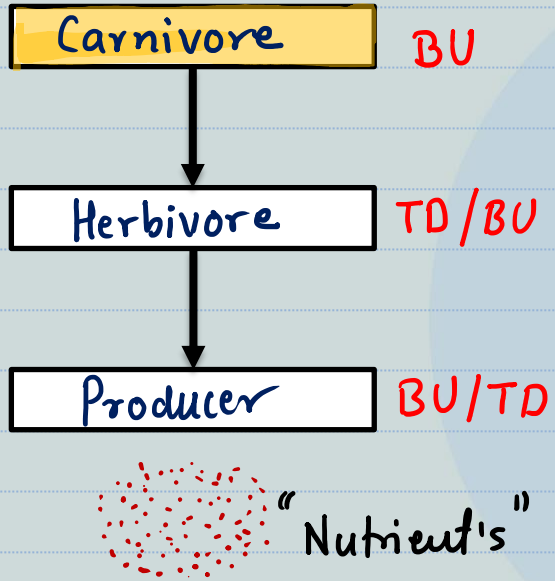


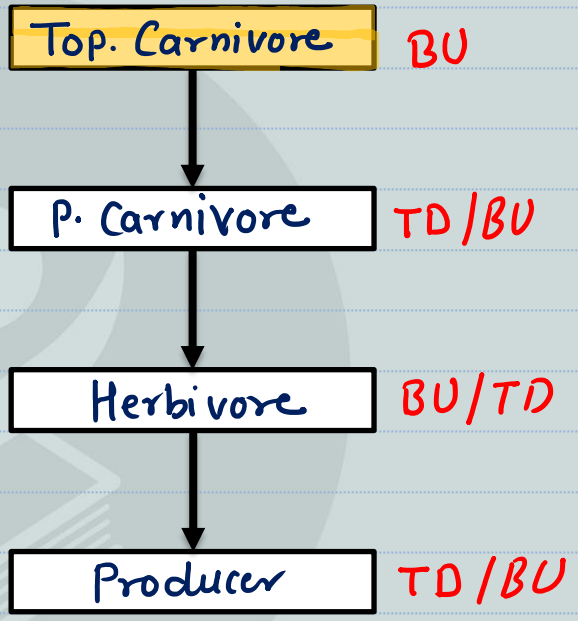
Bottom - up control

- Lower trophic level Regulate Upper trophic level.

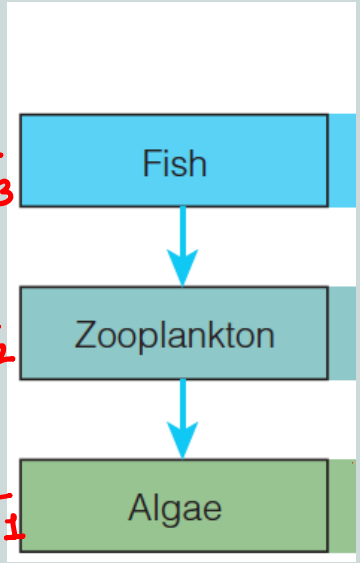
Example of Trophic Cascade:

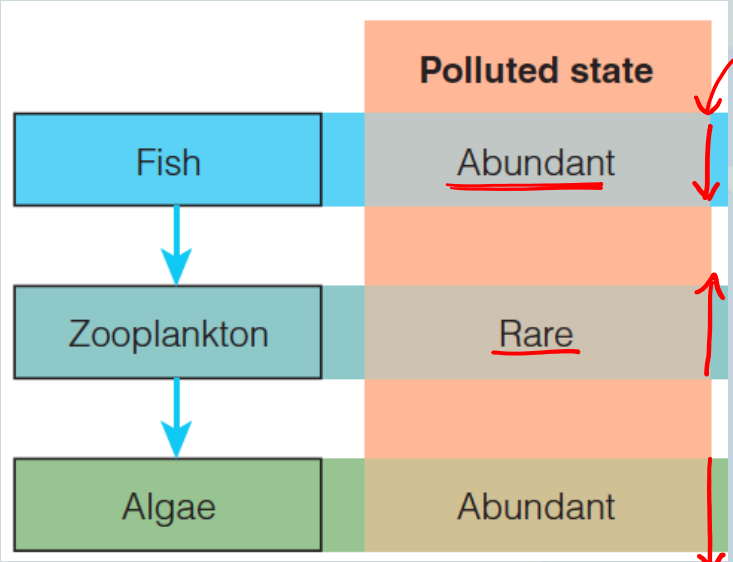


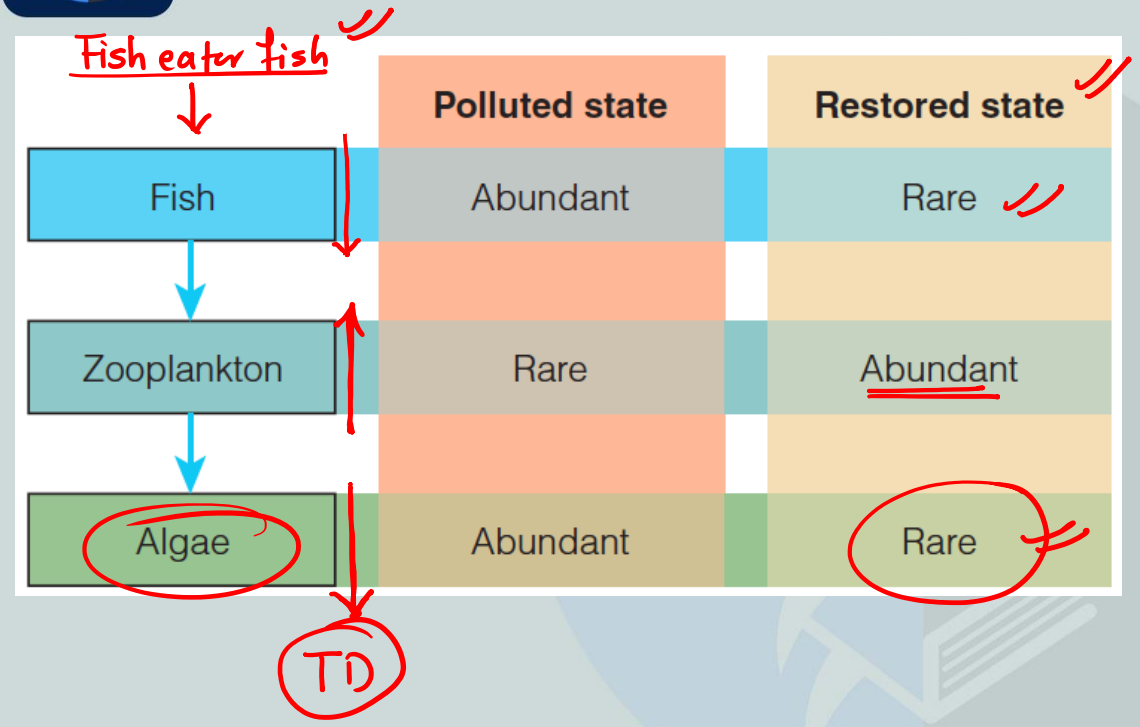

Carnivore
BU
Herbivore
TD/BU
Producer
BU/TD
"Nutrient's"


Top. Carnivore
BU
P. Carnivore
TD/BU
Herbivore
BU/TD
Producer
TD/BU

Example – Lake




Polluted state
Fish
Abundant
Zooplankton
Rare
Algae
Abundant
Fish eater


Fish eater fish
Polluted state
Restored state
Fish
Abundant
Rare
Zooplankton
Rare
Abundant
Algae
Abundant
Rare
TD

Which of the following is the correct decreasing order for the rate of decomposition of litter constituents?

(1) Hemicellulose, cellulose, lignin, phenol (Anti-microbial)

(2) Cellulose, hemicellulose, phenol, lignin

(3) Hemicellulose, cellulose, phenol, lignin

(4) Lignin, phenol, hemicellulose, cellulose

A much greater proportion of energy fixed by autotrophs is transferred to the herbivore level in the open ocean ecosystem than in a forest ecosystem because

(1) aquatic autotrophs are small.

(2) aquatic herbivores are more efficient feeders.

(3) terrestrial autotrophs are less efficient feeders.

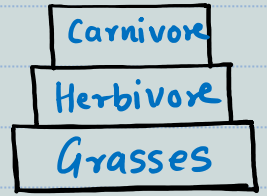
(4) terrestrial autotrophs have more indigestible tissues.

Ecological Pyramids

- Concept was given by: Charles Elton

1. Pyramid of Number :

Grassland → Upright

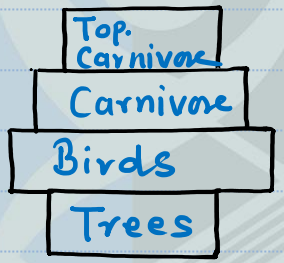


*

Aquatic → Upright

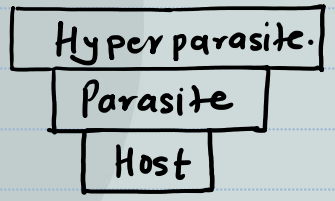
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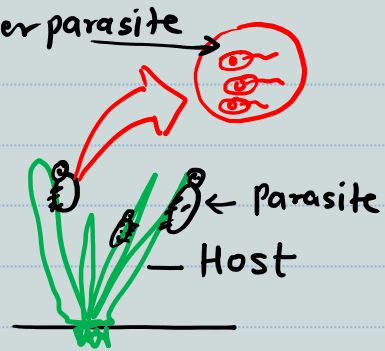
Forest → Uneven.



*

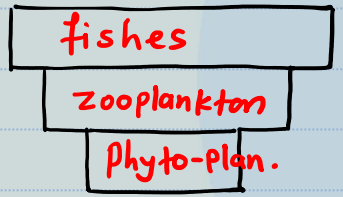
parasitic → Inverted





2. Pyramid of Biomass: (Dry mass)

* Grassland → Upright
* Aquatic → Inverted.



* forest → Upright



* parasitic → Upright.

3. Pyramid of energy :

- Alway upright in all Ecosystems.
- 2nd law of thermodynamic's.

Nutrient cycling

I. Sedimentary Nutrient's

- S
- P

II. Gaseous nutrient

- C
- O
- N

III. Out-put : ⟶ # Decomposition

1. Leaching:
2. Fragmentation: Detrivores.
3. Microbial breakdown(Enzymatic breakdown)
4. Humification : Dark, amorphus, Resistant
5. Mineralization : Nutrient's finally released in to soil.



Detritus

Rate of decomposition is affected.

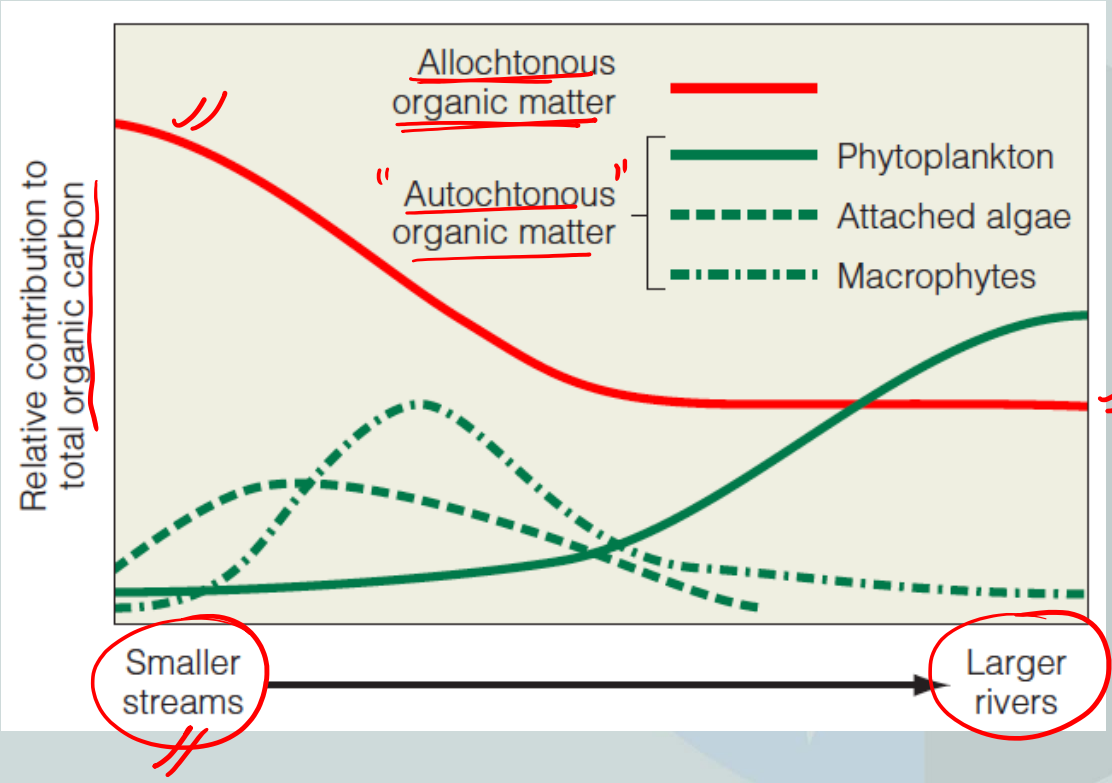
1. Temp.
2. Humidity
3. Composition dead organic matter.
4. Oxygen

Autochthonous: Organic carbon produced within an ecosystem.

- Photosynthesis in phytoplankton's

Allochthonous : Organic carbon inputs from outside the ecosystem.

- Adjacent terrestrial ecosystems


Allochtonous organic matter
Autochtonous organic matter
Phytoplankton
Attached algae
Macrophytes
Relative contribution to total organic carbon
Smaller streams
Larger rivers

HAPPY LEARNING

THANKS

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