

# Food, cuisine and diets: efficiency of Agricultural systems

Effects of food consumption  
on material and energy flow, on food-chain,  
on efficiency and sustainability of main agro-food systems.

## From what depends life on Earth?

All living beings on Earth depends, directly or indirectly, from the Sun.

The Sun give the energy that ecosystems use to produce chemical, thermal, mechanic and electric energies needed for life.

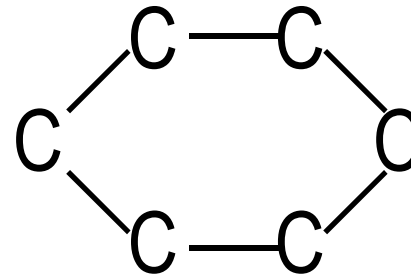
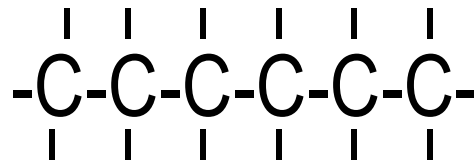
SUN ⇨ PLANTS ⇨ ANIMALS(MEN) ⇨ (MICROBES)

## Where is the energy for life?

All the living beings are made by organic matter, i.e. of molecules with a structure based on carbon.

Carbon is tetravalent.

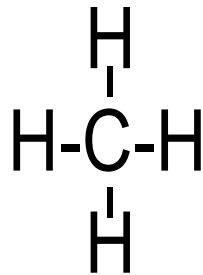
Carbon forms easily chains and rings.



# Where is the energy for life?

Carbon can bound hydrogen (H) with high energy bond and oxygen (O) with low energy bond.

Methane



Carbon dioxide



## In which medium happens the vital reactions?

Life was born from water and terrestrial organisms carry water environment within their cells and tissues.

Water is “medium” and “reagent”.

Chemical reactions of living beings happens at environmental temperature or at body temperature (mammals and birds).

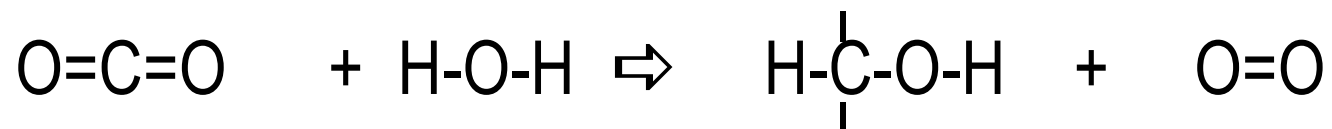


## How solar energy enter the ecosystem?

The base reaction of any ecosystem is chlorophyllian photosynthesis.

Autotrophic organisms: plants (fungi excluded) and many microorganisms (algae), use energy of Sun to create high energy bonds Carbon – Hydrogen :

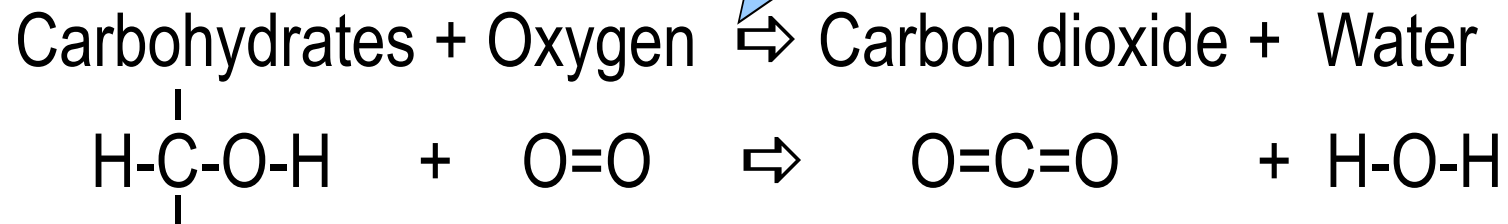
Carbon dioxide + water  $\Rightarrow$  carbohydrates + oxygen



## How solar energy flows through ecosystem?

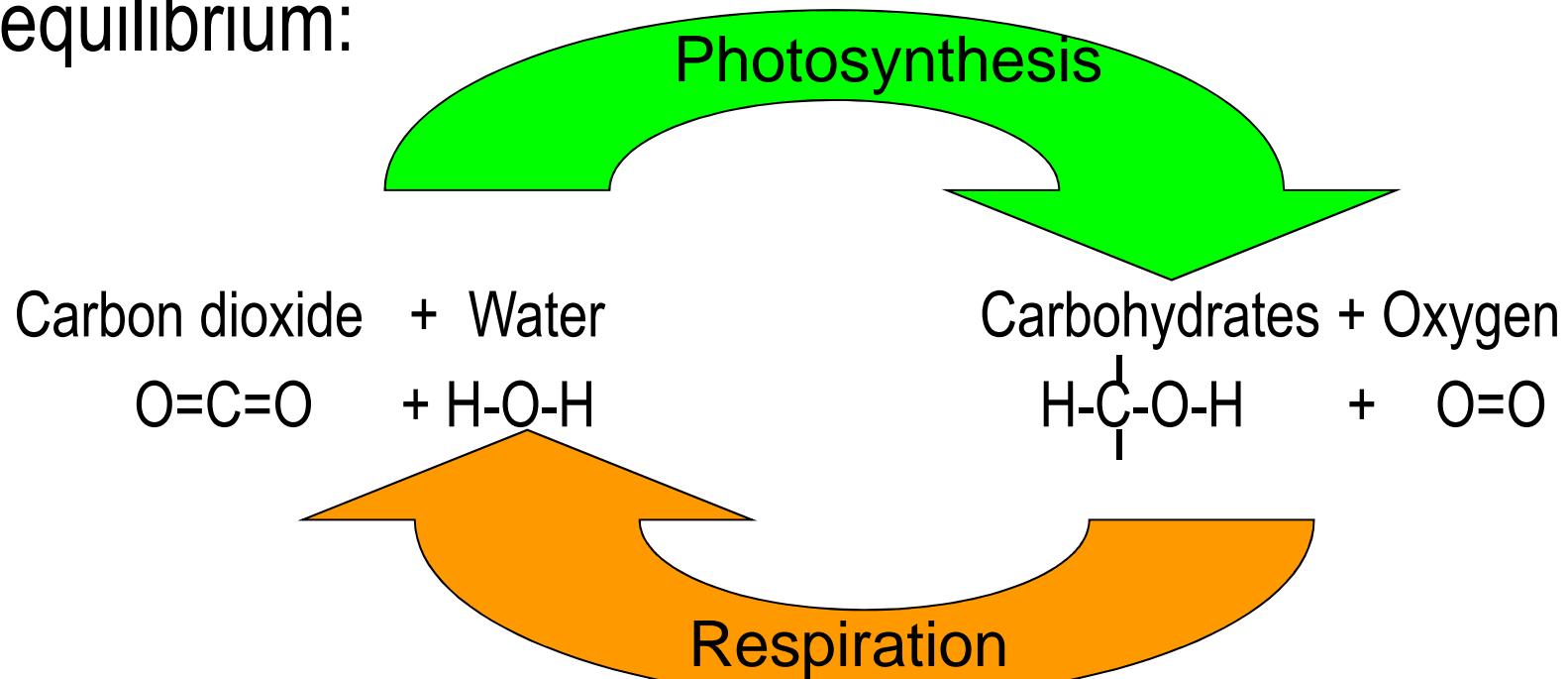
The base reaction of every living being is respiration. With respiration, at cell level, it is intended the following reaction:

*Respiration is the reaction opposite to Photosynthesis*



# When an ecosystem is in equilibrium?

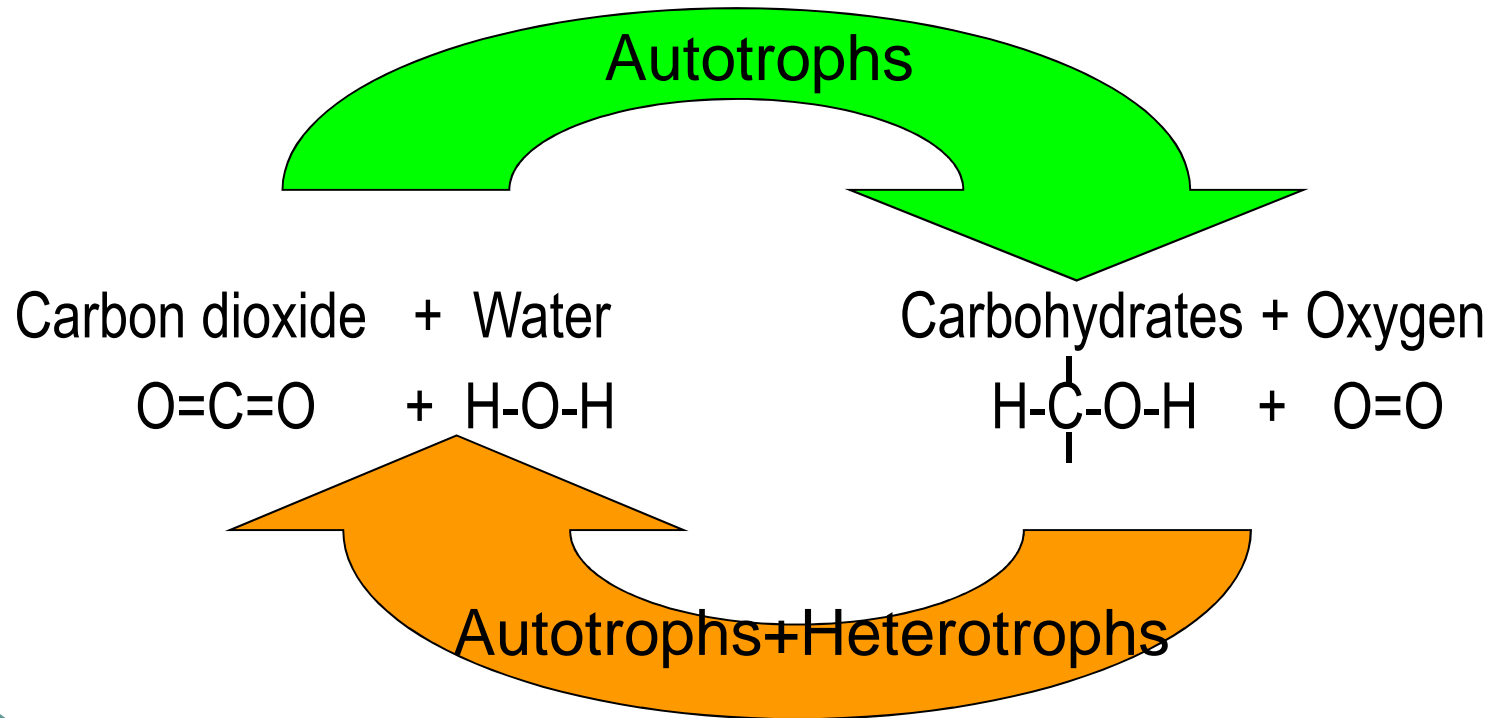
When, from the point of view of energy and materials, photosynthesis and respiration are in equilibrium:





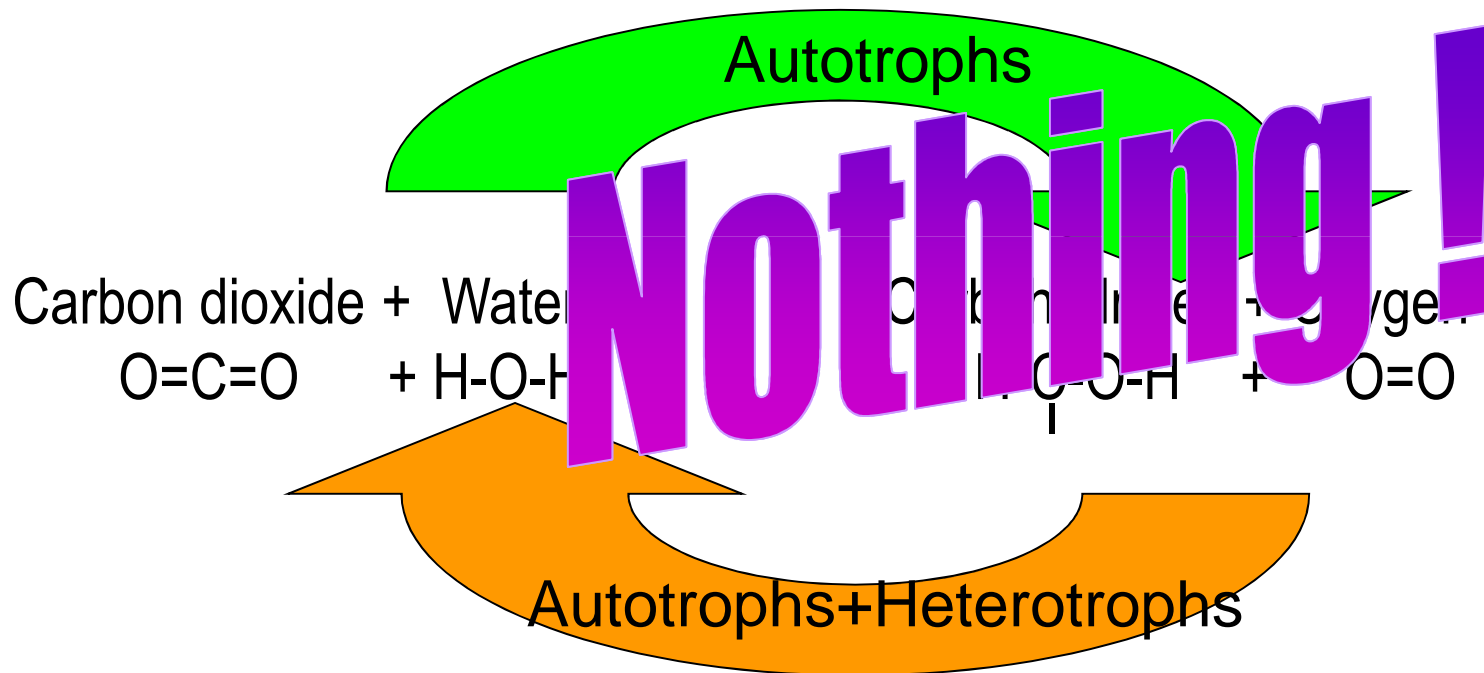
# What is a trophic chain (food web)?

Is the flow of energy and materials from a living being to another:



# What would happen if Amazonia will disappear?

The Amazon rainforest is the greatest supplier of oxygen of the world!



The Amazon rainforest is the greatest consumer of oxygen in the world!

# What is efficiency of an ecosystem?

Can be measured in term of flow or stock.

As flow, can be defined as the biomass of a given trophic level as a ratio respect to that of the previous level.

In many ecosystems, both natural or anthropogenic, efficiency is around 10%.

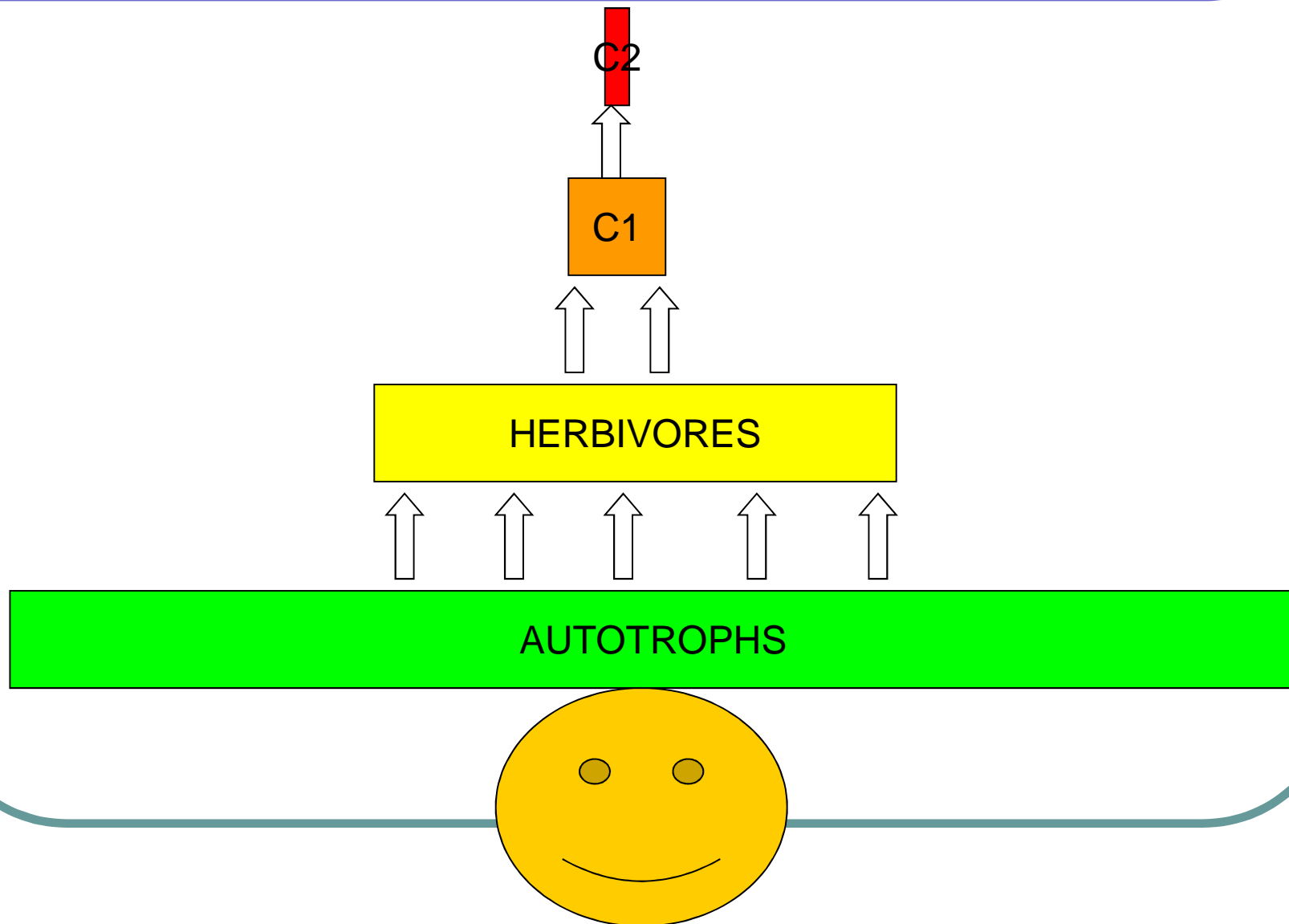
As an examples: herbivores are about 10% of grass (broad sense).

## Which relationships exist among different living beings?

It exists heterotrophs that eat other heterotrophs (carnivores) and carnivores that eat other carnivores (2<sup>nd</sup> level carnivores) etc.

The trophic chain can be very complex, especially in water environment (food web).

# What is the trophic pyramid?



# How many persons can we feed?

Plant food:	Energy N°/Ha	Protein N°/Ha
Wheat (bread, pasta, pizza)	16	19
Corn (polenta, corn flakes)	32	33
Beet (sugar)	38	31
Potato	22	25
Soybeans, legumes	15	56

# How much efficient are animals?

From plant feeds:	Energy %	Protein %
Milk	20	31
Eggs	13	32
Chicken	7	28
Pork	10	14
Beef	3	7
Veal calf	1	4

# How many persons can we feed?

Animal food:	Energy N°/Ha	Protein N°/Ha
Milk	6	15
Eggs	4	17
Chicken	2	12
Pork	3	6
Beef	1	3
Veal calf	0,4	1,4



# How many cereals are needed for animals?

## Cereal equivalents:

About 250 kg/pro capite

About 500 kg/pro capite

About 750 kg/pro capite

## Development stadium:

Human food

Human food  
+ draught animals

Human food  
+ draught animals  
+ feed for animal food