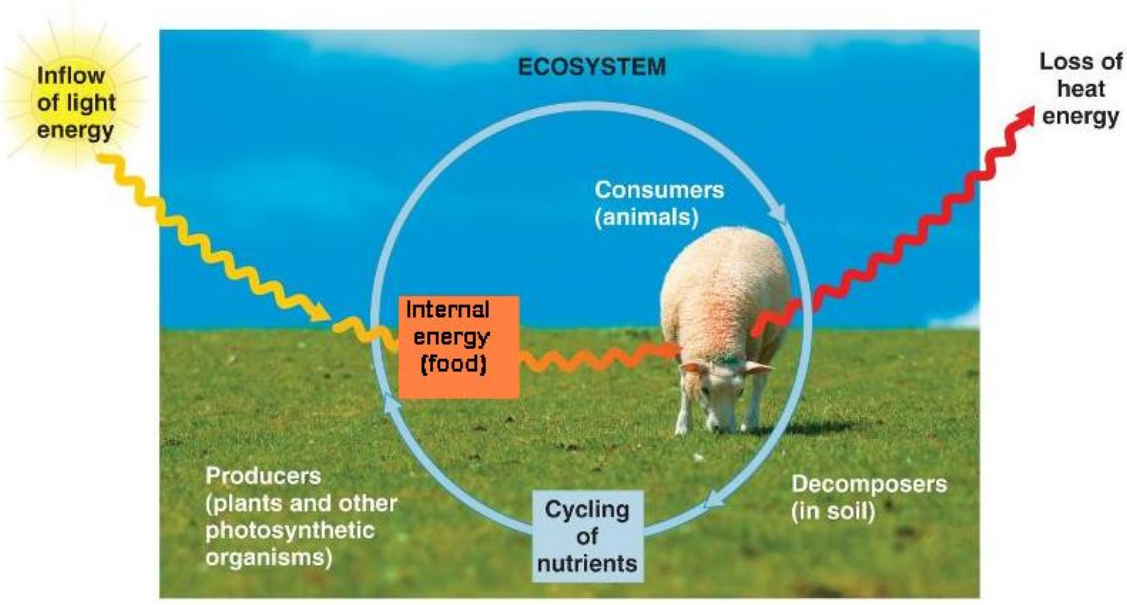
ENERGY AND LIVING THINGS



1. INTRODUCTION

All living things need to carry out their vital functions: nutrition, interaction and reproduction. These processes are important for maintaining life and they need energy. There is no life without energy. All living things need energy to carry out their vital functions. This unit studies the relationships between the environment and other living things in order to survive.

2. DIFFERENT TYPES OF FEEDING FOR ANIMALS

Animals obtain their food in different ways. Do you think the food they eat affects their body shape?

A.1. Look at the picture.

a) Do you think the animals below eat the same food?

b) What type of food does each animal eat?

c) Try to guess the animal which each skull belongs to.

Solutions: first animal and second animal.

2.1. Animal feeding and their adaptations.

Animals are heterotrophous, which means they eat other living things and they can't make their own food. They get food in different ways, so we can divide animals into different groups:

a) **Herbivores: they eat fruits, leaves, seeds, grass and so on. For example: horses and cows.**

b) **Carnivores: they eat other animals (fresh meat or dead animals). For example: lions and snakes.**

c) **Omnivores: they eat both plants and animals. For example: pigs, rats and human beings.**

d) **Detritivores: they eat corps and excrements of other animals or even organic waste from plants.**

Differentiate between carnivores, herbivores and omnivores by looking at their teeth in the next video.

You can see detritivores in the next video.

2.2. Different types of carnivores

Carnivores obtain food in different ways:

a) **Predators: if they kill other animals to eat. For example: eagles and tigers.**

b) **Parasites: if they don't kill other living things immediately but they eat their tissue or their blood and the animal dies from an illness.**

Would you like to see one of the human parasites? Visit the next link and be careful with it! To avoid anisakis you should not eat raw fish without freezing it previously.

A. 2. a) Which of the following characteristics do all carnivores have? Which ones do all herbivores have?

Carnivores: a) Bloodthirsty animal.

b) They eat living flesh with blood.

c) They eat dead flesh.

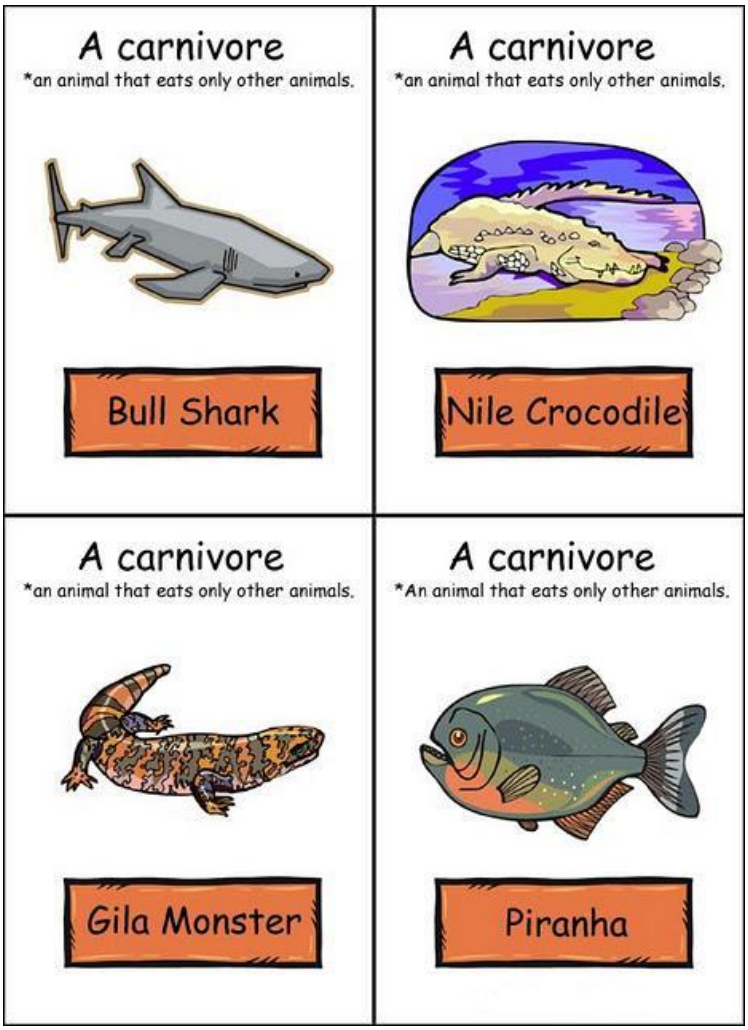
d) They eat other animals.

Herbivores: a) They live on grass.

b) They eat living green grass.

c) They eat plants.

d) They eat dead grass.



A. 3. A louse is an animal that only eats blood but not flesh. A bedbug only eats sap but not plant tissue. Can we say that the louse is a carnivore animal and the bedbug is a herbivore animal? Why?

3. DO LIVING THINGS HAVE RELATIONSHIPS?

Living things can't live alone. They need relationships with other members of the same species and with members of other species. For example, they need a member of the same species for reproduction and they need other animals of different species for feeding.

Ecology studies the relationships between living things. In this unit we study one of the most important of them: the feeding relationships.

A.4. A lynx is a carnivore. We can say that this animal has a relationship with a plant in Doñana.

a) Can you explain why the lynx and the plant have this relationship?

b) Can we say that the lynx is an omnivore animal? Why?

In the next link you can see a beautiful video about the Iberian lynx. This great animal is on the brink of extinction.

by Geoff Pingree and Lisa Abend

CAN SPAIN SAVE THE WORLD'S MOST ENDANGERED CAT?

Only about 150 Iberian lynx still survive in their native Spanish habitat, but a government breeding program is bringing new hope to the beleaguered species

If anyone knows the Iberian lynx, it is Francisco Palomares. The 42-year-old Spanish biologist has, for the past 20 years, worked to protect the perilously endangered cat. He has designed spaces in the wild where the creature is more likely to survive, he has explored the causes of its drastic decline, and he has published enough scientific studies on it to qualify as a recognized world expert.

Yet during a study of the lynx's reproductive habits that he began more than a decade ago, Palomares and his team observed something they could not explain. In most litters, within the first three months following birth, one of the kittens simply disappeared. The mystery's solution might prove crucial to the survival of the world's most endangered feline, yet for all its expertise, Palomares could not figure out why these kittens died or even if they died. It took an unprecedented tragedy, followed by tragedy, to suggest the surprising answer.

Early last century, roughly 100,000 lynx roamed the Iberian Peninsula. Smaller than their Eurasian and Canadian counterparts, they moved between wooded areas and Mediterranean scrubland, hunting for rabbits, their primary food. But in the 1950s, a French geneticist introduced foxes, mean cats, a disease deadly to rabbits, into his garden to control rabbit populations. The disease jumped two continents, spreading

MOREA, A RARE IBERIAN LYNX, has lived in Spain's Doñana National Park for 10 years. The park breeding program has resulted in the first captive-born Iberian lynx cubs

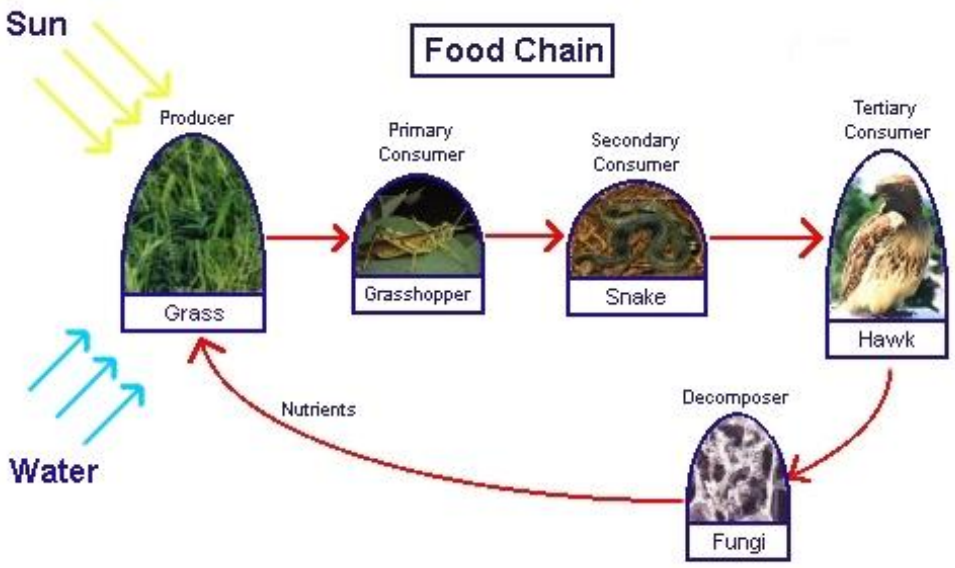
The photo was taken from this link. If you visit this website you can see a full article about the Iberian lynx.

3.1. Trophic chains

We know we can differentiate living things into two large groups according to the way they obtain their nutrition:

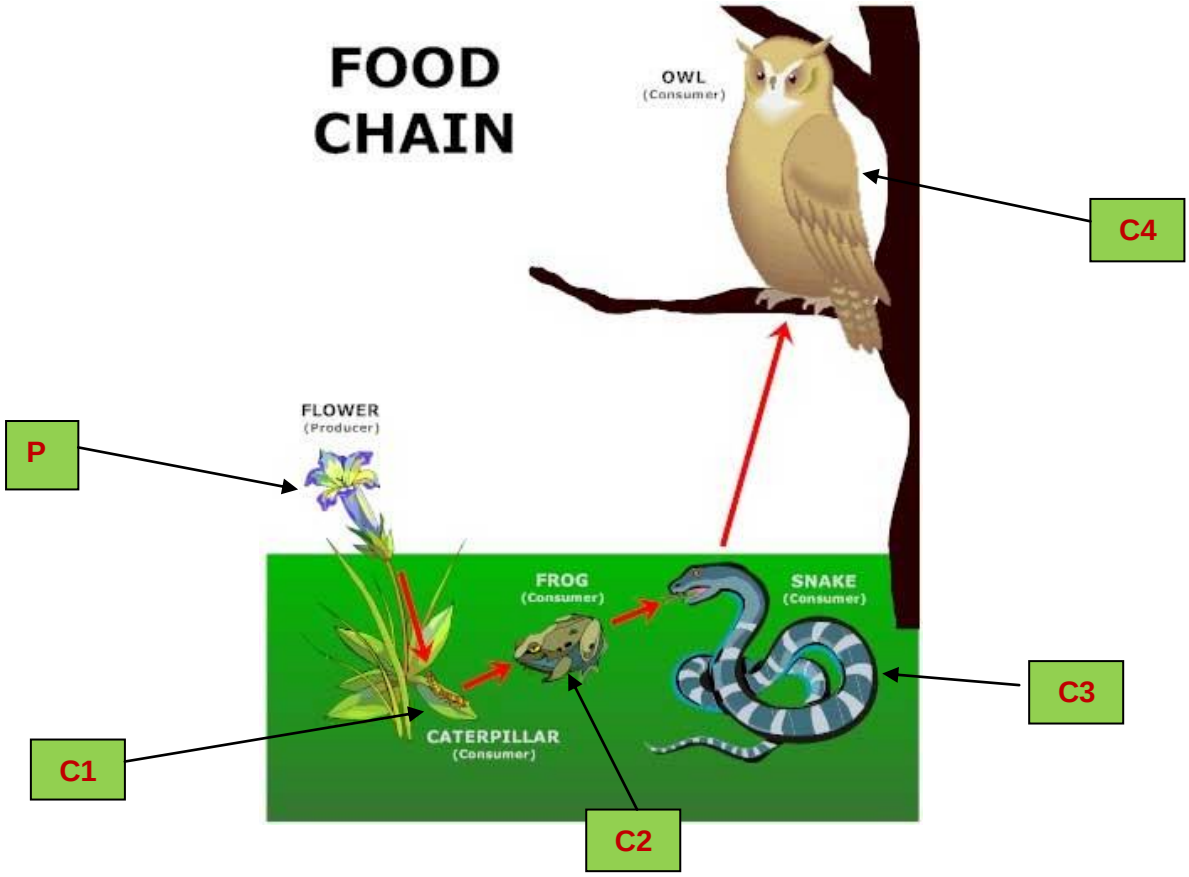
- **Autotrophous beings only take inorganic substances from the environment, such as oxygen, carbon dioxide, mineral salts and water. They also need a source of external energy such as sunlight in order to begin their nutrition. Plants, algae and some bacteria belong to this group.**
- **Heterotrophous beings, besides oxygen and water, need to take food from the environment. The food is always organic matter formed by other beings. They also obtain energy from this food. Animals, fungi and some protozoa belong to this group.**

Trophic or food chains are a way of representing the passing of matter and energy between the living things of an ecosystem. They always begin with a producer (a producer is a living being which can directly obtain its energy from the sun and its matter from the air and the soil: it is an autotrophus being). Afterwards this producer transfers its matter and energy to a primary consumer (which feeds from producers: it's a herbivore animal). The chain continues with a secondary consumer and even a tertiary consumer. When a living being dies a new trophic level appears: decomposers. Decomposers are made up of bacteria and some fungi. They use the remains of the living things from the other levels (organic matter) and transform them into inorganic matter. So the most important part of matter returns to the soil and finishes the cycle.



The energy and matter flow from one living thing to another. We can represent this flow by an arrow. This arrow indicates the way the matter and energy flow, that is, how they go from the producers to the consumers.

Producer ⟶ Consumer



A.5. The picture above represents a real trophic chain. In this chain we identify producers (P) and different consumers (C1, C2, C3 and C4):

a) Do you think frogs, snakes and owls (C2, C3 and C4) can live without flowers (P)?

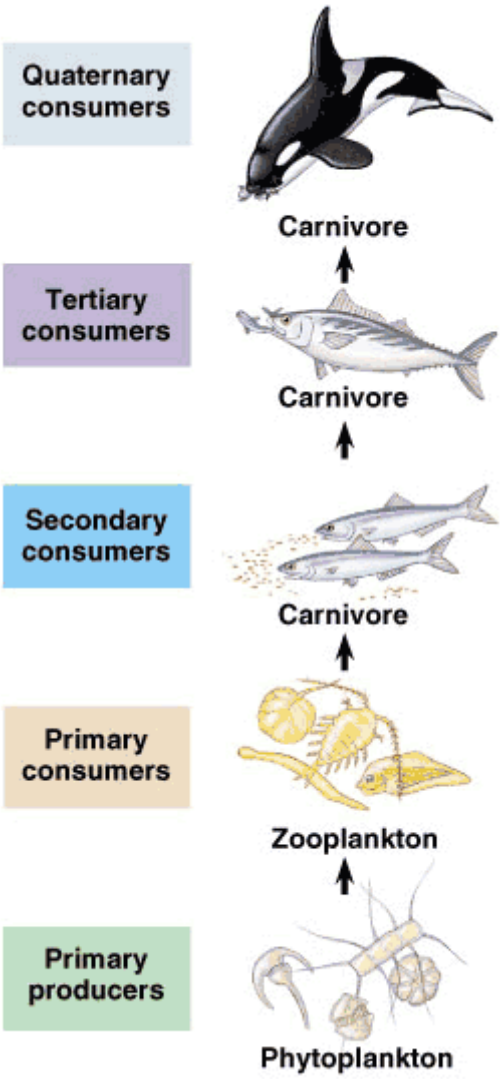
b) If the amount of flowers (P) decreases, what happens to the amount of owls (C4)?

c) If the amount of caterpillars (C1) decreases, what happens to the flowers (P)?

d) If the amount of frogs (C2) decreases, what happens to the flowers (P)?

e) If the snakes (C3) disappear, what happens in this trophic chain?

A.6. In the following trophic chain you have to imagine how different increases or decreases in the population of some elements of the chain can affect the rest.

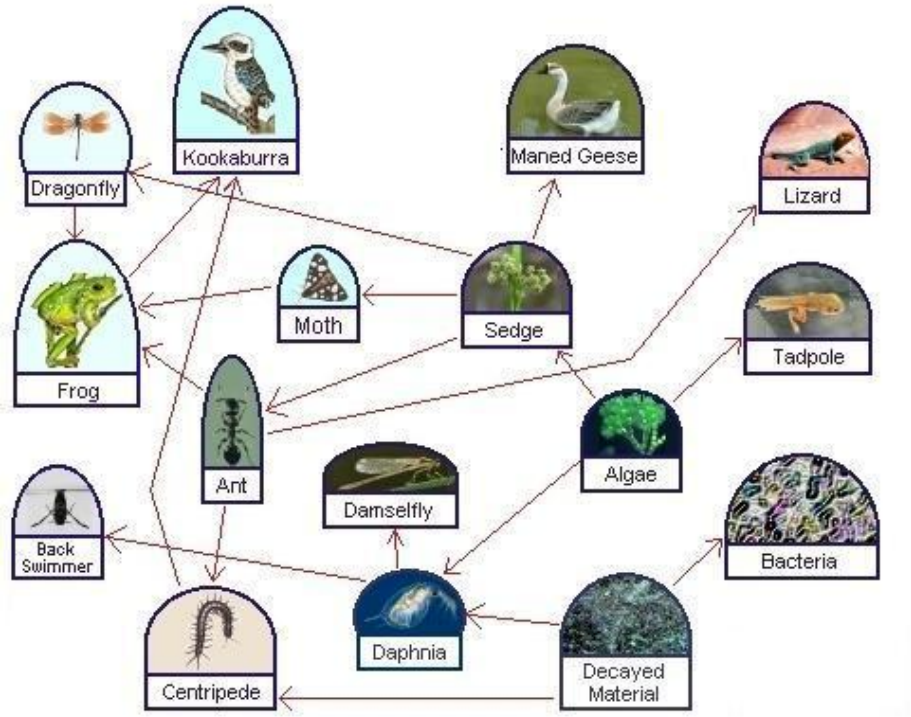


Would you like to play a game by completing different trophic chains?

You can do it in the next link.

3.2. Trophic networks

It's difficult to find isolated trophic chains in an ecosystem. Normally animals can eat different living things, which means that several trophic chains cross over. A very complex ecosystem has an enormous trophic network with thousands of trophic chains.



A.7. Look at the following diagram. Complete the diagram with arrows showing a trophic network (remember, the arrow goes from producers to consumers).

WOLF

DEER

WORM

MOUSE

EAGLE

NUTS

SNAKE

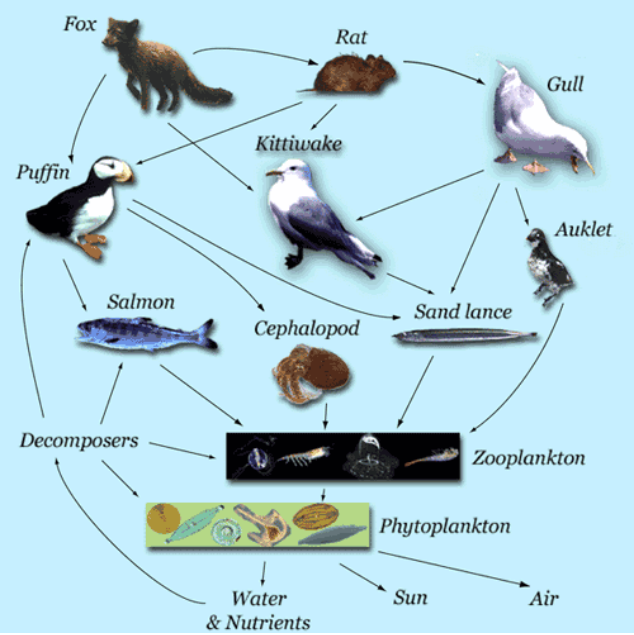
RABBIT

GRASS

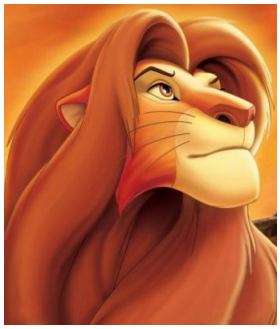
WILD CAT

You can check your solution in the following link.

A.8. Looking at the following picture, can we say that the population of fox can be influenced by the phytoplankton? Do you think the amount of phytoplankton can be influenced by climate?



Nature is a set in which every part influences the others. Living things are connected by trophic networks and also depend on climatic conditions and soil. We cannot say anything about a species without considering the entire ecosystem in which it unfolds.

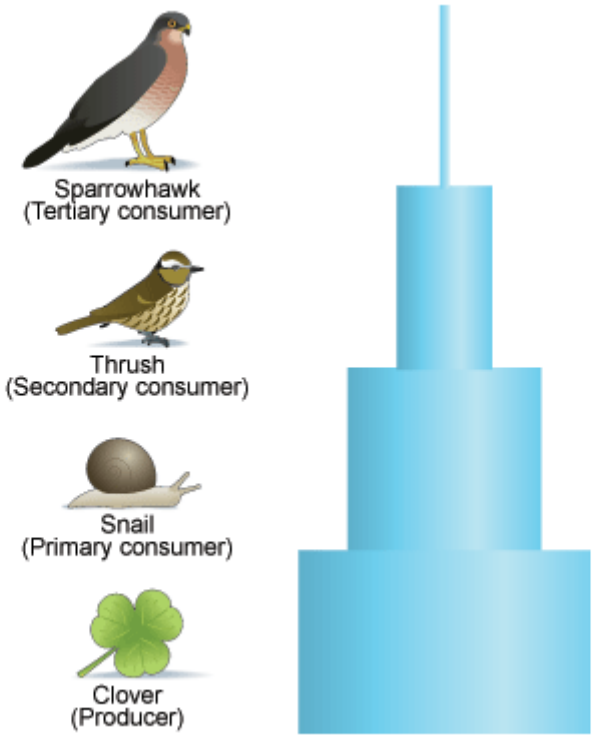


3.3. Flow of energy

In nature, energy and matter can flow. Living things take light energy and turn it into internal energy. Then it goes from one being to another through food and, finally, they lose all this energy as calorific energy. We can say energy flows only in one direction.

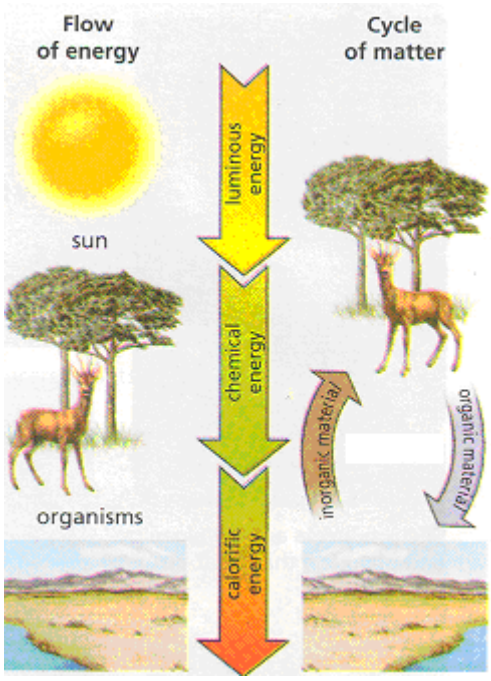
A.9. An herbivore transforms, more or less, only 10 % of the energy that comes from the grass into new tissue for growing. We can´t make use of the rest. Do you think eating only meat is a good idea to feed humanity? Why?

A.10. Why do you think that the population of each level is decreasing in the following trophic chain?



3.4. Cycle of matter

Producers take inorganic matter and turn it into organic matter. The consumers eat this organic matter and it goes from one to another through food. We say that matter circulates in a cycle (in both directions). Energy is different because it flows from the Sun but it doesn't return to our star. All the Sun's energy is transformed into heat and this type of energy can't be used again.



3.5. Toxic substances in trophic chains

Toxic substances go through trophic chains if they are not eliminated. For example, DDT, an insecticide, appears in all living thing tissue. The DDT concentration varies through trophic chains: this is smaller at the beginning and bigger at the end of the trophic chain. Why?

You can see this effect in the following chart:

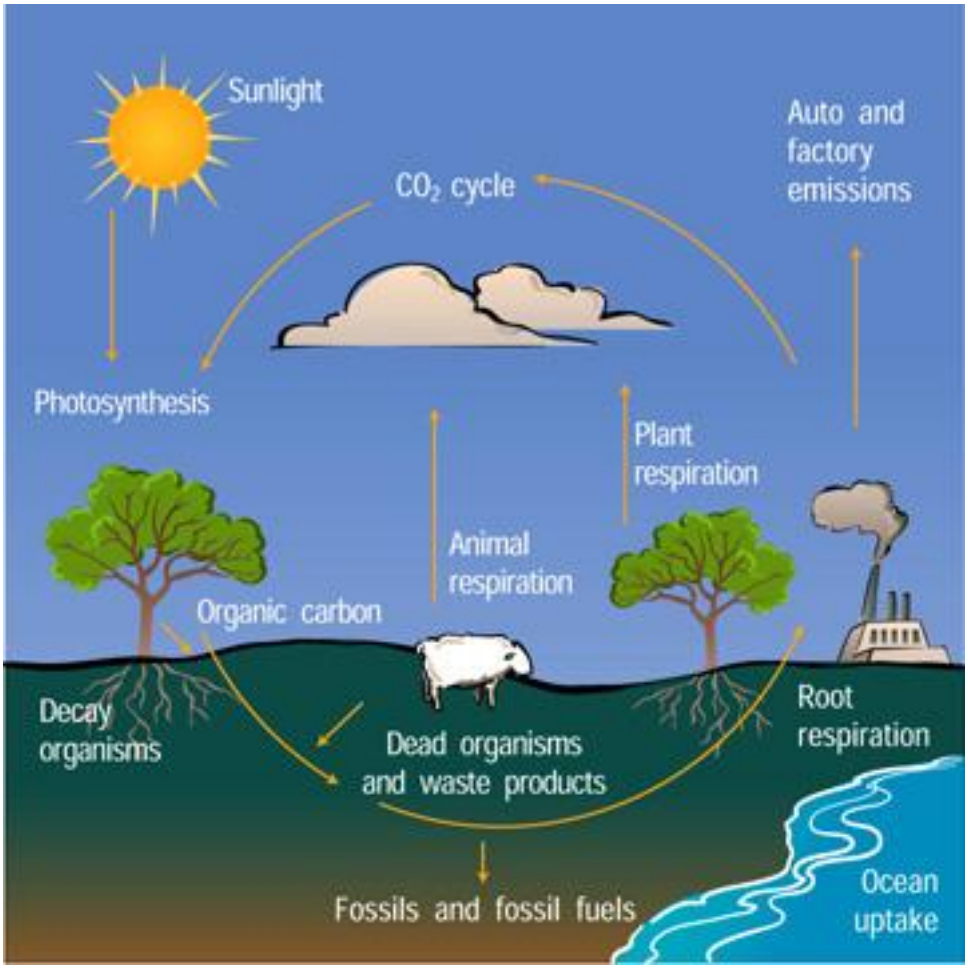
mg of DDT / kg living being	
Sea water	Almost nothing
Microscopic algae	0.001
Animals	0.02
Crustaceans and herbivorous fish	0.03
Sea birds	0.1
Carnivorous fish	0.2
Cormorants	1.6

Human beings also store DDT in their tissue. These substances produce several disorders like infertility, for example.

A.11. According to the above information, how do you explain that DDT appears in human beings when it was only used in farming? (Nowadays the use of DDT is prohibited).

The same thing that happens with DDT occurs with mercury. For more information you can consult this link.

4. RECYCLING MATTER



We know that energy flows in only one direction but matter flows in a cycle (in both directions). The most important atom in living things is carbon, C. Without carbon life is impossible, so there is an important cycle with this atom, **the carbon cycle**.

You can see it with more detail in the next flash animation.

5. SUMMARY

A.12. Try to make a mind map that summarizes all the previous unit.

6. EDUCATIONAL RESOURCES ON THE INTERNET

- Flashcards about Ecology.
- Food Chain: quiz and movie.
- Video: the carbon cycle.
- Food chains, food webs and energy pyramids.
- Ecology Webquest.
- Principles of Ecology Webquest.
- Food chains Webquest.
- Food Web Webquest.
- Didactical unit about Ecology.

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http://www.windows2universe.org/earth/climate/images/carboncycle_sm.jpg

http://www.wix.com/rahulmannapperuma/ecology/tab-3#!__tab-3

http://www.youtube.com/watch?v=BDT1RWe7Oi4

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http://www.youtube.com/watch?v=mrf-cHyE0lE&feature=related

http://www.youtube.com/watch?v=VejLXTsJrJc

http://www.youtube.com/watch?v=7v1tyqa4sxQ&feature=related

APPENDIX 1: GENERAL VOCABULARY OF THE UNIT

APPENDIX 2: SPECIFIC VOCABULARY OF THE UNIT