Ecology - Principles of Ecology (Summary)

**Food chain:** The pathway along which energy is transferred

Example

SEA

ANENOME

GULL

SHRIMP

SEAWEED



Each feeding stage in a food chain is called a **trophic level**

Indicate the trophic levels on the food chain above

**Producers** form the **1st trophic level**

**Primary consumers** are the **2nd trophic level.**

**Secondary consumers** form the **3rd trophic level.**

**Tertiary consumers** or top carnivores form the **4th trophic level**

**Transfer of energy**

* The sun is the primary source of energy for our planet.
* Light energy from the sun is used by green plants to produce food in a process known as **photosynthesis**.
* Plants are producers of food for themselves and for all other organisms on earth.
* Animals eat the plants and obtain energy.
* Other animals eat these animals and so obtain their energy.
* This feeding relationship establishes feeding as a pathway of energy flow in an ecosystem
* **A food chain is the pathway along which energy (in food) is transferred in an ecosystem.**
* Each species in the chain obtains its energy by eating the species preceding it.
* Plants at the beginning of the food chain obtain their energy directly from the sun.
* About 10% of the energy in each trophic level is passed onto the next level.
* The remaining 90% is used by the organism or is lost as heat, waste or detritus.
* Therefore the amount of energy passing along a food chain decreases from one trophic level to the next.
* This limits the length of a food chain (usually to no more than 4 trophic levels).

SUN

**SEAWEED**

**SHRIMP**

**SEA**

**ANENOME**

10%

10%

**90%**

**LOST**

**LOST**

10%

**LOST**

**90%**

1%

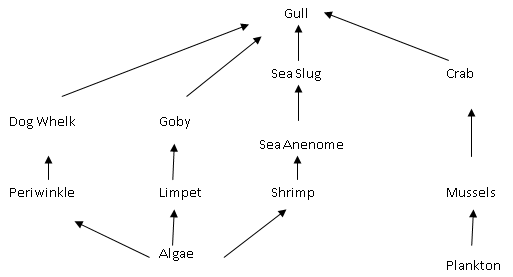
**99% LOST**

**GULL**

**90%**

**Food web**: A series of interconnected food chains

Example:



**Pyramid of numbers**:

**Pyramid of numbers** shows numbers of different organisms in a food chain.

Three main types: **Normal, Distorted and Inverted**

Plankton

Barnacle

Dog whelk

Crab

*MICROSCOPIC GREEN ALGAE*

*LIMPET*

*DOG WHELK*

*HERRING GULL*

*PARASITIC LICE*

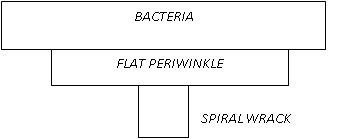
Numbers decrease

Size increases

2. Distorted

1. Normal

The presence of parasitic lice leads to a distorted pyramid shape . Many lice can live on a single gull



*FLAT PERIWINKLE*

*BACTERIA*

*SPIRAL WRACK*

Limitations

* Do not take into account the size of the organism.
* Numbers can be so great cannot be drawn to scale e.g. millions of lice can live on a single gull

3. Inverted

Upper level can be much larger than the lower i.e. numbers increase as you go up.

Inverted pyramids may occur where there is a single producer e.g. seaweed supporting a large number of organisms, or one of the animals in the chain is a **parasite** e.g. the bacteria in the above example

**Nutrient Recycling:**

The reuse and reprocessing of the raw materials required by living organisms e.g. carbon cycle, nitrogen cycle

**CARBON CYCLE**

**Decay**

**(7)**

**Death and Decay**

**Respiration (3)**

**Respiration (3)**

**Feeding (2)**

**Feeding**

**(5)**

**Respiration**

**(6)**

**Combustion**

**(8)**

**CO2**

**Plant food**

**Animal food**

**Photosynthesis (1)**

**Dead**

**organic material**

**Fossil fuels**

**Micro organisms**

**Death (4)**

* 1. Green plants take in CO2 from the air. They use this CO2 from the air to make food in the process of **Photosynthesis**.
  2. When the plants are eaten the carbon in the form of food becomes part of the animal.
  3. During **Respiration**, plants and animals break down their food and release carbon dioxide back into the atmosphere.
  4. Death of the plants and animals leads to the formation of dead organic matter.
  5. Decomposing micro organisms feed on the dead organic matter
  6. Carbon dioxide is released during respiration
  7. Over long periods of time dead organic matter becomes fossil fuels such as coal, oil, peat and natural gas.
  8. The burning **(combustion)** of fossil fuels release carbon dioxide back into the atmosphere.

NITROGEN CYCLE

*Nitrogen fixing bacteria*

*Denitrifying*

*bacteria*

(3) Nitrification

*Decomposing bacteria and fungi*

(2)

Decomposition

(1)

Nitrogen fixation

Absorbed

Eaten

(4) Denitrification

(3) Nitrification

**Nitrates**

**(in soil)**

**Plants**

**(protein)**

**Animals**

**(protein)**

**Ammonia and**

**Ammonium**

**salts**

**Nitrites**

**N2 Gas**

**in air**

*Nitrifying*

*bacteria*

1. **Nitrogen fixation** is the conversion of atmospheric nitrogen into nitrates. This is carried out by the ***Nitrogen fixing bacteria***. Lightening can also bring about the process of nitrogen fixation.

Plants absorb the nitrates from the soil and manufacture protein.

The plants are eaten by animals who in turn convert the plant protein into animal protein.

1. **Decomposition** of dead organisms is carried out by ***Decomposing bacteria and fungi*** which are found in the soil. This results in the formation of ammonia and ammonium salts in the soil.
2. **Nitrification** is the conversion of ammonium compounds to nitrites and then to nitrates. This is carried out by bacteria living in the soil called ***Nitrifying bacteria****.*

Some of the nitrates found in the soil is absorbed and assimilated by plants to make protein.

1. **Denitrification** is the conversion of nitrates into Nitrogen gas. It s carried out by ***Denitrifying bacteria*** in the soi

**Pollution**

**Pollution:** Any harmful addition to the environment usually due to human activity.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Domestic | Agriculture | Industrial |
| Pollutant | CO2 | Phosphates ( run off of fertilisers or animal slurry) | Smoke and CO2.  SO2 (from burning of sulphur containing fuels such as coal and fuel oil). |
| Effect | Global warming and Greenhouse effect | Eutrophication of streams and lakes | Global warming  Acid rain |
| Control | Reduce consumption of electricity and burning of fossil fuels. | Slurry should not be spread when land is wet.  Storing slurry in leak proof pits | Stop destruction of rain forests  Reduce burning of fossil fuels |

**Problems associated with waste management**

* Lack of availability of suitable landfill sites
* The toxic or polluting content of fumes from incineration (CO2, other acidic oxides and

dioxins – produced from burning plastic)

* Decaying waste produces methane gas which contributes to the “greenhouse gases”
* Harmful substances may leak into groundwater supplies (wells, lakes, reservoirs)
* Plants and animals in rivers and lakes may be killed through direct poisoning or

eutrophication

**Importance of waste minimisation:**

**Reduce** – use less, minimise waste.

**Re-use** – use again, without changing but maybe for a different purpose.

**Recycle** – change, recover some material and use again.

* Alter attitudes to littering, waste minimisation and disposal through education programmes.
* Use micro-organisms to degrade the rubbish
* Reduce the use of paper and recycle more paper.
* Replace non-biodegradable materials with biodegradable ones, e.g. bags made of paper instead of plastic.
* Increase incineration temperatures to avoid dioxin production and fit catalytic scrubbers inside chimneys.

**At Present in Ireland**

* Tax has been placed on plastic bags.
* Rubbish sorting at source makes disposal more efficient e.g. Householders separate metals, paper, plastic, glass for recycling and ‘vegetable’ waste for composting.

**Conservation**

**Conservation:** The management of the environment.

**Outline of any one conservation practice from one of the following areas;**

* **Agriculture** e.g. Mixed farming, crop rotation, biological controls, gene bank.
* **Fisheries** e.g. net size, quotas, re-stocking
* **Forestry** e.g. replanting, broad leaf/conifer mix

**The benefits of conservation include:**

• Existing environments are maintained

• Endangered species are preserved for reproduction

• The balance of nature is maintained

• Pollution and its effects are reduced

**Role of micro-organisms *in***

***(ii) pollution control. - bioremediation***

Use of microorganisms to remove pollutants e.g. oil spills

***(i) waste management - Composting***

