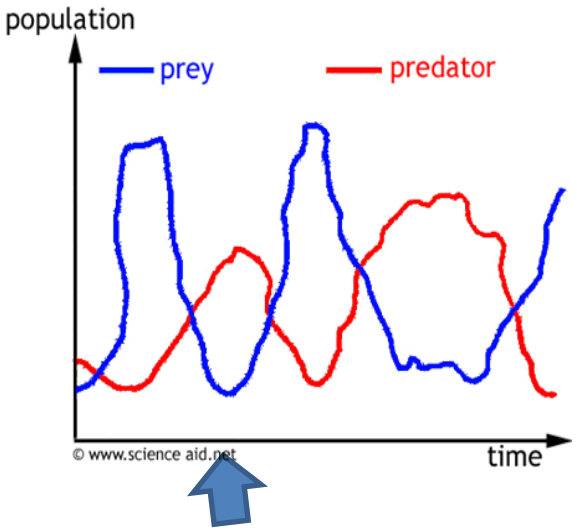
Y10 Biology (F) Ecology 1

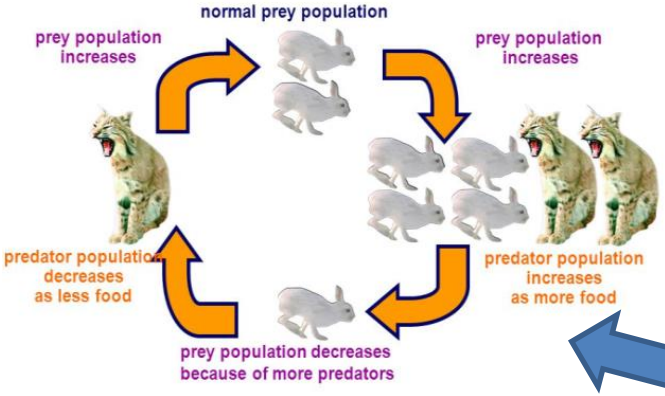
START

Abiotic Factors (environmental factors that are non-living)	Biotic Factors (environmental factors that are living)
Temperature, pH of soil, oxygen, carbon dioxide, sunlight and wind.	Food, pathogens, competition for mates and competition for food



Predator–prey cycle

Predator and prey population sizes follow a cycle.
What happens if the prey population **increases**?



Key words:

1. **Habitat:** A small area of an ecosystem where an organism lives e.g. under a log or in a forest.
2. **Community:** A collection of organisms of different species that live and interact with one another within an ecosystem.
3. **Ecosystem:** All the organisms in one habitat, plus the environmental factors that effect their survival.
4. **Interdependent:** Organisms in an ecosystem rely on each other for survival.
5. **Producer:** Makes their own food/energy through photosynthesis (plants).
6. **Primary consumer:** Herbivores that eat producers.
7. **Secondary consumer:** Eat primary consumers.
8. **Tertiary consumer:** Eat secondary consumers.
9. **Omnivore:** Eat plants and animals.
10. **Food chain:** Shows how energy is passed between organisms.
11. **Food web:** Shows all the feeding relationships within a community.
12. **Competition:** Organisms fight for survival and compete for food, mate, shelter, water to survive.
13. **Decomposer:** Fungi and bacteria that breakdown dead organisms and waste (faeces + urine).

Plants compete for:	Animals compete for:
• Light for photosynthesis • Water for photosynthesis • Nutrients (minerals) for growth • Space for leaves and for roots	• Mates • Food for growth • Territory

Plant Adaptations

- Deep roots to find water.
- Shallow roots absorb rain water.
- Thick stem to store water.
- Leaves reduced to spines to reduce surface area for water loss.
- Spines also prevent animals eating the plant to get water.
- Waxy cuticle on the leaf to prevent water loss.

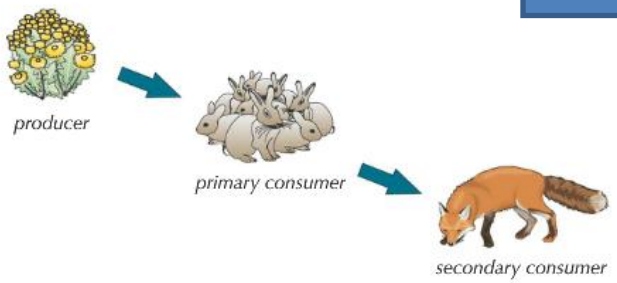
Animal Adaptations

- Thick fur to provide insulation, stopping heat escaping.
- Large paws spread the weight of the animal and prevent it sinking into the snow.
- Small ears reduce the surface area to volume ratio. Small surface area means less surface for heat energy to escape from.
- A coat that provides camouflage, so predators or prey are not easily seen.
- Long legs, long necks or big ears increase the surface area to volume ratio. This allows more heat to be lost to cool down.
- Behaviours, such as being nocturnal to help avoid predators or because it is cooler at night.

Y10 Biology (F) Ecology 2

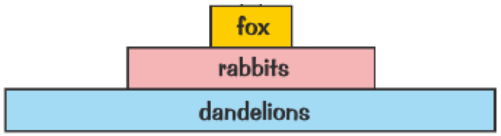
Food Chains

Here's an example of a food chain:



5000 dandelions feed 100 rabbits, which feed 1 fox.

Pyramid of Biomass

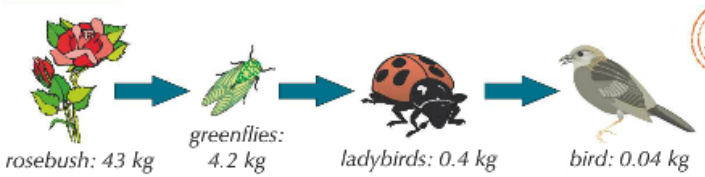


The big bar along the bottom of the pyramid shows trophic level 1. It always represents the producer (e.g. plants or algae). The next bar will be the primary consumer (the animal that eats the producer), then the secondary consumer (the animal that eats the primary consumer) and so on up the food chain. Easy.

You can also calculate the **efficiency of biomass transfer** between trophic levels using this formula:

$$\text{efficiency} = \frac{\text{biomass transferred to the next level}}{\text{biomass available at the previous level}} \times 100$$

Example



The numbers show the amount of biomass available to the next level. So 43 kg is the amount of biomass available to the greenflies, and 4.2 kg is the amount available to the ladybirds.

Biomass lost at the 1st trophic level

= 43 kg – 4.2 kg

= **38.8 kg**

Efficiency of biomass transfer at the 1st trophic level

$$= \frac{4.2 \text{ kg}}{43 \text{ kg}} \times 100$$

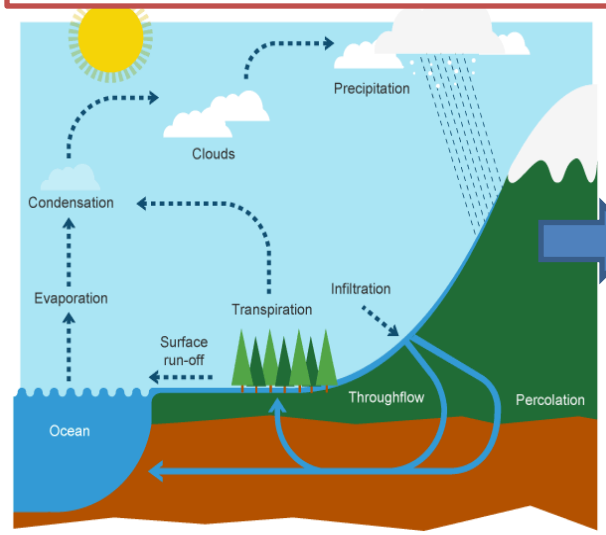
= **9.8%**

Decomposers (bacteria + fungi) break down the proteins in dead organisms (or excretion). This releases nitrates, carbon and other nutrients back into the soil. Plants can absorb these once again.

The Decay Cycle:

- Nutrients from the soil are taken up by plants.
- Through eating these nutrients are passed on to other organisms in the food chain.
- The organisms die and excrete waste (faeces and urine).
- Decomposers break down the dead organisms and their waste.
- Releases nutrients back into the soil to be taken up by plants.

Y10 Biology (F) Ecology 3



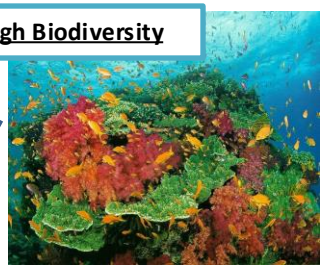
The Water cycle:

- Precipitation – rain.
- Percolation – water trickles through gaps in the soil and rocks.
- Some goes up into plant roots.
- Some goes into oceans / rivers from the soil.
- Water leaves the plants through transpiration – evaporation in the leaves and respiration in plants and animals.
- Water also evaporates from oceans / rivers due to the heat from the sun.
- Water vapour forms in the air.
- Condensation – moist air rises it cools back in to liquid water droplets forming rain clouds .

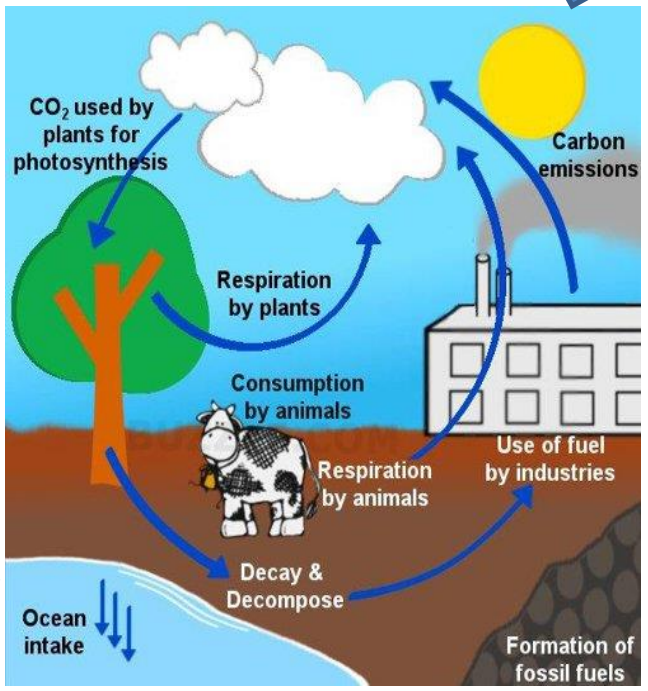
Ways CO_2 is taken <u>OUT</u> of the atmosphere	Ways CO_2 is put <u>INTO</u> of the atmosphere
Photosynthesis	Plant respiration
Dissolving in oceans	Plant burning
Stored in animals through eating	Animal respiration
Stored in fossil fuels when animals + plants die	Decomposers respiring dead stuff and waste
	Combustion of fossil fuels

<u>Biodiversity:</u> The number of different organisms in an ecosystem.

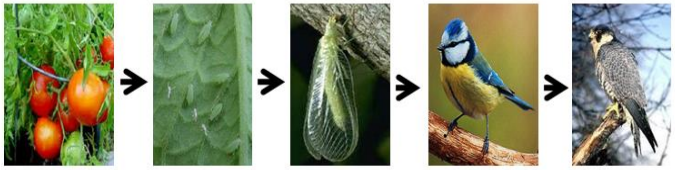
<u>High Biodiversity</u>



<u>Low Biodiversity</u>



Bioaccumulation of Pesticides in the Food Chain



Tomato plant is sprayed with Insecticide.

1 aphid receives **5** molecules of insecticide .

1 lacewing eats 100 aphids & receives **500** molecules of insecticide

1 blue tit eats 10 lacewing & receives **5,000** molecules of insecticide.

Peregrine falcon eats 5 blue tits & receives **25,000** molecules of insecticide

Bioaccumulation is the build up of poisons along a food chain

Quantitative Sampling

Sampling an ecosystem

Rules for sampling a field or wood:

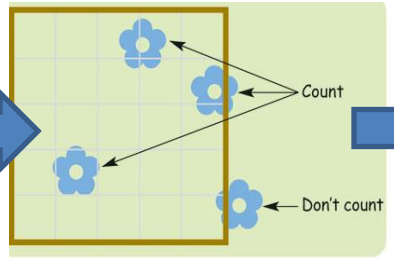
1.Place a quadrat randomly within the area (to prevent bias).

2.A quadrat is split into squares each square represents an overall percentage of the full square.

3.You count a square if the plant takes up half of the square.

4.Add up the number of squares to tell you the estimated percentage cover for that species.

5.Collect multiple random sample readings to calculate a mean – quantitative sampling.



Quadrat number	1	2	3	4	5	6	7	8	9
Percentage cover (%)	40	50	30	20	60	70	50	50	40

For this information we can calculate:
1)Mean
2)Mode
3)Median

1) **Mean** = add them all up and divide by the total number of quadrats.

1) Mean = (40 + 50 + 30 +20 + 60 + 70 + 50 + 50 + 40) / 9
= 45.6%

2) **Mode** = the most common number

2) Mode = 50%

3) **Median** = put them in order and the number in the middle is the median.

3) Median = 20, 30, 40, 40, **50**, 50, 50, 60, 70
= 50%

How to use a line transect:

1.Place a tape measure from the start of the area to end of the area.

2.Place a quadrat at regular intervals along the tape measure e.g. every 10m.

3.Estimate the percentage cover of the quadrat and record the results in a table.

Ecology Questions

1. What things do animals compete for in an ecosystem?
2. What are biotic and abiotic factors?
3. Explain the adaptations that helps organisms survive in a cold environment.
4. Explain the adaptations that helps organisms survive in a hot environment.
5. What do food chains always start with?
6. Explain what happens to the population size of a predator if its prey becomes more common.
7. Explain what decomposers do.
8. Explain how water vapour gets into the air in the water cycle.
9. Explain what can happen to water when it rains in the water cycle.
10. Explain how microorganisms return carbon to the atmosphere.
11. How is carbon taken out of the atmosphere?
12. Explain how a quadrat can be used to investigate the distribution of clover plants in two areas.
13. Suggest how to prevent bias when using quadrat sampling.
14. Suggest when you might use a transect when investigating the distribution of organisms.
15. Explain how to calculate a mean.