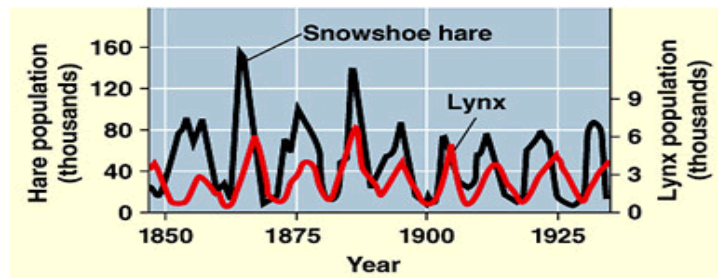


Competition

- Animals and plants compete for resources.
- **Inter-species** competition = between 2 **different species**.
- **Intra-species** competition = between individuals of the **same species**.
- The population of predators and prey are '**Interdependent**' because they affect each other.



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(When the number of prey increases the number of predators increases, and when the number of predators increases the number of prey decreases.)

Sampling Methods and Estimating Populations

- Calculating the size of animal populations can help us to **protect** them.
- Sampling methods (eg. quadrats) need to be **random** to ensure a **reliable** result.
- Computer models are a very **quick and cheap** way of estimating populations.
- Computer models are **not always very reliable** though because they can't simulate nature exactly.
- If you count the number of daisies in a few quadrats you can estimate the population of daisies in a whole field by doing a simple calculation:

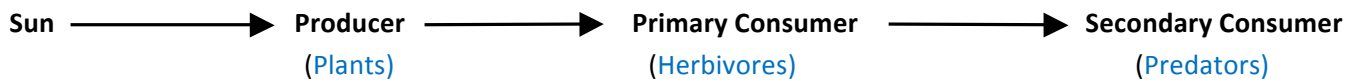
$$\text{Population} = \frac{\text{Total number of daisies counted} \times \text{Total area of the Field}}{\text{Area sampled with quadrats}}$$

(Note: in this calculation the 'Area sampled with quadrats' is the same thing as 'The number of quadrat samples' if they are each 1m²)

Human Impact on the Environment

- The human population is increasing rapidly - this means we are taking up more land space and burning more fuels.
- **Global Warming** = **Carbon Dioxide** is a **greenhouse gas** released by burning fuel, it **traps heat** around the Earth.
 - = Could cause climate change, higher temperature and rising sea levels.
- **Deforestation** = Forests are being chopped down.
 - = Could lead to **flooding** and soil being washed away.
- **Desertification** = Fertile 'green' land is turned into desert by **overfarming** and **overgrazing**.
 - = Few animals and plants can grow there anymore.

Food Chains



- All energy in food chains originally comes from the **sun**.
- Herbivores eat plants.
- Predators eat other animals.
- The **arrows** in food chains show which way the **energy** is being transferred.

Energy in Food Chains

- Energy is lost from every stage of a food chain because each organism uses it for respiration or loses it through excretion; only a small amount is used for growth.
- Only about 10% of energy an organism consumes is passed on to the next level of the food chain.
- Higher up the food chain there is less energy left (because energy has been lost on the way) – this means that if you want to get the most energy you should eat organisms from near the bottom of the food chain.

↳ Eat plants instead of animals!

Organic vs. Intensive Farming

- **Organic** = farming **without** chemical pesticides and fertilizers.
= use **manure** instead of fertilizer and **predators** to eat the pests instead of pesticides.

Advantage = good for the **environment** and makes **healthy** food.
Disadvantage = crops grow more **slowly** and not as much food can be produced.
- **Intensive** = farming with **chemical pesticides** and **fertilizers**.

Advantage = crops grow **fast** and give a **big crop yield**.
Disadvantage = chemicals are **toxic** to animals and humans.

Selective Breeding

- It is possible to change the characteristics of an animal or plant species by breeding the males and females with the **best characteristics** so that the next generation **inherit** the best characteristics.
- **Slow** – the process takes many generations to produce a useful change.
- Only mating the best males and females can result in **inbreeding** which could cause **genetic diseases**.

Genetic Modification

- An organism can be altered by changing just one gene or adding a new gene taken from another species.
 - eg. A gene can be added to wheat to make it resistant to insects or disease.
 - eg. A gene can be added to a fruit plant that keeps the fruit ripe for longer.
- Quick – a species can be altered in just one generation.
- Risky – the gene could have unwanted side effects or the gene could pass into another species and affect the food chain.

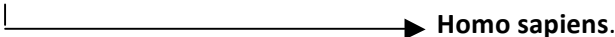
Natural Selection

- **Variation** = In a species all the individuals are varied (slightly different).
- **Survival of the fittest** = Some individuals have characteristics which give them a better chance of survival, others do not. These useful characteristics are known as **adaptations**.
- **Evolution** = individuals with the best characteristics **survive** and pass on their characteristics to their **offspring**.
 - = over time the whole population will **inherit** the best survival characteristics.
- **Extinction** = if a species does not have suitable characteristics for survival it may die out (go extinct).

Darwin and Evolution

- **Charles Darwin** first thought of the idea of evolution and natural selection.
- His main **evidence** for evolution was ancient **fossils** in the fossil record.
- Many people didn't (and still don't) agree with Darwin's ideas because the **Bible** says that all the organisms on Earth were created by a god.

Classification

- There are so many organisms on Earth that we need to classify them into a sensible order.
- They are classified through several levels:
 - 1) **Kingdom** – (the 3 main kingdoms are **Animals, Plants** and **Fungi**)
 - 2) **Phylum** – (the Animal kingdom is split into **Chordates** (backbone) or **Uchordates** (no backbone))
 - 3) **Class** – (the Chordates are split into **Mammals, Aves** (birds), **Reptiles, Fish.....**)
 - 4) **Order** – (the Mammals are split into many groups eg. the Apes)
 - 5) **Family**
 - 6) **Group**
 - 7) **Species**
- Humans are in the Animal kingdom, the Mammal class, the Homo group and are the Sapiens species
 **Homo sapiens.**

Asexual Reproduction and Cloning

- **1 parent** = only one parent is needed for asexual reproduction.
- **No gametes** = no sex cells are needed to produce an offspring.
- **Clones** = all the offspring will have **identical genes** to the parent and each other – they are clones.
- **Spider plants** and **bacteria** are both examples of asexual organisms.
- **Advantage** = **quick** and there is no need to waste **time** finding a mate.
- **Disadvantage** = all the offspring are clones so there is **no genetic variation** so the species **cannot evolve** easily.

Sexual Reproduction and Variation

- **2 parents** = a male and a female are needed for sexual reproduction.
- **Gametes** = a sex cell from the male (**sperm/pollen**) is needed to fertilise a sex cell from the female(**egg/ovum**)
- **Variation** – each offspring has a unique mix of genes from their parents so they are different.
- **Advantage** = creates unique offspring (**variation**) so the species can **evolve** and adapt to changing environments
- **Disadvantage** = time and energy must be spent **attracting a mate**.

DNA and Genes

- **DNA** is the **chemical** which makes up our **genetic code**.
- The DNA is kept in the **nucleus** of the cell.
- A piece of DNA which codes for one characteristic (eg. eye colour) is called a **gene**.
- We have millions of genes so it is necessary to organise them into chains called **chromosomes**. Humans have 46 in each cell.

Dominant and Recessive Alleles

- We have one copy of each gene from our mother and one from our father. Each copy is called an **allele**.
(eg. you could inherit an allele for brown eyes from your mother and an allele for blue eyes from your father.)
- **Genotype** = shows **which alleles** you have (represented by letters, eg. **Bb**).
- **Phenotype** = shows **which physical characteristic** you have (eg. brown eyes).
- **Dominant** alleles are 'powerful' and will decide your characteristic if you have a copy. (**CAPITAL LETTER**)
- **Recessive** alleles are 'weak' and will only decide your characteristic if you have **two copies** of it. (**small letter**)
- **Homozygous** = If you have 2 copies of the same allele in your genotype (eg. **BB** or **bb**).
- **Heterozygous** = If you have 2 different alleles in your genotype (eg. **Bb**)

Nature or Nurture

- Some characteristics are affected by our **genes (Nature)** and some are affected by our **environment (Nurture)**.
- **Genetics**
 - 1) Eg. **Eye colour** is genetic.
 - 2) Eg. Some diseases like **cystic fibrosis** are genetic (but not all diseases are).
- **Environment**
 - 1) Eg. **Body weight** is affected by the environment (how much we eat).
 - 2) Eg. **Plant growth** is affected by the environment (the minerals in the soil).
 - A lack of nitrates makes the plant have stunted growth.
 - A lack of magnesium causes stunted growth and yellow leaves.

Human Genome Project

- The Human Genome Project (**HGP**) set out **to identify and record every gene** in the human genetic code.
- The HGP could help to identify the cause of **genetic diseases**.

Designer Babies

- Using **IVF** technology (egg cells in a test tube) the **genes** of a **fertilised egg cell** can be **altered** to change specific characteristics of the baby.
- This technology could be used to **prevent genetic diseases**.
- Some people disagree with this technology because many **embryos** (human lives?) are **wasted** in the process.

Dominant and Recessive Alleles

- If you know the genotypes of the parents you can predict what their offspring will be. This is an example:

		Father	
		B	b
Mother	b	Bb	bb
	b	Bb	bb

- B** = Brown eyes allele
- b** = Blue eyes allele
- Father = **Bb** (Brown eyes)
- Mother = **bb** (Blue eyes)
- 2 offspring **Bb** (Brown eyes)
- 2 offspring **bb** (Blue eyes)
- 50% Brown eyes and 50% Blue eyes.

Gene Therapy

- If someone has a **disease** because they are **missing a gene** it might be possible to **give them the gene** using gene therapy.
- The missing gene is taken from a normal human cell and inserted into a **stem cell**, the stem cell is then put into the ill person so that it can **spread the missing gene to all the body cells**.
- Stem cells** are special cells in the body which are **undifferentiated** and have the ability to turn into any type of cell (eg. nerve cell, muscle cell, skin cell).
- Gene therapy is very **expensive** and **normally doesn't work**.