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| **4.7.1** | Adaptations, interdependence and competition |
| **4.7.1.1 Communities**  Image result for ecosystem gcse interdependence | An **ecosystem** is the interaction of a community of living organisms **(biotic)** with the non-living **(abiotic)** parts of their environment.  To **survive** and **reproduce** in acommunity, plants compete with each other for **light and space**, and **water and mineral ions from the soil**. Animals compete with each other for **food, mates and territory**.  Each species in a community depends on other species for **food, shelter, pollination and seed dispersal**, etc. If one species is removed it can affect the whole community. This is called **interdependence**. A **stable community** is where all the species and environmental factors are in balance for a constant population sizes. |
| **4.7.1.2 Abiotic factors**  Image result for abiotic | A change in an abiotic (non-living) factor would affect a given community. This includes **light intensity**, **temperature**, **moisture levels**, **soil pH and mineral content**, **wind intensity and direction**, **carbon dioxide levels for plants, oxygen levels** for aquatic animals. |
| **4.7.1.3 Biotic factors** | Biotic (living) factors which can affect a community are:  **availability of food**, **new predators** arriving, **new pathogens** or one **species outcompeting another**. |
| **4.7.1.4 Adaptations**  **http://media3.s-nbcnews.com/j/MSNBC/Components/Photo/_new/110912BugsPhoto-hmed-0920a.grid-6x2.jpg** | Organisms have **features** (**adaptations**) that enable them to survive in conditions in which they normally live. These adaptations may be structural, behavioural or functional.Organisms called **extremophiles** **live in environments that are very extreme**, such as at high temperature, pressure, or salt concentration. Bacteria living in deep sea vents are extremophiles. |

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| 4.7.2 | Organisation of an ecosystem |
| **4.7.2.1 Levels of organisation**  food chains tertiary consumers | Feeding relationships in a community is represented by **food chains**. It begins with a **producer** **(green plant or alga)** which **synthesises molecules such as glucose** for photosynthesis. Producers **are eaten by primary consumers**, which may be eaten by **secondary consumers** and then **tertiary consumers.** Consumers that kill and eat other animals are **predators**, and those eaten are **prey**. In a stable community the numbers of predators and prey rise and fall in cycles.  Methods such as **transects and quadrats** are used by ecologists to determine the **distribution and abundance** of species in an ecosystem. |
| **4.7.2.2 How materials are cycled**  Image result for CARBON cycle aqa gcse new | All materials in the living world are **recycled** to provide the building blocks for future organisms.  **CARBON CYCLE** returns carbon from organisms to the atmosphere in the form of carbon dioxide. It involves four main processes:   * **Photosynthesis:**   removes carbon (dioxide) from the air, by green plants, used to make carbohydrates, fats and proteins.   * **Respiration:**   chemical reaction in all living cells, which releases carbon dioxide back into the air.   * **Decay (or decomposition):**   Dead organic material is **broken down** (digested) by microorganisms. This releases nutrients back into the soil needed for plants to grow.   * **Combustion**   burning or (fossil) fuels, which is releases more carbon  dioxide into the atmosphere   * **WATER CYCLE** provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated. |
| **4.7.2.3 Decomposition (BIOLOGY only)** | Gardeners and farmers try to provide **optimum (best) conditions** for **rapid decay** of **waste biological material (compost)**. The rate of decay can be affected by **temperature**, **water** and the **availability of oxygen**.  The compost produced is used as a natural fertiliser for growing garden plants or crops. **Anaerobic** (no oxygen) decay produces methane gas. **Biogas generators** can be used to produce methane gas as a fuel. |
| **4.7.2.4 Impact of environmental change (biology only) (HT only)** | The distribution of species in an ecosystem can be affected by environmental changes (**temperature, availability of water and composition of atmospheric gases.** The changes may be seasonal, geographic or caused by human interaction. |

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| 4.7.3 | Biodiversity and the effect of human interaction on ecosystems |
| **4.7.3.1 Biodiversity**  Image result for biodiversity gcse | Biodiversity is the **variety of all the different species** of organisms on earth, or within an ecosystem. Greater biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another. |
| **4.7.3.2 Waste management**  Image result for waste management aqa gcse | Rapid growth in the human population and an increase in the standard of living means **more resources are used and more waste is produced**. Waste and chemical materials need to be properly handled to reduce pollution. Pollution can occur in **water** (from sewage, fertilisers or toxic chemicals), in **air** (from smoke and acidic gases), on **land** (from landfill and chemicals) and can **kill plants and animals**. |
| **4.7.3.3 Land useImage result for peat bog** | Humans reduce the amount of land available for other animals and plants by **building, quarrying, farming and dumping waste**.  **Peat bogs**, formed in waterlogged bogs over thousands of years by the growth of mosses and other plants, **absorb and ‘lock away’ carbon**. They are being destroyed to produce garden compost, **reducing the area of this habitat and the variety of different plant, animal and microorganism species** that live there. The decay or burning of the peat releases carbon dioxide into the atmosphere. |
| **4.7.3.4 Deforestation** | Large-scale deforestation in tropical areas has occurred to **provide land for cattle and rice fields** and **grow crops for biofuels**. |
| **4.7.3.5 Global warming**  **Image result for global warming** | **Carbon dioxide and methane levels** in the atmosphere are **increasing,** and contribute to ‘global warming’. |
| **4.7.3.6 Maintaining biodiversity** | Scientists and citizens have recommended programmes to maintain biodiversity. These include **breeding programmes** for endangered species, **protect and regenerate rare habitats, reintroduce field margins and hedgerows** in agricultural areas where farmers grow only one type of crop, **reduce deforestation** and **carbon dioxide emissions**, **recycle** rather than dump in landfills. |

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| 4.7.4 | 4.7.4 Trophic levels in an ecosystem (biology only) |
| **4.7.4.1 Trophic levels**  Image result for trophic levels  number | Trophic levels can be represented by numbers, starting at level 1 with plants and algae. Further trophic levels are numbered subsequently according to how far the organism is along the food chain.  **Level 1:** **Plants and algae** make their own food and are called producers. **Level 2**: **Herbivores** eat plants/algae and are called primary consumers. **Level 3:** **Carnivores** that eat herbivores are called secondary consumers. **Level 4:** Carnivores that eat other carnivores are called **tertiary consumers**. **Apex predators** are carnivores with no predators.  **Decomposers** break down dead plant and animal matter by **secreting enzymes** into the environment. **Small soluble food molecules** then diffuse into the microorganism. |
| **4.7.4.2 Pyramids of biomass** | Pyramids of biomass can be constructed to represent the amount of biomass in each level of a food chain. Trophic level 1 is at the bottom of. |
| **4.7.4.3 Transfer of biomass** | Producers (plants and algae) transfer about 1% of the incident energy from light for photosynthesis. Only around 10% of the biomass from each trophic level is transferred to the level above it.  **Loss of biomass** is because: **not all the ingested material** **is absorbed**, **only some is egested as faeces**, some **lost as waste** (such as carbon dioxide and water in respiration and water and urea in urine). Large **amounts of glucose** are used in **respiration.**  **Equation:** The percentage efficiency of energy transfer between trophic levels = energy transferred to next level ÷ total energy in × 100 |

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| 4.7.5 | 4.7.5 Food production (biology only) |
| **4.7.5.1 Factors affecting food security**  Image result for food security | Food security is having enough food to feed a population.  Biological factors threatening food security include: • **increasing birth rate**, **changing diets in developed countries** means **scarce food** resources are **transported** around the world, **new pests and pathogens that affect farming**, **environmental changes** (widespread famine in countries if rains fail), the **cost** of agricultural inputs, **conflicts** in some parts of the world. |
| **4.7.5.2 Farming techniques**  **Picture 5.png** | Food production can be improved by **limiting energy transfer** from food to animals to the environment. Examples include, **restricting animal movement and keeping them close together (so less energy is wasted)**, **controlling the temperature of their surroundings** or **high protein diets** to increase growth. |
| **4.7.5.3 Sustainable fisheries** | Fish stocks in the oceans are declining (going down). Certain **species of fish may disappear** if fish stocks levels are not maintained. Control of net size and the introduction of fishing quotas can help in conserving fish stocks at a sustainable level. |
| **4.7.5.4 Role of biotechnology**  DNA containing desired gene removed from human cell.  Plasmid taken from bacterium cell. Enzymes insert human gene into bacterium plasmid.  Bacteria with the new characteristic is created. | Modern biotechnology techniques enable large quantities of microorganisms to be cultured for food. The **fungus Fusarium, for example, is useful for producing mycoprotein**, a protein-rich food suitable for vegetarians. The fungus is **grown on glucose syrup** **in aerobic (oxygen)** **conditions** and the biomass is **harvested and purified**.  **Genetic engineering:** **Genes** from the chromosomes of humans and other organisms can be ‘cut out’ using **enzymes** and transferred to cells of other organisms.   * **GM crops** that have been given beneficial traits (eg. resistant to insect attack or to herbicides or improved nutritional value such as golden rice) * **Bacteria** that are genetically modified to produce human insulin (for diabetics)   (HT): Steps involved in genetic engineering  **Enzymes** are used to isolate and cut out the desired gene; this **gene is inserted into a vector**, usually a bacterial plasmid or a virus. Theplasmid or vector **reproduces quickly** with the desired characteristics. |