



UNIT 3: ECOSYSTEMS, BIODIVERSITY, AND MANAGEMENT

SIX MAIN GLOBAL BIOMES

The distribution of global biomes is influenced by a range of different factors, including latitude, altitude and continentality. These affect the broad ranging climates experienced globally, and thus vegetation found in different regions.

The six main global biomes, each of which possesses unique biodiversity, are:

- Tropical rainforests
- Grasslands
- Deserts
- Temperate deciduous forests
- Taiga
- Tundra



UK'S MARINE ECOSYSTEMS

As the UK is an island, it has many unique marine ecosystems around its coastline, from salt marshes to cold-water coral reefs. These can provide many benefits, including:

- Tourism:** 250 million people visit the UK's coast, supporting 200,000 jobs in coastal tourism.
- Fishing:** Provides 25,000 jobs and generates income as the UK sells fish overseas, particularly to European countries.
- Energy production:** London Array in the Thames Estuary is the world's biggest wind farm. The UK has oil reserves of around 24 billion barrels in the North Sea, which could be enough for another 30 years of consumption.

Human activity can damage marine ecosystems in many ways, including:

- Overfishing:** Removing too much of a particular species will disrupt the food chain, leading to less fish or smaller fish.
- Boat trawling:** Big nets pulled along the seabed can cause destruction to marine life and habitats.
- Economic development:** Growth of urban areas and industry can damage or remove coastal ecosystems like salt marshes.
- Eutrophication:** Fertilisers from farmland being washed into the sea causes an algal bloom, depriving sea life of oxygen.

UK'S TERRESTRIAL ECOSYSTEMS

There are four main ecosystems found in the UK.



MOORLAND



HEATHLAND



WETLAND



WOODLAND

Found in upland areas with heavy rainfall such as Dartmoor and the Cairngorms. Characterised by acidic or peaty soils, low-growing shrubs and grouse/deer.

Found in lowland areas such as the South Downs. Characterised by infertile soils, heather and common lizards. Lots of human intervention here.

Very small amount remaining in areas like East Anglia and Somerset. Characterised by waterlogged soils, reeds and bulrushes and birds e.g., mallard ducks.

12% of UK land is woodland. Mainly deciduous trees in England. Brown, earthy soils. 4 layered vegetation structure with trees main plant. Squirrels, foxes and hedgehogs found here.

THE THREAT OF DEFORESTATION

Deforestation is when trees are cut down or removed, usually for an economic purpose.

TROPICAL RAINFORESTS

- Urbanisation:**
- Trees are cut down for timber. This can be used in the construction of buildings, and demand for this material has increased as the rate of urbanisation has grown.
 - Land is cleared to build housing that can accommodate a growing population.
- Resource extraction:**
- Trees can provide fuel, timber and medicine.
 - Land is cleared to access resources beneath rainforests, such as minerals, metals and oil/gas.
- Agriculture:**
- Land is cleared for cattle ranching or palm oil production. Demand for both is increasing as populations rise.

TEMPERATE DECIDUOUS FORESTS

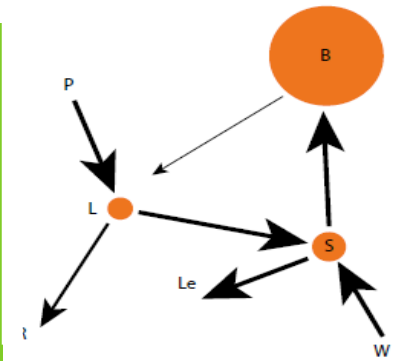
- Urbanisation:**
- Ancient woodlands were cleared to allow urban areas to expand (urban sprawl) and house a growing population.
- Resource extraction:**
- Trees are chopped down for resources such as timber, which can be used in the construction of housing and furniture.
- Agriculture:**
- Changing agricultural practices, and the need to feed a larger population, have meant more land is needed for agriculture. This has resulted in large areas of forest being chopped down.

NUTRIENTS IN THE TRF AND TDF

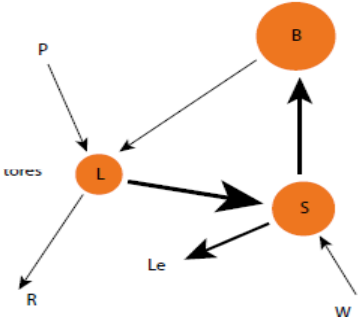
The nutrient cycle (**Gersmehl model**) involves the movement of nutrients between the physical environment (**abiotic**) and living organisms (**biotic**). Their interaction makes the ecosystem function.

TROPICAL RAINFORESTS

- Litter:**
- Hot and humid conditions allow for rapid decomposition of dead plant material. This provides nutrients easily absorbed by plant roots. High precipitation in the TRF causes increased rates of surface run-off and leaching.
- Soil:**
- Many of the soils in the TRF are old, impoverished and low in nutrients. Leaching occurs due to high precipitation, causing nutrients to be washed away.
 - Nutrients stay close to the surface and do not remain in the soil for long, due to high demand from the TRF's many growing plants.
- Biomass:**
- This is the largest store of the TRF's nutrient cycle, as high levels of biodiversity mean lots of nutrients are stored within the vegetation.



TEMPERATE DECIDUOUS FORESTS



- Litter:**
- Larger than the soil due to nutrient transfer being slower. This is due to rainfall and humidity levels being lower than that of the TRF.
 - The colder climate of temperate deciduous forests also reduces the rate of decomposition.
 - Bigger in the autumn/winter due to the high concentration of deciduous trees in the TDF.
- Soil:**
- Soils are more fertile than those in the tropical rainforest due to slower nutrient uptake, less leaching and less surface run-off.
- Biomass:**
- A large biomass because there is plenty of precipitation and summer warmth, though this is not as big as that of the tropical rainforest.



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THE IMPACT OF CLIMATE CHANGE IN THE TRF AND TDF

TROPICAL RAINFORESTS

Structure: Less rainfall may cause TRF to become a seasonal tropical forest due to a prolonged dry season. More similar in structure to wooded areas of grasslands as a result.

Functioning: Drier forest emits more CO₂ than it takes in. High likelihood of forest fires which will worsen this.

Biodiversity: Plant species cannot tolerate drier conditions, prolonged drought or forest fires. Spread of invasive species that TRF not immune to.

TEMPERATE DECIDUOUS FORESTS

Structure: High temperatures make drought and forest fires more likely. This could cause significant damage to plant and animal habitats.

Functioning: Increased risk of drought could threaten the survival of trees.

Biodiversity: Milder winters could mean an introduction of invasive species, threatening and possibly reducing levels of biodiversity in the temperate deciduous woodland.

SUSTAINABLY MANAGING THE TEMPERATE DECIDUOUS FOREST

LOCATED EXAMPLE: WYRE FOREST, WEST MIDLANDS, ENGLAND



The Wyre Forest is located in the West Midlands of England, straddling the border between Shropshire and Worcestershire. A 5,000 hectare site; it holds significant environmental importance as around 2,400 hectares is ancient woodland, a habitat for rare flora and fauna.

Today, the Wyre Forest is managed by the Wyre Forest Landscape Partnership who have created an action plan for the sustainable management of the forest. The partnership is made up of different stakeholders including the Forestry Commission, Natural England, Wyre Forest District Council, and the Wyre Community Land Trust.

MANAGEMENT STRATEGIES

Woodland Management: Areas previously planted with conifers will gradually be restored to oak woodland. Coppicing and tree felling will allow the forest to develop woodland glades.

Recreational Management: Provision of a visitor centre with bicycle access, waymarked footpaths, a car park, and a GoApe.

Education: Research is carried out in the Wyre Forest on how recreation impacts woodlands. Children and adults can attend courses in the woodland to learn about its biodiversity and how to protect it.

ADVANTAGES/DISADVANTAGES

Woodland Management: Preserves the most biodiverse parts of the forest and encourages this to increase. May leave trees vulnerable to disease from invasive species.

Recreational Management: Allows people to experience the woodland encouraging a healthier lifestyle. Provision of footpaths and car parking limits risks of erosion. Risk of disturbance to wildlife from recreational activities such as trampling of species and disturbance from noise.

Education: Allows people to learn more about the woodlands of the UK so increases the likelihood of citizen action. Visits are cost and time intensive so not all people benefit as West Midlands has high levels of deprivation.

BIODIVERSITY IN THE TRF AND TDF

The TDF has very high biodiversity because rainforests offer the optimum conditions for plant growth, which then supports very high animal biodiversity. There are a variety of layers which provide many different habitats. By contrast, the TDF has only moderate biodiversity in comparison to tropical rainforests due to the low temperature conditions that slow down the production of food in winter months.

TROPICAL RAINFORESTS

Plants

Buttress roots: Wide roots stabilise the tree as it increases in height. Shallow rooted in the soil as this is where nutrients are.

Drip tips: an adaptation of 95% of plants in the TRF, these help to remove excess water from the plant in a biome with frequent rain.

Animals

Lemur: Have strong arms/grip to allow them to swing between the different trees in the canopy layer.

Serpent eagle: Sits motionless then pounces on prey. Sharp beak and powerful legs enable it to catch snakes, lizards and other small mammals.

TEMPERATE DECIDUOUS FORESTS

Plants

Oak tree: Deciduous leaves shed in autumn/winter to preserve energy. Thick bark protects them during cold winter. Broad leaves allow tree to maximise photosynthesis during summer months.

Bluebells: Bloom in early Spring before trees come into leaf to maximise sunlight exposure.

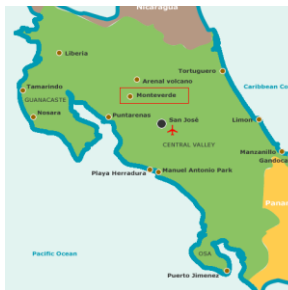
Animals

Hedgehogs: hibernate to slow down their energy use during winter months when food is scarcer.

Nightingales: Migrate to Africa during the winter months due to the lack of food availability in the UK.

SUSTAINABLY MANAGING THE TROPICAL RAINFOREST

LOCATED EXAMPLE: MONTEVERDE CLOUD FOREST, COSTA RICA



The Monteverde Cloud Forest is located in central Costa Rica, and is one of 11 forest reserves in the country. An estimated 25% of land in Costa Rica is protected, and the country is well-renowned for its efforts to sustainably manage its varied and biodiverse environments.

Monteverde Cloud Forest is protected in order to maintain its unique benefits for people now and in the future. Tropical rainforests offer a wealth of resources and local people may be tempted by the economic incentive of exploiting this, but sustainable management allows for this need, and the needs of the forest's future, to be met in a way that works for everyone involved.

STRATEGIES

Direct government action:

Payments for Environmental Services (PES) is a scheme for poverty reduction where landowners are given \$50 a year for every hectare they protect.

The **Forestry Law of 1996** brought in new legislation to further limit deforestation.

Ecotourism: Employs local people and educates 70,000 tourists.

Commodity value (carbon credits): Wealthy countries buy carbon credits to offset the emissions they produce, generating \$20m a year.

ADVANTAGES/DISADVANTAGES

Direct government action: Large-scale project meaning likely to have a bigger impact. Provides an incentive to keep trees alive. Cost of resources from the trees likely to be greater than \$50 a hectare.

Ecotourism: Locals are less likely to turn to deforestation if they are employed through ecotourism. 70,000 tourists may still do some damage e.g., footpath erosion.

Commodity value (carbon credits): Commodity value of trees is greater with them alive than being cut down. Carbon credit value can fluctuate. Gives industries a relatively inexpensive pass to release emissions.