

4.1a i: What is an Ecosystem?

An ecosystem is a distinct environment in which organisms interact with each other and with their environment. Climate, soil, water plants and animals are all interdependent

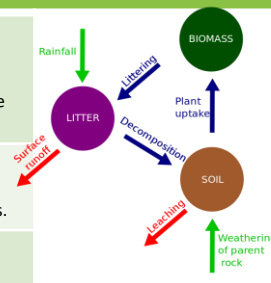
4.1a: Ecosystem's Components

Abiotic	These are non-living, such as air, water, heat, rock.
Biotic	These are living, such as plants, insects, and animals.
	Flora plant life.
	Fauna animal life

Energy from the sun powers the ecosystem. Nutrients & water keep the ecosystem operating. These are either stored or they flow. Sometimes they are lost from the system.

4.1a: Nutrient cycle

Plants take in those nutrients where they are built into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by decomposers.



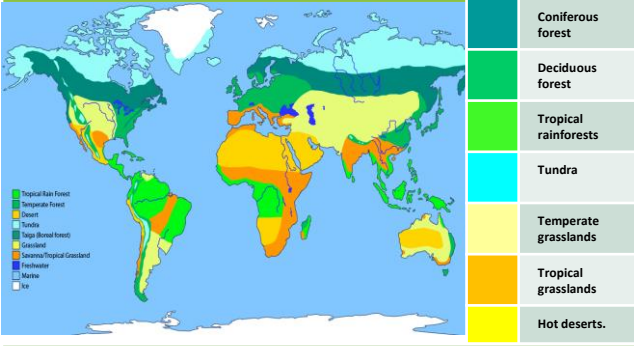
Litter	This is the surface layer of vegetation, which over time breaks down to become humus.
Biomass	The total mass of living organisms per unit area.

4.1a: Food Chains

Energy is transferred by eating or being eaten. Primary producers (plants) are fuelled by the sun. They fuel the primary consumers. Not all energy is transferred. Some is lost along the way (digestion; ingestion; excretion). No sun, no plants, no animals



4.1a:ii: Global distribution of the major Biomes (global scale ecosystem)



The most productive biomes (= have the greatest biomass)- grow in climates that are hot and wet.

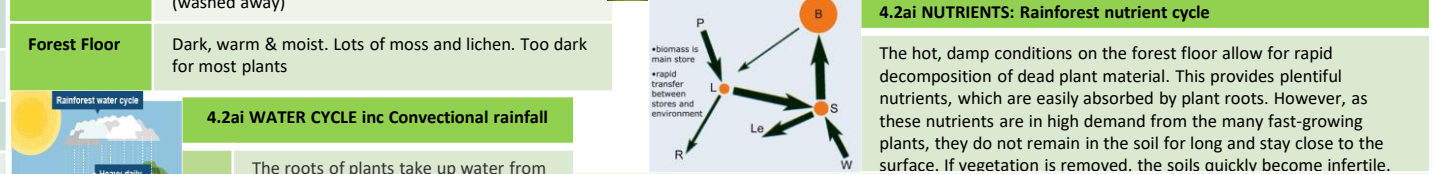
4.1a:ii: Location/Distribution 4.1a:ii: An overview of the climate, flora and fauna of the world's major biomes

Biome	Location	Temperature	Rainfall	Flora	Fauna
Tropical rainforest	Centred along the Equator, between the Tropics. Amazon = biggest	Hot all year (25-30°C)	Very high (over 200mm/year)	Tall trees forming a canopy; wide variety of species.	Greatest range of different animal species. Most live in canopy layer
Tropical grasslands	Between latitudes 5°- 30° north & south of Equator.	Warm all year (20-30°C)	Wet + dry season (500-1500mm/year)	Grasslands with widely spaced trees.	Large hooved herbivores and carnivores dominate.
Hot desert	Found along the tropics of Cancer and Capricorn.	Hot by day (over 30°C) Cold by night	Very low (below 300mm/year)	Lack of plants and few species; adapted to drought.	Many animals are small and nocturnal: except for the camel.
Temperate forest	Between latitudes 40°-60° north of Equator.	Warm summers + mild winters (5-20°C)	Variable rainfall (500-1500mm /year)	Mainly deciduous trees; a variety of species.	Animals adapt to colder and warmer climates. Some migrate.
Tundra	Far Latitudes of 65° north and south of Equator	Cold winter + cool summers (below 10°C)	Low rainfall (below 500mm/ year)	Small plants grow close to the ground and only in summer.	Low number of species. Most animals found along coast.
Coral Reefs	Found within 30° north – south of Equator in tropical waters.	Warm water all year round with temperatures of 18°C	Wet + dry seasons. Rainfall varies greatly due to location.	Small range of plant life which includes algae and sea grasses that shelters reef animals.	Dominated by polyps and a diverse range of fish species.

Topic 4 Sustaining Ecosystems

4.2a: Tropical Rainforest Biome

4.2a: CLIMATE: climate of Tropical Rainforests	4.2a: SOIL: Rainforest soil profile
<ul style="list-style-type: none"> • Temps fairly constant, usually around 28 degrees • Heavy rainfall 2500mm+ per year. Most afternoons have thunderstorms • 365 day growing season as a result unlike UK 	
4.2a: Layers of the Rainforest	
Emergent Highest layer with tree reaching 50 metres. Tallest get most light, water and sun.	
Canopy Most life is found here as it receives 70% of the sunlight and 80% of the light. It protects the ground like an umbrella, stopping soil getting baked or leached (washed away)	
Forest Floor Dark, warm & moist. Lots of moss and lichen. Too dark for most plants	Leaf Litter Thin litter layer rapidly decomposes in heat. Top Soil Shallow topsoil is a mixture of decomposed organic matter and minerals. Sub Soil The sub-soil is deep due to rapid weathering of rocks below. Rock Underlying rock weathers quickly at high temperatures to form sub-soil.




4.2a: WATER CYCLE inc Convectional rainfall	4.2a: Adaptations of rainforest species
<ol style="list-style-type: none"> 1 The roots of plants take up water from the ground and the rain is intercepted as it falls. 2 As the rainforest heats up, the water evaporates into the atmosphere. 3 Finally, the water condenses and forms clouds to make the next day's rain. 	4.2a: NUTRIENTS: Rainforest nutrient cycle The hot, damp conditions on the forest floor allow for rapid decomposition of dead plant material. This provides plentiful nutrients, which are easily absorbed by plant roots. However, as these nutrients are in high demand from the many fast-growing plants, they do not remain in the soil for long and stay close to the surface. If vegetation is removed. the soils quickly become infertile.
	4.2a: Adaptations of rainforest species
	Sloths Are camouflaged to blend in to the forest environment. Helps as they move slowly
	Buttress Roots Located above the ground, like a tripod. They support tall trees & help absorb nutrients, quicker and easier before they get washed away or used by other plants.
	Drip Tips Allows heavy rain to run off leaves easily. Leaves have a waxy coating too.
	Lianas & Vines These climb trees to reach sunlight in the canopy.

4.2: Tropical Rainforest Biome (continued)

4.2bi: Goods & Services of the rainforest		4.2bi: Rainforest inhabitants	
Raw Materials	Commonly used materials such as timber, rubber and oils are found here.	Many tribes have developed sustainable ways of survival, such as shifting cultivation. The forest provides inhabitants with... <ul style="list-style-type: none"> • Food through hunting and gathering. • Natural medicines from forest plants. • Homes and boats from forest wood. • Clean water 	
Water	Controls the flow of water to prevent floods/droughts. Water is purified too.	4.2bii: Effects of Human Activity on the Rainforest	
Food	Important foods such as bananas, pineapples, cocoa and coffee are grown there.	Logging (felling trees for timber)	Agriculture
		<ul style="list-style-type: none"> • Most widely reported cause of destructions to biodiversity. • Timber is harvested to create commercial items such as furniture and paper. • Has lead to violent confrontation between indigenous tribes and logging companies. 	<ul style="list-style-type: none"> • Large scale 'slash and burn' of land for ranches and palm oil. • Increases carbon emissions. • River saltation and soil erosion increases due to the large areas of exposed land • Increase in palm oil is making the soil infertile. • Beef and soya – widely produced
Health	25% of modern medicines are made from rainforest ingredients.	Mineral Extraction	Tourism
Energy	Previously wood, now HEP which generates 2/3 of Brazil's energy needs.	<ul style="list-style-type: none"> • Precious metals are found in the rainforest. • Areas mined can experience soil and water contamination. • Indigenous people are displaced from their land due to roads being built to transport products. 	<ul style="list-style-type: none"> • Mass tourism is resulting in the building of hotels in extremely vulnerable areas. • Negative relationships between the government and indigenous tribes • Tourism has effected wildlife (apes) by exposing them to human diseases.
Climate	Acts as a carbon sink by storing 15% of carbon emissions. Evaporation from surfaces cools the Earth's surface		

4.2biii: Case Study: Sustainable TRF Management in Costa Rica – Samasati Nature Retreat - Ecotourism

Location & Background	
Costa Rica is a small country in Central America. SNR is located on the NE coast. It is home to 6% of the world's biodiversity. The country attracts 4+ million tourists a year.	
Ecotourism	
Enviro-friendly tourism – creates jobs, brings in \$ with minimal environmental impact	
Advantages	
Soc: jobs for locals only Ec: brings in income from overseas visitors Env: no heavy machinery used; buildings blend in; water from springs; rainwater collected and used; only biodegradable soap is allowed; buildings on stilts allows drainage	
Disadvantages	
<ul style="list-style-type: none"> • Use of 4x4s on dirt track roads can cause erosion • Deforestation to clear areas for tourism industry. 	

4.2bii/4.2biii: Threats to the Costa Rican Rainforest

<ul style="list-style-type: none"> *1960 rapid deforestation due to cattle ranching and agriculture (By 1990, 32,000 hectares chopped p/a) *Gold and other metal mining meant large scale soil and rock removal. This meant areas were deforested and chemicals entered water systems.
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4.2biii: Other TRF management in Costa Rica

<ul style="list-style-type: none"> *Government created 28 National Parks with 24% of the country's land protected. *Laws and enforcement meant that deforestation had fallen from 1.8% per year to almost zero by 2010. *Agroforestry encourages growing trees and crops- trees protect crops & soil from excess heat and water. *Afforestation has led to the replanting of trees to replace original forest that have been lost. *Selective logging – only removing trees that are needed instead of bulldozing the lot! *Monitoring – use of satellite technology to ensure rules are followed and that no illegal logging occurs. *Wildlife corridors – fragmented bits of forest are a threat to species. By joining them together, wildlife can roam freely and reproduce.

4.3: Polar/Tundra Regions Biome

4.3a: Distribution of Polar Regions		4.3aiii: Effects of Human Activity in Polar Regions	
Arctic	Antarctic	Oil & Gas exploration	Whaling
Is the region north of latitude 60°N around the North Pole.	A continent south of latitude 60°S around the South Pole.	<ul style="list-style-type: none"> *Arctic holds a large amount of untapped oil and gas. *Oil spills would threaten ecosystems as clean up operations would be slow. 	<ul style="list-style-type: none"> *Hunting of whales is a major industry – this led to a rapid decline in whale populations. *Many countries have banned whaling, but some still continue
		Fishing	Tourism
4.3ai: Climate		<ul style="list-style-type: none"> *Has made area possible to fish large untapped stocks. *The polar areas are difficult to police due to harsh conditions. *Collapse of the fish stocks there might damage ecosystems. 	<ul style="list-style-type: none"> *The tourism industry is steadily growing within polar regions. *Travel by tourist increase emissions further. *Wildlife may become disturbed by tourists getting too close.
Very cold with temperatures rarely reaching above 0 °C. Winters average below -40 °C with summer maximum temps of only 5 °C. Precipitation is low throughout the year.		4.3bi: Case Study: Small Scale Sustainable Management: Arctic	
4.3ai: Land & Sea Features		Location & Background – sustainable whaling	
Arctic	Antarctic		
Large areas are permafrost. At sea, most of the region is frozen over.	Large, thick ice sheets. A mountain range crosses the continent.	Baffin Island; Clyde river; northern Canada; became a Marine Wildlife Area. Covers 3360km ² ; is a sanctuary set up to protect Bowhead whales. Whales stop off here on their migration, almost like a motorway services – the whales rest and feed. It is ideal as there are two deep troughs full of zooplankton (whale feed). Bears, seals, fish and ducks also benefit from this 'safezone'.	
4.3ai: Flora (Plants)	4.3ai: Fauna	Sustainable Management ?	
There are very few plants in polar areas – some lichens, mosses and grasses along the coastal areas.	Relatively few species of animals. Polar Bears, Penguins and marine mammals like whales, seals and walrus are examples.	<p>Socially: the wildlife area protects the natural way of life of the 1000 Inuit people who live here.</p> <p>Economic: They can feed themselves</p> <p>Environmental; Hunting is not allowed, so species survival is guaranteed; no oil pollution from boats</p>	
4.3aiii: Arctic soil profile		4.3bii: Case Study: Global Scale Sustainable Management: The Antarctic Treaty System	
Active Layer	Thaws in the summer. Can cause plants to drown	Background	
Permafrost	Permanently frozen all year. Layer increases further north.		
Bed Rock	Low temperatures weathers rock slowly = less nutrients.	Signed by 46 nations in 1961, the Treaty sets aside Antarctica as a scientific preserve, establishes freedom of scientific investigation and bans military activity.	
4.3aiii: Interdependence		Basic Principles of the Antarctic Treaty	
Soil	Very thin, often frozen = lacks nutrients due to limited plant growth.	<ul style="list-style-type: none"> • Bans mining and resource extraction. • Prevents territorial disputes of the continent. • Promotes scientific research and co-operation. • Protects the fragile environments and its wildlife by preventing and managing waste/pollution. 	
Climate	Cold, Limited rainfall, windy Short growing season; limited photosynthesis – plants short	Successful?	
Decomposition	Very slow as it is so cold.	Stayed in place for 50 years with more countries signing up to enforce strict controls and improve its stability. THE THREAT MIGHT BE CLIMATE CHANGE!!	
Could we take this idea and create an Arctic Treaty???? BUT: harder to do as people live there permanently and it is already being exploited. Greenpeace wants to try and set up an Arctic Wilderness like in 4.3bi !!!! 'copycat'!!			