

Keyword		Definition	What are the direct threats to the rainforest?	
Biodiversity	Means the number of different plant and animal species in an area.		Deforestation is the main threat. It occurs for a number of reasons. The main cause of deforestation in the rainforest is cattle ranching, logging, commercial agriculture such as palm oil and small scale, subsistence agriculture.	
Biodiversity in the rainforest is extremely high. It receives heat, sunlight + water all year round, they grow continually. Also there is multiple layers which provide numerous different specialised habitats				
Nutrient Cycle	The continuous cycle of nutrients between stores such as biomass, the soil and litter via transfers. This keeps plants and soils healthy.			
Food web	A complex network of overlapping food chains that connect plants and animals in biomes.			
Deforestation	Means the deliberate cutting down of forests to exploit forest resources (timber, land or minerals)			
Direct Threats	Involve the deliberate cutting down of trees for timber, to make roads or convert the forest to farmland.			
Indirect Threats	Comes from pollution, global warming or disease. For example, Brazil only emit 1.5% of global CO2 emissions but suffer the global effect of global warming/climate change affect their rainforests.		Poverty	In many LICs (Low income countries), local people cut down small areas of forest for land to farm because they have no other way of making a living.
			Debt	Countries are driven to cut down forests to provide timber to export or grow cash crops for export, to pay off debts.
			Economic Development	Most tropical rainforests are in the developing world. In order the develop their economies forest is sacrificed in place of roads, expanding cities and to dam rivers to produce hydro-electric power (HEP)
			Demand for Resources	TRFs contain raw materials including timber, oil, gas, iron ore and gold. To get at these, forest has to be destroyed. Land is also needed to provide food for growing populations.

How does the nutrient cycle in rainforests compare to typical nutrient cycles?

Biomass (plants/vegetation which is a STORE in the nutrient cycle)	The biomass is extremely dense in the rainforest which means it is a larger store of nutrients. Most nutrients in the rainforest is stored in the biomass. This means land cannot be farmed for long following deforestation as it is lacking nutrients.
Litter (decaying leaves and twigs on the soil surface is a STORE)	This store is smaller due to hot, wet conditions which means bacteria and fungi decay litter very quickly, returning nutrients to the cycle.
Growth uptake by biomass (TRANSFER)	Larger as biomass grows all year round.
Weathering TRANSFER (break-down of rock which adds nutrients to the soil)	Larger as chemical processes in hot humid conditions means weathering happens at a faster rate.
Leaching TRANSFER (nutrients is washed out of the soil by precipitation)	Larger in the rainforest due to heavy rainfall.
Soil (STORE)	Smaller as nutrients is rapidly up-taken by the biomass or leached out by rainfall.

What are the indirect threats to the rainforest?

Drought	Drought is caused by global warming. Drought causes leaf litter to dry out which means it is more susceptible to forest fires. Forest fires emit huge amounts of carbon dioxide into the atmosphere. This means there is less evaporation and transpiration from the biomass and therefore less moisture in the atmosphere, therefore less rain. This makes drought worse. Drought also threatens the nutrient cycle as fungi and bacteria responsible for decay/decomposition die. The food web is also affected as the food supply is reduced.
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How are animals and plants adapted to living in the rainforests?

Animals		Plants	
Sloths: Huge claws allow them to hang upside down on branches. Green algae growing on their fur helps camouflage them against predators.		Drip tip leaves: Most rainforest plants have thick, waxy leaves with drip tips which mean they shed water quickly which prevents them from rotting.	
Birds: They have loud calls because it easier to hear a mate in the dense canopy than see one. They also have powerful beaks to break open nuts.		Epiphytes: These plants live in the canopy on the trees and have evolved to get all their nutrients from water and the air rather than the soil, so their roots dangle in mid-air.	

Protecting Tropical Rainforests

Conservation: Protecting threatened biomes e.g. setting up national parks or banning trade in endangered species. This is vital if goods and services are not to be lost for future generations.

Global action 1 designed to protect TRF: **CITES** (Convention of international trade of endangered species)

Global action 2 designed to protect TRF: **REDD** (Reducing emissions from deforestation and forest degradation)

Advantages	Disadvantages	Advantages	Disadvantages
Many countries have signed up, protecting a wide variety of species.	Focus on species, not ecosystems so does not halt deforestation.	Helps low-income countries fund protection of their rainforest.	Global CO2 emissions are reduced as deforestation does not take place. However high income countries use this impact so it looks like they have reduced their own CO2 emissions to help them reach a target.
Has reduced trade in ivory and halted decline of African Elephants.	Expensive for countries to set up and monitor which many low-income countries can't afford.	Will have reduced deforestation in Juma, Brazil by 60% by 2050 by paying local people NOT to deforest the land.	This project relies on donations from TNCs. If the donations stop, then the project will stop. Also some illegal logging does still take place as the area is too large to police

Keyword	Definition
Taiga	A biome with coniferous trees that have adapted to cold climates. Also known as boreal forest. Found in countries at northern latitudes such as Russia and Canada.
Biodiversity is low in the Taiga as they have a short growing season (4-5 months) and plants and animals have to be specially adapted to survive such harsh conditions. The climate consists of short, wet summers with long, dry winters with snow on the ground for many months.	
Net Primary Productivity (NPP)	A measure of how much new biomass is added to a biome, each year.
NPP is measured in grams, per square metre, per year. Biomes with longer growing seasons/better growing conditions have higher NPP values.	

Sustainable Management of TRF

Rates of deforestation vary between countries because of differing poverty levels, laws and public opinion. Sustainable management conserves rainforest and ensures they are not destroyed faster than they can be renewed so future generations can use them. The key is to provide local people with alternative livelihoods so they don't need to cut down the forest to make money.

Agroforestry: Farmers grow different crops between trees instead of deforesting the land to do so.

Benefits: Agroforestry helps to reduce soil erosion and flooding as well as maintaining crop and forest biodiversity.

Ecotourism: This is wildlife/culture tourism on a small-scale which means it has a low impact on the environment.

Benefits: Tourists stay with local people, eat local food and pay local people directly instead of a tourist company. This money can be used to improve facilities in the local community e.g. schools, health clinics etc.

Challenges of achieving sustainable forest management

1. Population growth will increase pressure to deforest areas for resources.
2. Urban growth, industry and roads could encroach on the forest.
3. Money/donations could end.
4. Climate change could begin to degrade the forest.

How are animals and plants adapted to living in Taiga?

Animals	Plants
<ul style="list-style-type: none"> • Many mammals have thick, oily fur e.g. grizzly bears to help retain body heat and provide waterproofing. • They also hibernate as food is hard to find. Others that can, such as birds, migrate. 	<ul style="list-style-type: none"> • Branches are flexible which means they can bend downwards to shed snow without snapping. • Needle-like leaves are waxy which protects them from frost and minimises moisture loss via transpiration.

How does the nutrient cycle in taiga compare to rainforest nutrient cycles?

Nutrient cycling in Taiga is much slower than in rainforests due to the colder temperatures which slow down processes. Both flows/transfers and stores are smaller.	
Chemical weathering (input/transfer)	Slower as chemical weathering/breakdown of rock is slowed by cold temperatures.
Biomass (store)	Smaller because trees only grow for 4-5 months.
Litter (store)	Larger. Most nutrients is stored in the litter as decay by bacteria and fungi is slow due to cold temperatures.

What are the direct threats to taiga?

Direct Threats	
Paper production	Paper is made from pulp, produced from softwood trees (fir/pine trees found in taiga).
Softwood logging	Softwood is also used in construction for roof beams, window and door frames.
Indirect Threats	
Result from the exploitation of minerals, fossil fuels and HEP potential which require the land to be deforested.	
Strip Mining	Involves digging large holes in the ground to extract ores and minerals close to the surface.
Tar sands are a mixture of fossil fuel oil and sediment that can be mined and heated to separate the oil. Tar sands have been extracted by deforestation and strip mining. A toxic waste is produced, collected in tailing ponds.	
HEP Projects	Water stored behind dams is used to generate hydro-electric power.
The stored water floods taiga forest behind the dam. Dams along with other infrastructure e.g. electricity pylons and roads interrupt migration of animals. Decaying Taiga can release mercury which gets into the food web.	
<p>Biodiversity in Taiga is threatened by:</p> <ul style="list-style-type: none"> • Wildfires: Despite Taiga being a cold biome, a thick carpet of pine needle litter provides fuel for fires as well as a sticky substance on conifer trees which burns easily. Storms in summer are started by lightning strikes. Wildfires have increased with global warming but are good for biodiversity as different species thrive or release in newly burned forests. However there is a tipping point. If wildfires are too frequent they do more harm than good, causing loss of biodiversity as forests can't mature before they are burnt again. • Pests and diseases: Thousands of creepy crawlies (different types of beetle) exist in the Taiga normally killed in cold-harsh winters but global warming is reducing this. Biodiversity is reduced as only trees that can resist the pests and diseases grow in an area. Food webs are affected. • Acid Rain: Occurs when sulphur dioxide is released when fossil fuels are burnt, which reacts with clouds and then precipitation carries acids down to the surface. Acid rain kills plant and animals in lakes and weakens trees and soils, which are more vulnerable to pests/diseases. Food webs are affected and biodiversity is reduced. 	

How can we manage and protect Taiga from over-exploitation?

1. **National parks:** where conservation takes priority under law. Large areas have park rangers that monitor the area. They have legal protection. Much of taiga is in high income countries so debt/poverty are less of a barrier when it comes to protecting them compared to rainforests. An example of is Wood Buffalo National Park in Canada. Despite the status of the area it is still threatened by tar sand/strip mining occurring outside, but near-by the national park which can pollute or reduce rivers. River flow can also be disrupted by HEP dams.
 2. Declaring areas as **"wilderness"** (isolated, hard to reach places) is also a form of protection as motorised transport, road building, logging and mining are banned.
- An unsustainable logging method called **"clear-cutting"**. This involves logging of all trees in a wide area of forest. It makes soil erosion more likely and increases risk of landslides. Even if this land is replanted biodiversity is lower in the secondary forest that regrows as compared to the primary forest that was deforested as logging companies only replant commercially valuable trees.
 - A more sustainable method would be **"selective logging"** which only removes a small amount of large, valuable trees leaving the majority of the forest intact.

Conflicting views on protecting vs exploiting the forest/natural resources of the taiga (environment vs economic development)

Reasons to conserve the taiga	Reasons to exploit the taiga's resources
<ul style="list-style-type: none"> • Taiga forests are vital carbon sinks to help combat global warming. • Exploitation causes pollution and degradation. • They are culturally important to some indigenous people. <p>Environmentalists and scientists hold this view.</p>	<ul style="list-style-type: none"> • GDP of a country can be increased by exporting resources. • Provides jobs in local areas. • Only a tiny fraction of the biome is exploited. <p>Businesses, local governments and locals hold this view.</p>

Topic 8: Forests Under Threat