

Tropical rainforests:

Interaction of abiotic (non-living: rocks, water & soil) & biotic (living: plants & animals) factors maintains ecosystem stability via interdependence

Plant growth: need warm & wet climate, dense leaf cover (protects forest floor from heavy rain) + root systems, preventing soil erosion

Symbiotic relationships: no wind on forest floor = plants need bees for pollination & they extract nectar from plants

Deforestation = no carbon sinks (trees) = enhances greenhouse effect = climate change

Stratified (layered) structure of TRF:

Emergents: tallest trees (straight trunks) with big leaves that poke out of the canopy to absorb sunlight, supported by buttress roots

Main canopy: continuous layer of trees to shade the forest & intercept rainfall

Under-canopy: younger trees which receive sunlight through gaps in the canopy

Shrub layer: broad leaves to absorb as much light as possible on the shaded forest floor

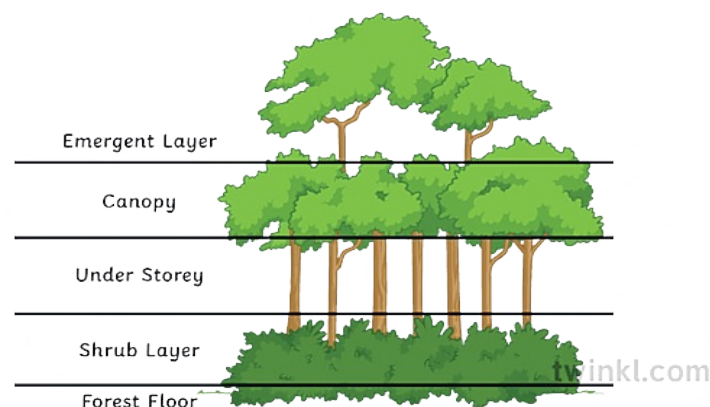
Plant adaptations:

Thick waxy leaves & drip tips: waterproofing for plants so weight of water doesn't damage plant (or allow bacteria to grow in moist conditions)

Smooth, thin barks: water runs off easily

Climbing plants: lianas use tree trunks to climb up to the sunlight

Plants stop their leaves = rapid nutrient cycling



Tropical rainforests:

Animal adaptations:

Camouflage to hide from predators

Nocturnal animals conserve energy by sleeping during the day

Sharp hearing & smell to detect predators on the dark forest floor

Rapid nutrient cycling due to:

Evergreen trees shedding seasonally

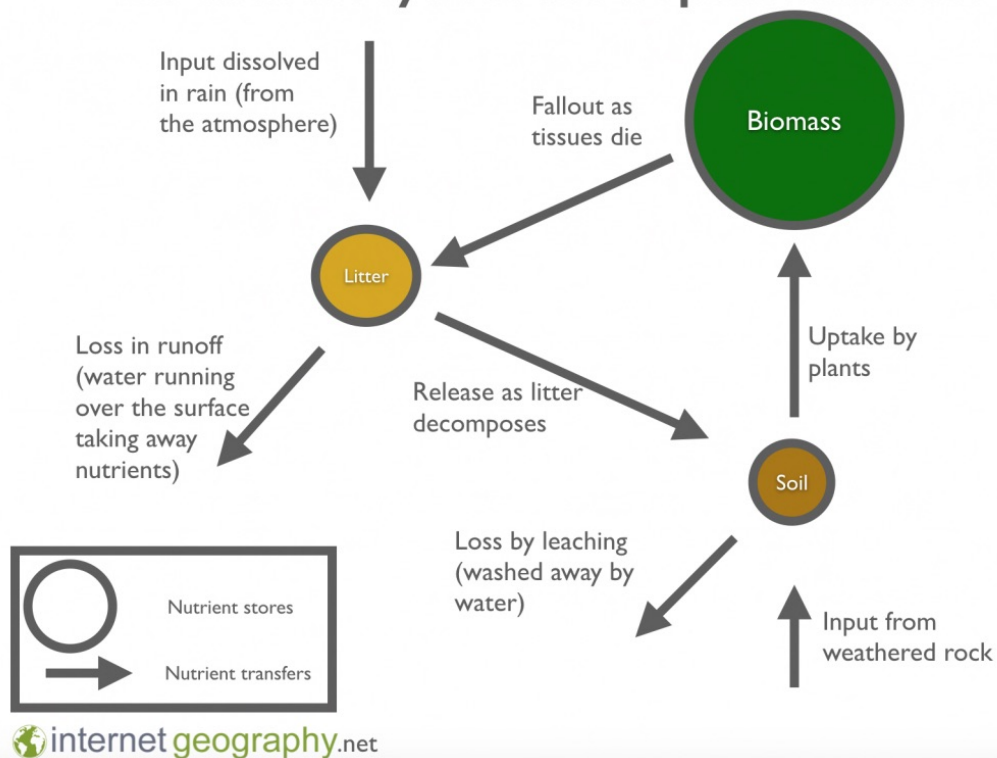
Warm, moist climate is optimum for decomposers

Dense vegetation & rapid plant growth = roots take up soluble nutrients that dissolve in the soil quickly

Stores:

Biomass, litter & soil: they transfer nutrients between each other

The nutrient cycle in the tropical rainforest



Tropical rainforests:

High biodiversity due to:

Old biome & constant climate so species evolve with little need to adapt

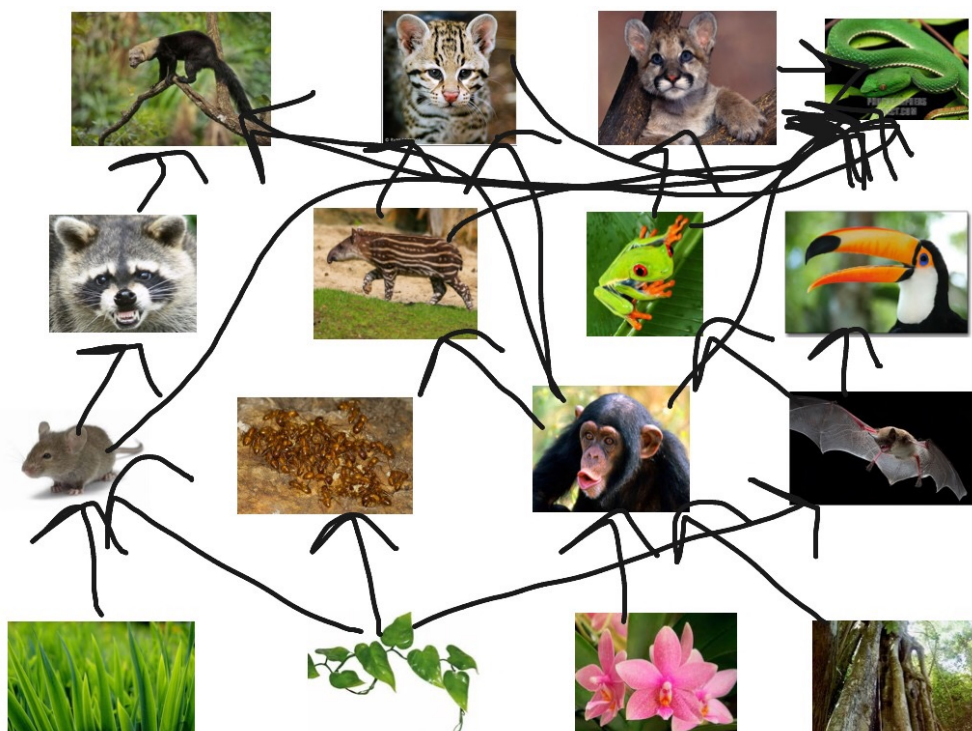
Stratified layers = lots of habitat (species specialise to suit food sources & environments → their ecological niche)

Hot & wet all year, plants always grow (biomass) & rapid nutrient cycling = stable environment

Complex food webs:

1. Producers: photosynthesise
2. Primary consumers: herbivores
3. Secondary consumers: omnivores
4. Tertiary consumers
5. Predators: carnivores

Energy is passed down webs, decomposers eventually break them down
TRF have lots of species & some function as both primary & secondary consumers (omnivores)



Threats to tropical rainforests:

DEFORESTATION (a direct threat) due to:

HEP: dams flood forests

Biofuels: space for crop growth for combustion

Mineral extraction: mining to reach metal ore deposits

Fuel wood: locals use wood for cooking & heating

Commercial farming: cattle grazing, palm & soy plantations

Subsistence farming: crops to sustain a farmer & his family

Commercial hardwood logging: felling trees for furniture & building clears trees

Impacts:

No trees to hold soils together = landslides & soil erosion

No tree canopy for rainfall interception = nutrient leaching

No carbon sinks = climate change as greenhouse effect is enhanced

Rise in deforestation in developing countries:

Poverty: more subsistence farming & fuel wood use

Foreign debt: huge market for goods for trade from wood to clear debt

Development: road & railway projects for mining & farming

Reduction in deforestation in emerging countries:

Gov policy: ecotourism investment = reforestation

International pressure: lead to businesses pledging carbon neutrality & 0 emissions

Monitoring systems: GFW uses satellite data to track forest loss = authorities act quickly to stop illegal logging

Climate change (an indirect threat) causes:

Drought as temps increase, inducing ecosystem stress (animals aren't adapted to survive) = extinction

Forest fires as litter ignites

Conservation efforts:

REDD: rewards subsistence farmers for no deforestation

Pros: counters deforestation directly, protects habitat, cheap

Cons: no clarity in their terms e.g. can deforest rainforests then replant palm oil plantations for rewards = reduces biodiversity, loss of livelihoods

CITES: controls trade of plants & animals

Pros: global scale to prevent endangerment, educates people on impact of biodiversity loss

Cons: species are protected but not their habitats, not all states are members, some nations promote trade of endangered species

Sustainable forest management:

Preventing long-term damage but utilising resources now E.g. selective logging & replanting

Barriers to sustainability:

Economic: not good for poor countries now, costly so not appealing to TNCs, funded by NGOs & govs so if priorities change, funding is cut

Social: fewer jobs than conventional forestry, some could turn to illegal logging which is hard to police, population increase = demand for forest goods increases

Environmental: replanting doesn't restore original landscape (incomplete restoration of ecosystem) & is a slow process, selective logging could remove endangered trees in the process of removing target trees

Alternatives for the long-term:

Ecotourism: minimises environmental damage & benefits locals (with a source of income), entails: disposing waste to prevent water contamination, raising awareness on conservation; if locals make a living from tourism & it dominates the economy there's no incentive to log trees

Sustainable farming: protects soil so land remains productive

Agroforestry: plant trees & crops simultaneously to bind the soil

Green manure: increases soil fertility

Crop rotation: crops are planted in different fields annually so soil can recover

Taiga forests:

Interdependent ecosystems:

Plants absorb sunlight during summers + grow, shading the permafrost to prevent thawing (releases green house gases) & the permafrost provides water for plants

Cold climate = slow nutrient cycling so minimal plant growth

Herbivores migrate to areas with mosses, predators follow prey

Structure of the boreal forest:

Simple structure, lack of plants as infertile soils & little sunlight gets through the dense canopy

Conifer tree adaptations:

Evergreen (don't drop their needles) to maximise sunlight absorption

Needles reduce surface area so less water loss

Cone-shaped = snow falls off trees to avoid branch breakages

Animal adaptations:

Thick, white fur: camouflages prey from predators & helps retain heat

Hibernation conserves energy

Slow nutrient cycling due to:

Evergreen trees (don't shed leaves) = little biomass

Low temps aren't optimal for decomposers = infertile soil

Slow plant growth as no nutrients

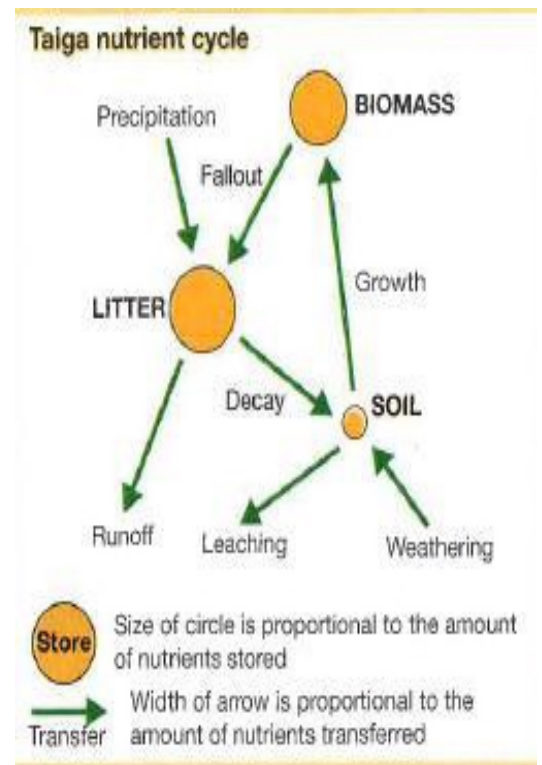
Nutrients are added via leaching & runoff (not precipitation or weathering)

Low biodiversity:

Land was covered in ice 15,000 years ago = little time for species to adapt to the climate

Little habitat as less layers = less ecological niches = less species

Less productive as slow nutrient cycling (partially due to short growing season)



Threats to the taiga:

Exploitation of resources:

HEP: dams flood land

Mineral extraction: land is cleared for mines & access roads

Pulp & paper: felling trees to manufacture paper

Logging for softwood: for housing & furniture

Fossil fuels: clearing for oil & gas extraction

Tar Sands, Canada:

Extraction of the sands entails open pit or strip mining, causing mass deforestation for oil

Acid rain:

Combustion of fossil fuels releases sulphur oxides which combine with rain to become dilute acids which rain down, eroding soils

Pests & diseases:

Pests attack one tree species which can endanger their population

Climate change increases temps = more pests

Forest fires:

Wildfires regenerate forests but climate change increases their frequency & longevity, leading to uneven distribution of species as some species are better at recolonising burnt areas, reducing biodiversity

Taiga conservation:

Human activity is expanding into remote forests in Canada & Russia

Protective efforts:

Wilderness areas: undisturbed areas to protect landscape

Pros: highest level of protection via strict monitoring

Cons: hard to police large area, economic pressure to exploit resources & create access roads for tourists

National park: area in its natural state that promotes recreation

Pros: protect species, easy access for tourists

Cons: indigenous communities use land for hunting, infrastructure & pollution from tourism arises to maintain the park

Sustainable forestry: harvesting timber with no long term damage

Pros: limit deforestation, allowing regeneration after selective logging

Cons: hard to enforce regulations e.g lots of illegal logging in Russia, unclear management, opposition groups e.g. loggers & environmentalists

Conflicting views on taiga management:

Protection: function as carbon sinks to reduce the rate of climate change, protect biodiversity of species only adapted to the taiga, indigenous people depend on taigas for traditional ways of life

Exploitation: resource demand increase, forest industries employ masses (25k in Canada), exploitation generates major profit (\$15 in Sweden/annum)