

KI : Ecosystems exist at a range of scales and involve the interaction between biotic and abiotic components

Key term	Definition
Abiotic	Relating to non living things
Biotic	Relating to living things
Consumer	Creature that wats herbivores and / or plant matter
Decomposer	An organism that breaks down dead tissue which is then recycled to the environment
Ecosystem	A community of plants and animals that interact with each other and the physical environment
Food chain	The connections between different organisms that rely on one another as their food source
Food web	A complex hierarchy of plants and animals relying on each other for food
Nutrient cycling	A set of processes whereby organisms extract minerals necessary for growth from soil and water before passing them on though the food chain
Global ecosystem	Large biomes with flora and fauna adapting to their environment
Producer	An organism or plant that is able to absorb energy from the sun through photosynthesis

Biome	Key Characteristics
Tropical Rainforests	<ul style="list-style-type: none"> Along equator (Asia, Africa / South America) 6% earth's surface 25°C – 30°C and over 250mm rain per year
Temperate Grassland	<ul style="list-style-type: none"> 40° - 60° N of the equator (N America and E Europe) Centre of continents away from the sea Short grasses Wet and dry seasons
Coniferous Forest	<ul style="list-style-type: none"> 60°N (Scandinavia / Canada) Cone bearing evergreen No sunlight for part of the year
Deciduous forests	<ul style="list-style-type: none"> Higher latitudes (W Europe, N America, New Zealand) 5 – 20°C and between 500 – 1500 mm rain per year 4 distinct seasons Lose leaves in the winter to cope with the cold
Tundra	<ul style="list-style-type: none"> Above 60°N (Arctic Circle) Less than 10°C and less than 500mm per year rain Cold, icy and dry means 2 month growing season
Mediterranean	<ul style="list-style-type: none"> 30- 40°N and S on west coast of continents Drought resistant small trees and evergreen shrubs
Tropical Grasslands	<ul style="list-style-type: none"> Between equator and tropics 20 – 30°C and between 500- 1500 mm of rain per year Wet and dry seasons
Deserts	<ul style="list-style-type: none"> Tropics (Sahara and Australia) Over 30°C and less than 300 mmm per year rain 20% of land's surface

Tropical rainforest ecosystems have a range of distinctive characteristics

Key term	Definition
Biodiversity	The way of life in the world or a particular habitat
Convictional rainfall	Warm air at the surface heats up, rises, cools and condenses forming clouds. This leads to heavy daily rainfall

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The diagram illustrates the vertical structure of a rainforest. It is divided into four main layers: the emergent layer at the top (50m), the canopy (40m), the under canopy (30m), and the shrub layer at the bottom (10m). Various plants and animals are depicted within these layers, such as sloths in the canopy and toucans in the under canopy.

- Average temperature 27°C
 - More than 2000 mm rain per year
 - Wet season (December to May)
 - Infertile soils
 - Shallow roots
 - 4 layers of vegetation
 - Trees lose leaves all year
- PLANT ADAPTATIONS**
- Tall and straight to reach the sun
 - Buttress roots to support the tall trees
 - Lianas use trees to reach the sun
 - Drip tips so leaves don't rot
 - Thick waxy leaves
 - Smooth thin bark
 - Epiphytes grow on trees and get nutrients from air and water
 - Shade tolerant ferns
- ANIMAL ADAPTATIONS :**
- Sloths – hook to grip branches
 - Parrots – sharp beak for nuts and fruit; 4 toes per foot to clamber
 - Long limbed spider monkey – sharp nails to peel bark to get to sap
 - Flying frog – web like feet to glide through the air
 - Titan beetle – flies and lives on decaying material
 - Anteaters – long tongues; good smell and hearing; sharp claws to open ant hills
 - Harpy eagle – short pointy wings to manoeuvre

- INTERDEPENDENCE OF CLIMATE, WATER, SOILS, PLANTS, ANIMALS AND PEOPLE**
- Small changes to biotic and abiotic factors can have serious knock on effects
 - Biomass is the largest nutrient store and the biggest transfer is from soil to biomass
 - Fertility's quickly lost from the soil if trees are cut down
 - Poor soils due to leaching (the washing away of nutrients)
 - Thick litter layer. Rapidly breaks down due to climate
 - Warm humid climate means rapid plant growth

- ISSUES RELATED TO BIODIVERSITY**
- More than half the world's species are found in rainforests
 - Human exploitation is a major threat
 - Many extinct and endangered species are leading to a decrease in ecosystem productivity

KI : Deforestation has economic and environmental impacts

Key term	Definition and facts
Commercial farming	Farming to sell produce for a profit. Palm oil in Malaysia. Cattle and crops. 80% of destruction as ruins soil and nutrients
Deforestation	The chopping down and removal of trees to clear an area of forest
Logging	The business of cutting down trees and transporting the logs to sawmills. Selective logging and clear felling. Teak and Mahogany worth the most
Mineral extraction	The removal of mineral resources from the earth. Gold, Bauxite, Oil and gas. Tin in Malaysia. Pollutes rivers and air
Soil erosion	Removal of topsoil faster than it can be replaced due to natural, animal and human activity
Subsistence farming	A type of agriculture producing food and materials for the benefit only of the farmer and his family
Other uses	<ul style="list-style-type: none"> • Road building – Opens up rainforest for other uses • Settlement – Government resettled poor and gave them land • Energy development – HEP rots vegetation and turbines corrode e.g. Bakun Dam, Malaysia.

IMPACTS IN MALAYSIA

<p>Economic development</p> <ul style="list-style-type: none"> • Brings in jobs and income • Tax revenue to improve services. • Improved infrastructure – benefits tourism etc. • Cheap renewable power from HEP • Destroys resources in the long term • Livelihoods of locals destroyed • Rainforest tourism could decrease 	<p>Soil erosion</p> <ul style="list-style-type: none"> • Land left unprotected from heavy rain leads to landslides and flooding • Nutrients are washed away decreasing nutrients in the soil • Rivers silt up
<p>Contribution to climate change</p> <ul style="list-style-type: none"> • Trees cut down change the water cycle and make it drier and warmer • Rainforests are the lungs of the earth and so when deforested there is ore carbon dioxide in the air and less oxygen. Burning also releases carbon to the air (Greenhouse effect) 	<p>Others</p> <ul style="list-style-type: none"> • Loss of biodiversity – possible plants with medical potential. • Loss of indigenous tribes • Tribal people re settled due to Bakun dam may have drugs and alcohol issues. Loss of indigenous knowledge • Conflicts between developers and indigenous people

KI : Tropical rainforests need to be managed to be sustainable

Key term	Definition
Debt reduction	Countries are relieved of some of their debt in return for protecting their rainforests
Ecotourism	Responsible travel to natural areas that conserve the environment, sustains the well being of local people and may involve education
Selective logging	The cutting down of trees which are mature or inferior to encourage the growth of the remaining trees
Sustainability	Actions and forms of progress that meets the needs of the present without reducing the ability of future generations to meet their own needs

GOODS AND SERVICES

<p>GOODS :Food; Building materials; HEP; Water; Medicines (1/4 of drugs use products found in the rainforest)</p>	<p>SERVOCES : Air purification; Water and nutrient cycling; Protection from soil erosion; Habitats; Biodiversity; Employment</p>
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MANAGEMENT STRATEGIES

STRATEGY	KEY FACTS
Selective logging and replanting	<ul style="list-style-type: none"> • Only fell fully grown trees on 30 – 40 year cycle • Replanting – collect seeds from primary forest; grow in nurseries and replant • Forest Stewardship Council – mark sustainably sourced timber
Conservation and education	<ul style="list-style-type: none"> • Education of locals key • WWF (NGO) – education; train conservation workers; provide practical help; buy threatened areas and set up nature reserves
Ecotourism	<ul style="list-style-type: none"> • Minimises damage to environment and benefits locals • Small visitor numbers • Waste and litter disposed of properly • Locals employed so incentive to preserve environment
International agreements about use of tropical hardwoods	<ul style="list-style-type: none"> • International Tropical Trade Agreement 2006 and 2011 – restricts trade in hardwood from rainforests • Needs to be felled from sustainably managed areas and stamped with registration numbers • UN Sustainable development goals include protection of forests
Debt reduction	<ul style="list-style-type: none"> • Debt for nature swaps – in 2010 USA converted debt of \$13.5 million from Brazil and used the funds to protect the rainforest • HICs wipe off debts of LICs

KI : Cold environments (polar and tundra) have a range of characteristics	
Key terms	Definitions
Biodiversity	The variety of life in the world or a particular habitat
Permafrost	Permanently frozen ground
Polar	The regions of the earth surrounding the North and South Poles
Tundra	The flat, treeless Arctic regions of Europe, Asia and North America where the ground is permanently frozen

CHARACTERISTICS OF POLAR AND TUNDRA AREAS

POLAR ENVIRONMENTS	TUNDRA ENVIRONMENTS
<ul style="list-style-type: none"> Very cold; Below 0°C; winter between -40 and -90°C Less than 100mm per year of rain 66°N and S (Greenland, N Canada, Siberia and Antarctica) Covered in ice Few plants Few indigenous people and scientists Polar bears, whales, seals and penguins 	<ul style="list-style-type: none"> Cold; -30° - 10°C; cold summers, very cold winters Less than 380mm of rain per year High latitudes (Russia and Canada) Layer of permanently frozen soil (permafrost) Indigenous groups and oil and gas workers Lemmings, wolves and reindeer Slow growing plants. Short grasses, lichens and mosses



PLANT ADAPTATIONS

- Dormant in winter
- Shallow roots
- Adapted to grow in 50 – 60 days
- Use underground runners / bulbs instead of seeds to reproduce
- Arctic Willow – small and round for protection from wind
- Bearberry – small leaves and bright red berries for reproduction
- Snow Buttercup and Arctic Poppy – produce flowers quickly

ANIMAL ADAPTATIONS

- Caribou – large hooves for water logged ground; 2 coats for insulation; survive on limited food in the winter e.g. Lichens
- Polar bears – thick coats for insulation; white for camouflage
- Birds migrate
- Arctic wolves – padded paws to grip the permafrost
- Arctic ground squirrels – hibernate in the winter

Issues related to Biodiversity

- Low biodiversity
- Changes have effects on all dependent species
- Global warming is causing species to move to the poles
- Arctic species are at real risk

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INTERDEPENDENCE OF CLIMATE, SOILS, PERMAFROST, PLANTS, ANIMALS AND PEOPLE

- Nutrients from the soil move to grass and then animals. Animals help spread seeds leading to the reproduction of plants
- Low plant cover and slow decomposition means low nutrients in the soil and less ability of plants to grow
- Herbivores e.g. reindeer migrate and carnivores follow
- In summer in the Tundra the plants absorb heat and prevent permafrost thawing. Permafrost provides water for animals. Soil waterlogged as lower layer of permafrost does not melt
- If it melts it will cause floods and release greenhouse gases

KI : Development of cold environments creates opportunities and challenges

Key terms	Definitions
Infrastructure	The basic equipment and structures that are needed for a country or region to function properly
Mineral extraction	The removal of solid mineral resources from the earth

OPPORTUNITIES FOR DEVELOPMENT IN SVALBARD

Mineral extraction	<ul style="list-style-type: none"> Rich reserves of coal, which is the main economic activity but environmentally controversial.
Energy	<ul style="list-style-type: none"> The Longyearbyen coal-fired power station supplies all of Svalbard's energy needs. Carbon capture and storage is a likely development for the future Geothermal energy is a likely future source of energy.
Fishing	<ul style="list-style-type: none"> The Arctic waters of the Barents Sea are rich fishing grounds with 150 species, including cod, herring and haddock. Fishing is carefully controlled and monitored to ensure sustainability of the ecosystem.
Tourism	<ul style="list-style-type: none"> Tourism now provides as many jobs as mining. Increasingly popular in recent years as tourists seek the Northern Lights and explore more extreme natural environments. Cruise passengers land at Longyearbyen seeking glaciers, fjords and wildlife- especially polar bears. Adventure tourists seek hiking, kayaking and snowmobile safaris.

CHALLENGES OF DEVELOPMENT IN SVALBARD

Extreme temperatures	<ul style="list-style-type: none"> Even in Longyearbyen, winter temperatures can fall below -30 degrees C Given the risk of frostbite, several layers of thick clothes, gloves, socks and boots are essential. Protected like this, outside work can be slow, difficult and dangerous.
Construction	<ul style="list-style-type: none"> Most building, construction and maintenance happen during the brief summer. There is four months of winter darkness! The frozen ground surface (permafrost) has to be protected from melting, or buildings would collapse. Most dirt and gravel roads are raised above the ground surface.
Services	<ul style="list-style-type: none"> Most power, water and sanitation pipes have to be heated, insulated and raised above the ground. This allows easy maintenance and prevents thawing of the permafrost.
Accessibility	<ul style="list-style-type: none"> Svalbard can only be reached by sea or air. There are no roads outside Longyearbyen. International flights link to mainland Norway and Russia, with smaller aircraft connecting to other islands. Most people use snowmobiles, particularly in winter.

KI : Cold environments are at risk from economic development

Key terms	Definitions
Fragile environment	An environment that is easily disturbed and difficult to restore if disturbed
Wilderness areas	A natural environment that has not been significantly modified by human activity

VALUE OF WILDERNESS AREAS AND WHY PROTECT THESE?

- Habitats and help biodiversity – scientists can study these
- Natural ecosystems – last remaining areas not affected by humans
- White snow reflects sunlight and helps regulate global temperatures
- Indigenous people live here traditionally
- Very fragile environment – takes long time to recover
- Highly specialised species that can't adapt quickly
- Conflict with the traditional cultures if put upon e.g. Inupiat use bowheaded whales and Inuits help hunters get polar bears

PROTECTING THE COLD ENVIRONMENT

Use of technology	<ul style="list-style-type: none"> Modern construction methods to minimise environmental impacts e.g. piles Mobile phones in remote area 2 way video conferencing for health care and education used by Inuit University of Alaska – online degrees Alaska Native Knowledge Network – online database preserving Inuit culture
Role of Governments	<ul style="list-style-type: none"> 1964 Wilderness Act – wilderness areas protected from development including Alaska Alaska running short of money due to low world oil process. Oil exploration banned in the Alaska National Wilderness reserve NOAA (National Oceanic and Atmospheric Administration) oversees sustainable fisheries
International Agreements	<ul style="list-style-type: none"> 1959 Antarctica Treaty limits visitor numbers; stops nuclear activities. No ships of more than 500 people International Whale Convention 1986 0 ban on commercial hunting Arctic Council – delivering sustainable development through Arctic regions. Represents 8 countries and indigenous populations.
Conservation groups	<ul style="list-style-type: none"> WWF and Greenpeace argue for sustainable management Inuit Circumpolar Council represents indigenous people. Campaigned against Pebble Mine gold mine Greenpeace calling for the Arctic to be a global sanctuary WWF works with local communities, scientists, oil companies and governments to move to a sustainable future

