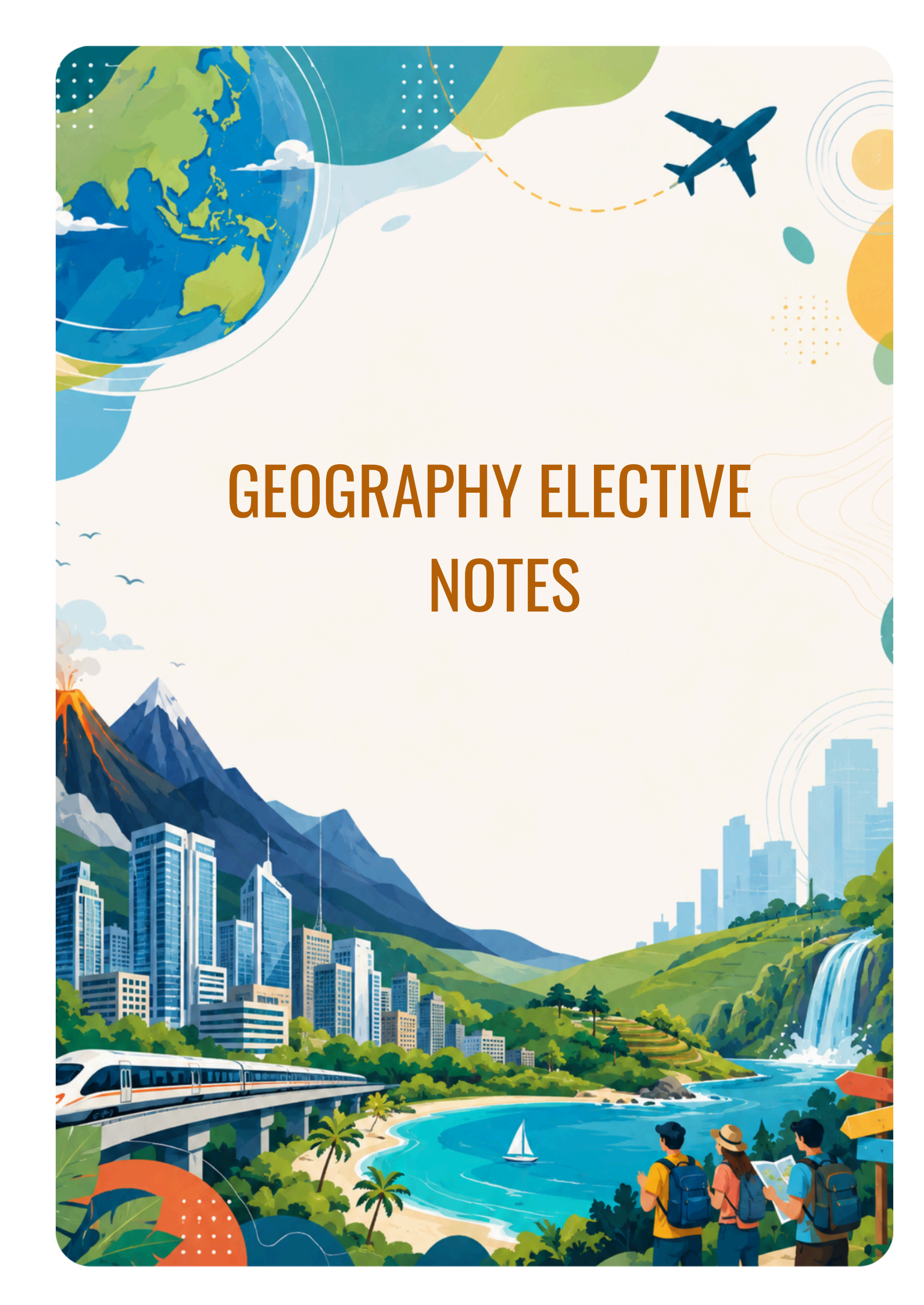




GEOGRAPHY ELECTIVE NOTES

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Link to original docs:

https://docs.google.com/document/d/1a03Q59xh-ZY_fkVHNP99CClwMHf5myJZNrdb0v42w4w/edit?usp=sharing

GEOGRAPHY IN EVERYDAY LIFE

Topic 1: Thinking Geographically

KEYWORDS

Word	Definition	Additional notes
Community	A group of people in a particular place who have a sense of belonging to both the place and to the group.	
Nature area	Also known as the natural environment, it refers to the nonhuman world, which are areas that are untouched or barely affected by humans.	
Recreation	Any voluntary activity undertaken for purposes of enjoyment, pleasure, personal satisfaction.	
Neighbourhood*	A sub-division of an urban area distinguished by some character or quality, where residents share commonalities .	Sub-division—Division of land into smaller parts
Wildlife	Animals of a wild nature including their young or eggs.	
Vegetation	The collection of plant life that provides ground cover in a region.	
Environmental protection	Any activity to protect, conserve and restore natural habitats and species.	
Soil erosion*	Soil particles being detached, transported and deposited by water, wind, gravity, animals or plants.	
Pollutant	Substance that is present in concentrations that may harm humans, plants, and animals.	

Pollution	The introduction of harmful substances in the atmosphere.	
Meanings	Significant ideas that individuals associate with a location.	
Memories	Significant experiences of a location that individuals remember.	
Built Environment*	The design and configuration of roads, buildings, structures and spaces .	
Landmarks	Buildings or structures with distinguishing characteristics that are easily recognised .	
Gathering places	Spaces where people are able to congregate and interact .	
Media	Range from entertainment to news media, including traditional media such as television, and new media such as social media .	Social media- Instagram, Facebook, Tiktok, Youtube etc.
Influence	Effect on people or objects, causing significant changes.	
Non-random	Not random; elements do not have an equal probability of occurrence.	
Cluster	A number of similar objects that are close to one another.	
Geometry	Shape, spatial configuration or arrangement of objects.	
Tendency	An inclination towards a particular outcome.	
Nested Areas	An area located within a larger area	
Precincts*	An area with 400 to 800 residential units; a public housing planning concept in Singapore	

Synergies*	Improved results when two or more people or organisations work together.	
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RELATIONSHIP BETWEEN PEOPLE AND NATURE IN THEIR NEIGHBOURHOODS

Relationship between people and nature

1) Communities and nature are interdependent.

- **People** rely on nature for:

- Survival essentials (air, water)
- Food security (pollination via bees)
- Well-being (recreation and bonding)

- For example, NParks' Therapeutic Gardens help to connect people with nature and reduce stress



which improves their physical, physiological, and social well-being.

- For example, places like East Coast Park allow families and friends to cycle, picnic, and exercise together, supporting physical and mental well-being.
- For example, forests such as the Amazon rainforest produce oxygen and help maintain clean air, while reservoirs in Singapore provide clean water for daily use.

- **Nature** relies on communities for:

- Maintenance and health monitoring
- Sustainable usage and advocacy

- For example, NParks organises a range of activities for schools during the week of international day



for biodiversity in May. One such activity is the Green Wave campaign which aims to educate youths about the importance of protecting our natural environment.

- For example, residents may volunteer in community gardening or tree-planting activities organised by NParks to help maintain parks and protect habitats for plants and animals.
- For example, families and friends visiting MacRitchie Reservoir may remind one another not to litter, stay on designated trails, and avoid disturbing wildlife so that the environment remains protected for everyone.

2) Communities and nature mutually affect each other.

- A mutual relationship provides shared benefits.
- Green spaces improve mental health.
- Human conservation efforts boost biodiversity.
 - Reforestation benefits:
 - Provides jobs and well-being.
 - Enhances wildlife habitats.

The benefits that people and nature bring to each other

1) Benefits that nature brings to people:

Lowers air temperature	Removes pollutants	Provides recreation space
● Vegetation effects: ○ Shade blocks direct sunlight. ○ Cools the surrounding air through evapotranspiration as the water that plants absorb through their roots is released into the air as water vapour. This process uses	● Photosynthesis absorbs CO₂ and pollutants while releasing oxygen. ● Leaves intercept and wash away particles during rain. ● Wetland plants filter suspended materials and excess nutrients.	● Offers outdoor exercise and leisure space. ● Interaction with nature reduces health condition severity. ●

heat from the surrounding, thus cooling it.		
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2) Benefits people bring to nature:

- Raising awareness through positive behavior and education.
 - For example, the NParks Citizen Science initiative, Dragonfly Watch, trains participants to identify different dragonfly species by raising awareness of their importance in the environment.
 - For example, nature groups may use social media campaigns to remind people not to feed wild animals as it may harm the ecosystem.
 - For example, schools and community groups may put up posters or conduct workshops to remind visitors to stay on designated paths and avoid disturbing wildlife in nature reserves.
- Participation in active conservation efforts.
 - Clean-ups and habitat restoration help species thrive.
 - For example, the waterways clean-up programme organised by Waterway Watch Society creates opportunities for schools to pick up trash from the Marina Reservoir
 - For example, volunteers may take part in coastal clean-up programmes at beaches to remove plastic waste that can harm marine animals and damage coral reef ecosystems.
 - For example, volunteers may participate in habitat restoration projects by planting native vegetation to provide food and shelter for urban wildlife.



The disadvantages that people and nature bring to each other

- Human-driven environmental degradation:
 - Vegetation damage and soil erosion.
 - Impact of off-trail hiking:
 - It may cause soil compaction which prevents rainwater from infiltrating the surface. This leads to higher surface flows and soil erosion as the flowing water washes away the soil particles.
 - This may trample on the vegetation, damaging the plants and affecting their growth.
 - For example, in 2014, human activities led to severe soil erosion and habitat degradation in Bukit Timah Nature Reserve. This resulted in the limiting of public access to the reserve for 2 years.
 - For example, visitors walking through sensitive mangrove areas may damage young mangrove plants and affect the growth of the ecosystem.
 - For example, hikers leaving designated trails in national parks may destroy plant habitats and reduce the amount of vegetation available for wildlife.
 - Pollution and wildlife interference.
 - Littering endangers animals (entanglement, ingestion).
 - Feeding disrupts natural behaviors and increases conflict.
 - Associate people with food leading to aggressive behavior.
 - Feeding wild animals may also lead to changes in the habitats and behaviours of wildlife, and human-wildlife conflict can increase when animals associate food with people.
 - For example, some think that they are doing wild animals a favour by feeding them but it actually does them more harm than good. In



Singapore, the law prohibits the feeding of any wild animals, and anyone caught doing so intentionally will be fined \$5,000 on the first offence

- For example, litter such as metal cans and broken glass in nature reserves may injure animals by cutting their feet or bodies.
- For example, wild boars that are regularly fed by visitors may become dependent on humans for food and approach people aggressively, increasing human-wildlife conflict.

The disadvantages that nature brings to people

- Frequent encounters increase conflict risks.
- Contributing factors in Singapore:

Urban expansion	People's growing interest in outdoor recreation	Greening efforts
Singapore continues to clear land to urbanise and develop, leading to natural habitats shrinking. Wildlife may venture out of the nature areas in search of food or shelter, potentially increasing the frequency of human-wildlife encounters	With growing interest in outdoor recreational activities, people are now spending more time in nature areas, which increases the frequency of human-wildlife encounters	Singapore aims to bring nature back into the city(e.g. Becoming a garden city) and promote human-wildlife encounters

- Unintentional provocation of wildlife leads to attacks.
- Animal fear in urban spaces triggers aggressive reactions.
- Conservation is perceived as an obstacle to development.
 - Protection of nature may conflict with community needs.
 - For example, the Cross Island line (CRL) was proposed to be built around, instead of under, the Central Catchment Nature Reserve to protect our largest primary rainforest.
 - Residents were afraid that these developments would:
 - Bring them inconvenience
 - Damage their property
 - Result in their homes being acquired to make way for construction
 - However, the nature reserve is home to numerous critically endangered species. Construction of the CRL may

damage their habitat, affecting their survival.

A SENSE OF PLACE IN NEIGHBOURHOODS

What is a sense of place?

- Associating meanings and memories with specific locations.
- Reflects personal relationships with surroundings.
- Identity and self-understanding.
 - Allows us to understand ourselves and others better.
- Shaped by experiences and social interactions.
- Subjective meanings vary by lifestyle and needs.
 - A location may hold different meanings for different people, depending on our needs, lifestyle and how we make sense of our experiences and places.
 - Locations in a neighbourhood may also hold special memories for a specific group of residents that they serve.
 - Homemakers and retirees may associate different meanings with hawker centres.
 - Homemakers associate hawker centres with ideas of convenience and variety as they frequently purchase meals from there.
 - Retirees associate hawker centres with ideas such as leisure and relationships as they regularly meet up with friends there for drinks.

How do people acquire a sense of place in their neighbourhoods?

1) Repeated encounters with objects and people

- Familiarity helps recall features and build memories.
 - For example, many residents in Singapore have vivid memories of scenic journeys along the East Coast Parkway as it is a route that they go by when they return home from overseas.
 - For example, seeing the same MRT station daily during the journey to school makes it feel familiar and comforting.
 - For example, spending time repeatedly at a shopping mall helps people remember its layout and the experiences they had



there.

2) Significant or memorable events at local landmarks and gathering places.

- Landmarks and gathering places host memorable events.
- Visibility and symbolism aid historical preservation.
- They may serve symbolic or historical purposes.
 - For example, the Truss Bridges in Bukit Timah were built in 1932 as part of a railway line.

- Due to their unique design, many people associate them with Singapore's railway history.

Many couples and families take photos there, thereby creating memories and acquiring a sense of place.

- For example, people who attended concerts or countdown events at The Float @ Marina Bay may associate the place with joyful memories and celebrations.
 - For example, many Singaporeans gathered at Padang during the National Day Parade, making it a meaningful place linked to national identity and celebration.

- Can represent community responses to tragedy.
- They may feature public symbols that reflect a community's response to a tragedy, serving as a place for people to preserve their memories of loved ones.

- For example, the anfield memorial at the Liverpool Football Club's stadium in England remembers the club's supporters who had lost their lives due to overcrowding at Liverpool's old stadium in 1989
 - For example, many Singaporeans visit the Kranji War Memorial to remember soldiers who died during World War II.
 - For example, memorial walls and



monuments built after natural disasters help communities remember those who lost their lives.

- Everyday social spots foster neighborhood belonging.
- Community events transform ordinary spaces into memorable ones.
 - For example, Jurong Lake Gardens was transformed into a music arena when it hosted the Parks Concert Series in the park: Rockestra, thus becoming a memorable place for many residents.
 - For example, children who regularly play with friends at nearby playgrounds may develop happy memories and emotional attachment to those places.
 - For example, open fields and plazas may become memorable gathering spaces during community events such as National Day celebrations or festive markets.



How is a sense of place represented?

- Media types reflect location significance and ideas.
- Expression through text, audio, and imagery.
- Shared via print, broadcast, and digital platforms.
 - For example, using #sgmemory, users of the Instagram share photographs of their memorable experiences of places around Singapore.
 - For example, organisations may also reflect people's collective sense of place, through both print and internet-based media.

How may representations of sense of place enhance or contradict an individual's sense of place?

- Media emotional resonance shapes perception.
- Positive alignment with existing feelings enhances the sense of place.
- New information adds layers of meaning to a location.
 - For example, websites which feature the interesting history of the Beaulieu House in Sembawang may develop a greater appreciation for the place, enhancing their attachment to it.
 - For example, documentaries and social media posts about Tiong Bahru

may highlight its heritage buildings and unique cafes, making residents feel proud of their neighbourhood.

- For example, articles and videos showing the transformation of Jewel Changi Airport into a lifestyle destination may increase people's pride in Singapore.
- Contradictory content may lead to defensive dismissal or perceptions of untruth.
 - For example, the negative media portrayal of Yishun after the occurrence of rat problems and other crimes caused the Nee Soon Town Council and residents to share official statistics to show that Yishun is just like any other town in Singapore.
 - For example, some Singaporeans may feel upset by online comments criticising HDB estates as boring because they associate these neighbourhoods with home and childhood memories.
 - For example, people who grew up in kampungs may reject media portrayals that only describe kampung life as poor because they remember strong community bonds and meaningful experiences there.



RELATIONSHIP BETWEEN LOCATIONS IN A NEIGHBOURHOOD

What are regions?

- Defined by shared physical or human characteristics.
- Variable in size and scale.
- Classification criteria:
 - Environmental characteristics e.g. Nature or built up areas
 - For example, Little Guilin, a nature park in Bukit Batok, is a nature region
 - Human characteristics e.g. Commercial or residential areas
 - For example, Jurong town is broken into 2 regions:
 - The commercial region where industrial buildings are found→West and South
 - The residential region where most homes are located→East and North
 - Geographical location e.g. North, East, South, and West
 - For example, the residential area in Bukit Batok can be further broken down into 2 regions:
 - Western Bukit Batok where there are a large number of public housing apartment blocks.
 - Eastern Bukit Batok where there are a larger number of private landed housing and condominiums.
- Spheres of influence from services and objects.
- Boundaries determined by where effects are most prevalent.
 - For example, regions in our neighbourhoods can be classified as the areas that our Town Councils service
 - Town Councils are responsible for the common areas in public housing and commercial property within the town and carry out a variety of works that benefit residents.
 - For example, the influence of Changi Airport extends across Singapore because many transport routes, hotels and businesses are built around serving air travellers.
 - For example, shopping malls such as VivoCity attract visitors from many parts of Singapore, making the surrounding area a retail region.

What are spatial patterns?

- Arrangements including shapes, clusters, or regular intervals.
 - Non-random placement due to specific functional reasons.

- Identification via points, lines, or polygons on maps.
- Recognising spatial patterns is useful as it helps us understand the world around us.
- Spatial patterns can be easily identified on maps where services, events and objects are represented by points, lines or polygons. Spatial patterns may appear as:

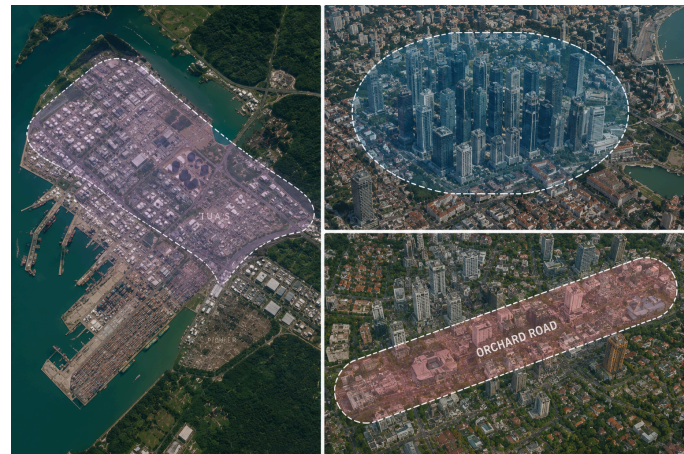
- Recognisable shapes and geometry, such as circles and lines on a map

- For example, train stations on Singapore's Circle line resemble a circle.
- For example, the circular shape of roundabouts can be easily recognised on road maps.
- For example, parks and reservoirs may form large green or blue shapes that stand out clearly on physical maps.



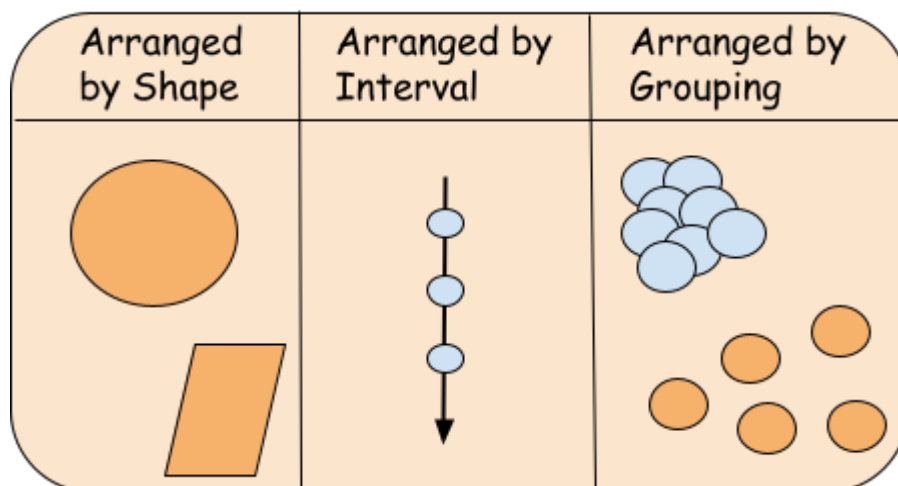
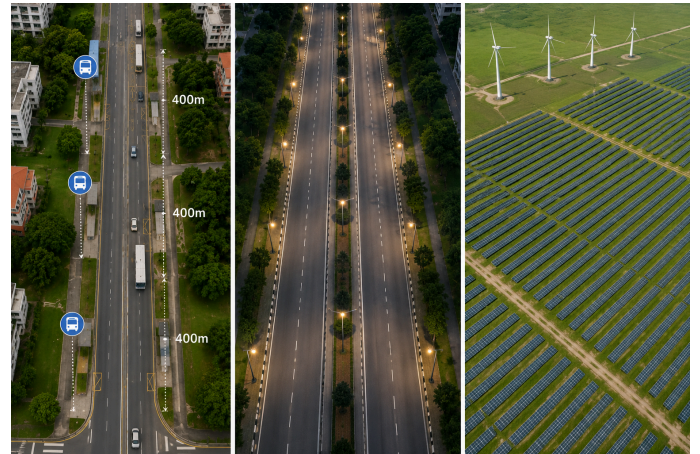
- Clusters or concentrations on a map.

- For example, companies in the heavy industry are clustered in the west of Singapore, located in places such as Tuas and Pioneer.
- For example, a cluster of skyscrapers in the Central Business District can be identified on maps as a concentration of commercial activities.
- For example, shopping malls and retail stores concentrated along Orchard Road create a recognisable retail cluster.



- Repeated occurrences at regular intervals on a map.

- For example, public bus stops are located at regular intervals of about 400m, increasing accessibility and convenience, enabling most people to use the public bus services.
- For example, lamp posts placed at regular distances along roads create repeated patterns on maps and satellite images.
- For example, wind turbines or solar panels installed at regular intervals create repeated geometric patterns on maps and aerial photographs.



What are spatial associations?

- Proximity tendency between pairs of services or objects.
 - For example, lifts and stairways are often located next to each other.
- Suggests functional connections or logical links.
 - For example, fitness centres are found near studio HDB blocks, allowing the elderly to easily access them without having to travel to another estate or block.
- Enhances everyday living through accessibility and efficiency.
 - For example, train stations and bus interchanges are often located near each other to increase the convenience of switching between modes of transportation. Understanding this can help residents decrease their

travel time if they plan their trips.

ORGANISATION OF NEIGHBOURHOODS IN SINGAPORE

What are spatial scales?

- Spatial scales refer to the extent of an area in which a phenomenon or process takes place.
- Scales are at different hierarchies (global, regional, local).
 - Global areas consist of many regions, countries, and smaller spatial units (e.g., provinces or districts).
- **Nested areas** are smaller areas located within larger areas.
- Understanding spatial scales helps show how events and processes at one scale may affect people and nature at other scales.
- Examining phenomena/processes at different scales offers different perspectives.

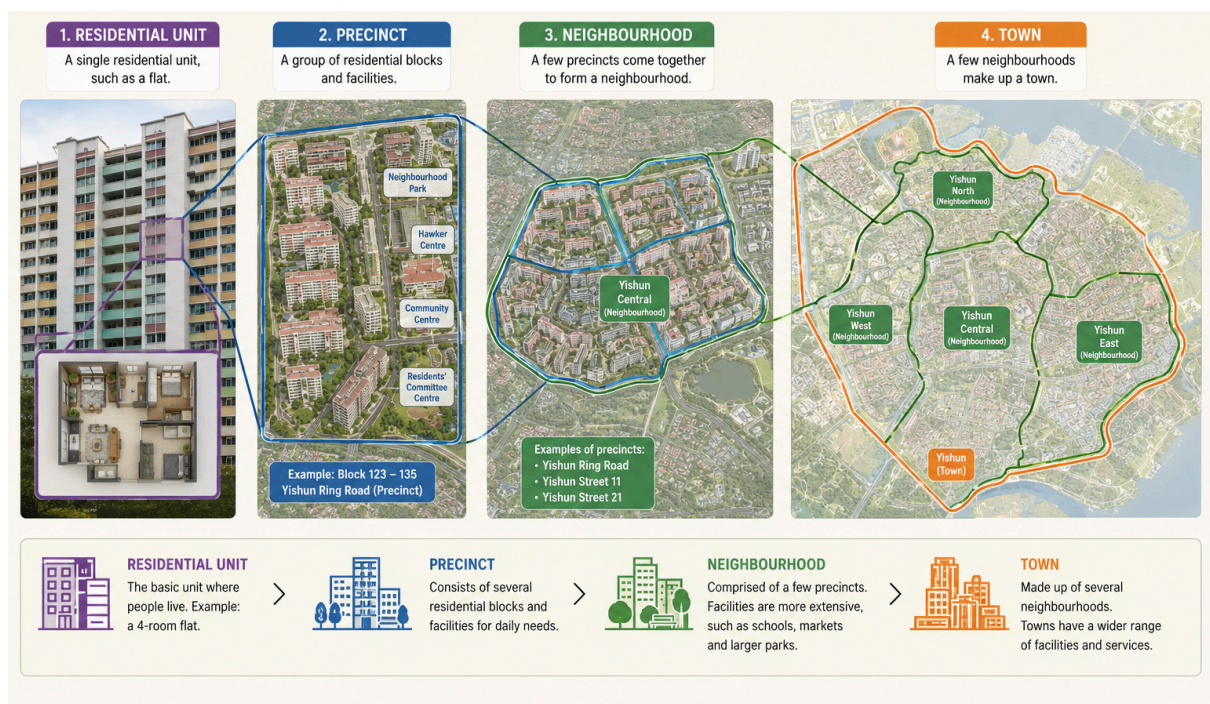
What are the spatial scales in Singapore?

- Singapore has over twenty towns across the island, each with a **town centre**.
- The town centre is the commercial and social hub for residents.
- Town centres may include **integrated transport hubs** (bus interchanges and train stations are near shopping malls).
- The convenience attracts visitors from other towns and businesses seeking lower costs and reduced worker travel time.
- The convenience of such town centres may attract visitors from other towns to visit, making it viable for large shopping malls to be located there.
- It may also attract businesses to locate their offices in these town centres, as they can take advantage of lower costs and reduce travelling time for their workers.
 - For example, the Bishan bus interchange and train station make it very convenient for visitors from other towns to visit Junction 8 mall.
 - For example, people from nearby towns may visit NEX shopping mall in Serangoon because it offers a wide range of shops, restaurants and services.

- For example, businesses may locate offices in Paya Lebar Quarter to benefit from lower rental costs compared to the Central Business District.
- Town centres also feature large **gathering places** (e.g., Punggol Town Square, Festive Plaza at Our Tampines Hub) for community activities.
- The design supports Singapore's long-term goals (e.g., sustainability, liveability).
 - For example, the roads in the proposed Tengah's town centre will run underground to encourage walking and cycling on ground level. This contributes to our goal of reducing carbon emissions and enhancing liveability.

What spatial hierarchies can we observe in Singapore?

- Singapore uses **nested areas**, beginning with a single residential unit.
- Hierarchy: Residential Unit → Precinct → Neighbourhood → Town.



- **Precinct:**
 - Comprises between 400 to 800 residential units.
 - Facilities (playgrounds, gardens, covered linkways) are often in close proximity for everyday needs.

- Some facilities are spread out (e.g., bus stops) to meet residents' needs.
 - Bus stops are spread out at regular intervals such that there is a bus stop near every apartment block, which ensures most residents in the precinct can have easy access to the bus stops.
- **Neighbourhood and town:**
 - A neighbourhood serves between 4,000 and 6,000 residential units.
 - A few precincts form a neighbourhood; a few neighbourhoods form a town.
 - Neighbourhoods surround the town centre for convenient travel.
 - Towns have extensive networks (roads, cycling, pedestrian) and amenities (shops, schools).
 - Some neighbourhoods feature **integrated facilities** that combine amenities under one roof.
 - For example, the Bukit Panjang Bus Interchange is located next to a train station and it also has community spaces, eldercare and childcare centres, food outlets and a medical centre.
 - For example, Our Tampines Hub brings together sports facilities, community services, a library and retail outlets under one roof, making it more convenient for residents.
 - For example, residents can walk from nearby HDB blocks to schools located within the neighbourhood, making education facilities easily accessible.

How is town planning done in Singapore?

- Town planning:
 - Serves residents and provides for nature at precinct, neighbourhood, and town levels.
 - Creates connections and **synergies** across all scales.
- **1) Planning serves residents and provides for nature:**
 - Land is allocated for housing, industrial, commercial development, and essential facilities (roads, parks, schools).

- This enables towns to be self-sufficient, provide employment, and ensure facilities complement each other.
 - For example, Tengah is Singapore's first "forest town" that will feature a 5km long forest corridor to support a rich biodiversity in the town.
 - For example, key features of Tengah will revolve around nature and the community, creating a town where future residents can experience being "At home with nature."
 - For example, at the town level, a dedicated network will enable residents to travel conveniently within Tengah on foot or by cycling.
 - At the neighbourhood level, residents will have opportunities to farm together at community gardens.

- **2) Planning creates connections and synergies:**

- Long-term plans (coordinated by URA) optimize scarce land resources for diverse needs and sustainability.
 - For example, in Singapore, the Urban Redevelopment Authority (URA) coordinates the long-term planning for Singapore, which involves multiple stakeholders and agencies.
 - For example, the Long-Term Plan maps out land uses and infrastructure needs in Singapore over the next 50 years, where plans are reviewed every ten years.
 - For example, diverse needs, competing land uses and space for key infrastructure, train lines and cycling networks are also considered.



- Urban planners must accommodate facilities typically not found in cities (e.g., military facilities, waste treatment plants, seaports).
 - For example, the Senako waste-to-energy plant is a waste treatment plant that is located near two towns, Woodlands and Sembawang. Given its location, the Senako waste-to-energy plant not just manages pollution concerns through waste treatment,

but also maximises benefits such as job creation and education opportunities for students in the nearby towns. As a result, synergy is produced as considerations for both nature and people are taken into account.



Topic 2: Sustainable Development

KEYWORDS:

Word	Definition	Additional notes
Standard of living	Measure of consumption of goods and services by an individual or group.	
Economic sustainability	To ensure that all human beings can enjoy prosperous, fulfilling lives and economic progress can occur in harmony with nature.	
Social sustainability	To ensure that societies are inclusive and resilient, where residents have a voice.	
Environmental sustainability	To sustainably manage natural resources and take urgent action on climate change to support the needs of present and future generations.	
Ecosystems	A dynamic complex of plant, animal and microorganism communities and the non-living environment interacting as a functional unit.	
Living communities	Communities of living (biotic) things, including living organisms like humans, animals, plants, insects and bacteria.	
Non-living environment	The environment consists of non-living (abiotic) components like rocks, soil, water, sunlight and the built environment.	
Aquatic	Related to water bodies such as rivers and lakes.	

Ecosystem services	The benefits people obtain from ecosystems to make human life possible. It is categorised into provisioning, regulating, cultural and supporting services.	
Provisioning services	Tangible resources that people can get from ecosystems such as food, water, and wood.	
Regulating services	Benefits obtained from the regulation of ecosystem processes including microclimate regulation, flood mitigation, and air and water quality control.	
Cultural services	Non-material benefits people obtain from ecosystems and include aesthetic experiences, education and recreation.	
Supporting services	Services necessary for the functioning of all other ecosystem services, including soil formation, pollination and photosynthesis.	
Hazards	Processes, phenomena or human activities that may cause loss of life or injury, property damage, social and economic disruption or environmental degradation.	
Air pollution	The presence of contaminant or pollutant substances in the air that do not disperse properly and hence interfere with human health or welfare, or produce other harmful environmental effects.	
Adaptation	The process of making adjustments to actual or expected hazards to moderate harm or take advantage of beneficial opportunities.	

Environmental stewardship	The actions taken by individuals or groups, to protect, care for or responsibly use the environment to pursue environmental and/or social outcomes.	
Volunteerism	The practice of providing time and skills for the benefit of other people and causes rather than for financial benefit.	
Disaster risk	The likelihood of damage to properties, injuries and loss of lives from a disaster in a given period of time.	
Exposure	The situation of people and their belongings located in hazard-prone areas.	
Disaster risk management	Applying plans and actions to prevent new risks, reducing existing risks and managing disaster risks, thus contributing to the strengthening of resilience.	
Community resilience	The ability of a community to resist, adapt and recover from the impacts of disasters in a timely and efficient manner.	
Vulnerability	The conditions determined by physical, social, economic and environmental factors, which increase the susceptibility of people and their belongings to the impacts of hazards.	

SUSTAINABLE URBAN NEIGHBOURHOODS

What is development?

- It refers to the economic, social and political process which results in an improvement of standard of living for a population.
- Countries may be classified according to their level of development based on a combination of economic and social indicators:
 - Economic indicator: Gross Domestic Product(GDP) per capita
 - Social indicator: Life expectancy and Adult literacy rate

What is sustainable development?

- It refers to development that:
 - Meets the needs of the present population by achieving high standards of living for all.
 - Ensures the ability of future generations to meet their own needs.
- Three key aims of sustainable development are economy, environment and society.
- An overfocus on one dimension may lead to other dimensions being overlooked.
 - If economic growth is prioritised by the government, the environment may be neglected and destroyed resulting in a loss of biodiversity, and deterioration in the quality of the environment for the present and future generations. Hence it is important for the government to also ensure that the environmental and social dimensions are considered.
- The approach to sustainable development should vary from place to place and across time.
 - It does not mean that all three dimensions of sustainability are always balanced.
 - While all three dimensions should be considered, greater emphasis might need to be placed on one dimension over others at different places.
- United Nations(UN) sustainable development goals were introduced to achieve the 2030 Agenda for sustainable development.
 - It is a shared goal that aims to achieve high standards of living and peace for current and future generations

Achieving economic and social sustainability as an urban neighbourhood

1)Economic sustainability

- Achieved by ensuring that a neighbourhood has a high enough population density, which helps to support local businesses, and keep transport and infrastructure costs low.
- Local businesses are able to sustain themselves as there will be sufficient demand for their goods and services.
- Residents can also take up employment opportunities in these shops, earn income, and increase their standard of living.
- Transport and infrastructure costs can be kept low within the community.
- Buildings and objects are usually located close to one another, hence residents need not travel far, keeping their transportation costs low. This is because connecting infrastructures need not be built or built over long distances. Hence transportation costs for residents are lowered.
 - When a bus interchange is located next to a train station there is no need to build additional infrastructures (e.g. roads, bridges) to connect them, lowering the cost of development.

2) Social sustainability

- Achieved by ensuring residents feel included and have a sense of shared identity.
- This can be fostered by having shared community spaces to promote regular social interactions
 - If the population size in the urban neighbourhood is kept small, it can facilitate regular interactions between residents.
 - This builds resilience and positive relationships between residents, as this helps to maintain a culture of open communication, mutual respect and understanding, thus reducing misunderstandings and conflicts.
- A majority of the problems faced by local residents are day-to-day, mundane issues which can mostly be resolved locally with an adequate neighbourhood structure.
 - For example, In Singapore, the Residents' Networks (RN) was set up to promote neighbourliness and community cohesiveness amongst residents.



- Each neighbourhood is divided into smaller designated zones and residents are encouraged to join the network.
- Regular activities are organised at the designated zonal level to cater to the small population size in the zone .
- This encourages residents to voice their opinions and participate in decision-making regarding issues affecting their neighbourhood.
- For example, residents can interact regularly at neighbourhood parks and playgrounds, strengthening friendships and fostering a sense of belonging.
- For example, residents may use neighbourhood WhatsApp or Telegram groups to report issues such as lost items, suspicious activities or maintenance problems, allowing them to be resolved quickly.

Sustaining neighbourhoods environmentally

- There are various ways environmental sustainability can be achieved in a neighbourhood such as:
 - Ample protection for nature.
 - When there is ample protection for nature, wildlife can thrive in our urban spaces and human-wildlife coexistence can be fostered.
 - Concerted efforts should be made to protect existing native species, habitats and ecosystems, and to re-establish species that once existed.
 - For example, the National Parks Board has developed multiple strategies aimed at safeguarding Singapore's habitats and ecosystems for long-term sustainability. Some of these strategies include the implementation of species conservation and recovery programmes.
 - For example, Singapore's Green Plan 2030 aims to plant 1 million more trees by 2030.



- Biodiversity in urban neighbourhoods can be maximised by having a wide variety of habitats including street trees, pocket parks and roof gardens in the neighbourhood, instead of just having large uniform areas of grass.
- The types of plants and trees planted in an area should also be of different varieties and species.
- This provides adequate shelter and food for a wider variety of wildlife to thrive, thus maximising biodiversity in an urban neighbourhood.
 - For example, the existing 44 Nature Ways in Singapore connects areas of high biodiversity across Singapore.
- Facilities that support waste minimisation and recycling.
 - Conveniently located recycling facilities and infrastructure such as blue recycling bins around the estates can encourage residents to recycle.
 - Having a high enough population density in a neighbourhood ensures adequate waste can be collected and recycled in an economically viable manner.
 - Pneumatic waste conveyance system to reduce manpower and vehicular trips needed to collect waste.
 - Waste recycling can be encouraged through neighbourhood-scale recycling activities organised by either the residents or the town council.
 - For example, the town council may put up posters or banners to educate and encourage the residents to recycle properly.

- For example, the town council may put up posters or banners to educate and encourage the residents to recycle properly.



- For example, the Pneumatic Waste Conveyance System (PWCS) in



estates such as Punggol transports waste through underground pipes, reducing the need for rubbish trucks and manpower.

- For example, community clubs may hold e-waste

collection events where residents can recycle old phones, batteries and small electronic appliances safely.

- Energy and water-efficient design approaches for buildings and landscapes

- Buildings and landscaping in urban neighbourhoods may be designed to

be energy and water efficient to minimise the use of resources.

- Smart technology and eco-friendly features can be installed.
 - For example, under the large-scale Housing Development Board(HDB) Green Towns Programme, cool paint is going to be used in neighbourhoods to lower temperatures by up to 2°C, reducing energy consumption.
 - For example, water harvested from rain is used for block washing of void decks and corridors to reduce overall water consumption.



ECOSYSTEM SERVICES IN URBAN NEIGHBOURHOODS

Why are urban neighbourhoods regarded as ecosystems?

- An ecosystem is a geographic area where living communities and non-living environments interact with each other to form a bubble of life.
- Ecosystems vary in size
- Every aspect in ecosystems depends on one another, directly or indirectly.
- People are integral parts of ecosystems and dynamic interactions exist between people and other parts of the ecosystem.
- Activities carried out by people may directly and/or indirectly change the ecosystem in both positive and negative ways.



- For example, a man-made concrete canal in Bishan-Ang Mo Kio Park was transformed into a naturalised river allowing more organisms to thrive in this aquatic ecosystem.
 - This brought wildlife back into the park, enhancing the neighbourhood's biodiversity.
- For example, a neighbourhood park is a small ecosystem, while the Amazon rainforest is a much larger ecosystem, showing that ecosystems vary in size.
- For example, the restoration of coral reefs provides habitats for marine organisms, increasing biodiversity and improving the health of the marine ecosystem.

What are ecosystem services?

- Ecosystem services refer to the benefits brought about by nature to people.
- These services are produced by the living communities and non-living environment of ecosystems.
- These services are critical to our survival and their benefits are optimised when we have a healthy and thriving natural environment.
- These ecosystem services consist of:
 - Provisioning services
 - Regulating services

- Cultural services
- Supporting services

What are provisioning ecosystem services?

- Provisioning ecosystem services refer to the tangible resources that people can get from ecosystems such as food, water, and wood.
- Food is one of the most important provisioning services provided by nature to people and it can be obtained through means such as agricultural activities and fisheries.
- They can also be found in an urban neighbourhood ecosystem.
 - For example, food grown in urban community gardens focused on planting edibles on rooftops at Tampines. HDB [blocks.em](https://www.hdb.gov.sg/block/445A1)
 - For example, reservoirs such as Marina Reservoir collect and store freshwater, providing clean water for households and industries.
 - For example, herbs and medicinal plants grown in gardens can be used for traditional medicine and healthcare products.



What are regulating ecosystem services?

- Regulating ecosystem services refer to the benefits obtained from the regulation of various ecosystem processes.
 - Include services such as climate regulation, disease outbreak regulation and flood regulation.
 - These ecosystem processes work together to ensure that the ecosystems are functional, clean, sustainable and resilient to changes.
- In an urban neighbourhood, these include microclimate regulation, flood mitigation as well as air and water quality control.
 - For example, some of the regulating services at Bishan-Ang Mo Kio park include:.

Regulating the local climate	● Trees in Bishan-Ang Mo Kio park can lower surface and air temperatures by providing shade to residents ● On a larger scale, forests can help to cool areas
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	by generating rainfall.
Regulating water flows	- The vegetation cover in Bishan-Ang Mo Kio park can reduce surface runoff by retaining water in soil. This is also known as water flow regulation. - It is a key service provided by natural land cover.
Regulating local air quality	The trees or other plants in the park play an important role in regulating air quality by removing pollutants from the atmosphere.

What are cultural ecosystem services?

- Cultural ecosystem services refer to the intangible benefits people obtain from ecosystems, including aesthetic experiences, educational opportunities and recreational activities.
- In an urban neighbourhood, the presence of green spaces can provide many cultural ecosystem services such as aesthetic appreciation and opportunities for stress-relieving activities.
- These activities may improve people's physical and mental health and foster social belonging and group identity, thus strengthening their sense of place.
 - For example, the Bukit Temah Nature reserve is a site for residents to engage in recreational activities such as hiking, as well as a space which provides educational opportunities, such as when geography students engage in fieldwork.
- Residents may also gain aesthetic experiences from nature objects in urban neighbourhoods such as heritage trees, skyrise greenery and community gardens.
 - For example, community gardens in HDB estates provide pleasant green spaces where residents can interact, strengthening social bonds and fostering a sense of belonging.
 - For example, the Bukit Temah Nature reserve is a site for residents to engage in recreational activities such as hiking, as well as a space which provides educational opportunities, such as when geography students engage in fieldwork.
 - For example, residents can jog, cycle or walk in East Coast Park, improving their physical health while reducing stress.



What are supporting ecosystem services?

- Supporting ecosystem services refer to services that are necessary for the functioning of all other ecosystem services, including soil formation, pollination, and photosynthesis
- For instance, soil is formed when micro-organisms and physical processes decompose organic matter and break them down into smaller particles.
- Soil is essential for the health of all terrestrial ecosystems as it provides a habitat for billions of organisms, contributes to biodiversity, and acts as a water filter
- Soil formation, as a supporting ecosystem service, ensures that human activities such as agriculture can take place.
- In urban neighborhoods, animals like wild bees play a significant role in crop pollination which is vital as it ensures that crops are able to reproduce to provide food for animals and humans.
- During photosynthesis, plants absorb carbon dioxide and release oxygen, and this maintains the oxygen content of the Earth's atmosphere. This ensures that all other ecosystem services can function.

COMMON HAZARDS IN URBAN NEIGHBOURHOODS

What are hazards?

- A hazard refers to a process, phenomenon, or human activity that may cause loss of life, other health impacts, property damage as well as social and economic consequences.
- Can be classified as natural or man-made.
- Some examples of natural hazards include earthquakes and volcanic eruptions while examples of man-made hazards include traffic hazards.

What are fire hazards and their impacts?

- In urban neighbourhoods, fire hazards may occur in both residential and non-residential areas.
- Common causes include unattended cooking and faulty electrical appliances and wiring which can ignite nearby flammable materials, resulting in a fire.
 - For example, in 2021, there were a total of 358 cases of fires due to unattended cooking reported in Singapore.
 - There has also been an increase in fire cases involving Personal Mobility Devices(PMDs) which typically occur in residential areas.
- Impacts of fire hazards:

- Health impacts
 - During a fire, people may suffer from burn injuries if they are unable to evacuate in time, and severe burn injuries may lead to disabilities or deaths.
 - For example, there were a total of 3 fire fatalities and close to 200 fire injuries in Singapore in 2021.
 - High levels of carbon monoxide and carbon dioxide may be released during a fire, and may cause carbon monoxide poisoning. This may cause headache, dizziness, weakness and confusion, and even lead to loss of consciousness and death. They can make it more difficult for people to escape a fire.
 - Other irritants from a fire, such as acid gases, can permanently damage one's respiratory system.
 - Smoke inhalation can cause breathing difficulties and suffocation, which may lead to death.
- Property Damage
 - Fires can destroy commercial or residential properties which leads to economic losses as goods, furniture and important documents may be destroyed.
 - Further costs may also be incurred after the fire is over as money is required to repair and rebuild the properties that were damaged in the fire.
 - For example, the 1961 Bukit Ho Swee Fire destroyed over 2,000 homes, causing major economic losses as properties and belongings were destroyed. Significant costs were also incurred to rebuild housing and infrastructure after the fire.



What are air pollution hazards and their impacts?

- Air pollution:
 - Air pollution occurs due to the presence of contaminating or polluting substances in the air that do not disperse properly and hence interfere

with human health, welfare or produce other harmful environmental effects.

- Some common causes include:
 - Burning vegetation: carbon dioxide and other pollutants are released into the atmosphere when vegetation burns, causing air pollution.
 - For example, in the first half of 2019, Singapore saw approximately 555 vegetation fires, a 56% increase in vegetation fires from 2018 due to drier and hotter weather. This resulted in a slight deterioration in air quality.
 - Industrial and motor emissions: increase in car ownership and usage led to an increase in pollution hazards.
 - Vehicles produce large amounts of exhaust emissions such as nitrogen oxides, carbon monoxide and other pollutants.
- Health impacts:
 - Some of the negative health impacts of air pollution include respiratory infections, heart diseases and lung cancer.
 - Nitrogen dioxide is emitted in areas of high vehicle traffic.
 - PM2.5, also known as particulate matter such as soot, smoke, dust and liquid droplets measuring less than 2.5 micrometers in diameter, may be produced in urban neighbourhoods.
 - These pollutants may lead to poor health.
 - High levels of exposure to nitrogen dioxide may lead to higher risks of asthma in children.
 - It may also cause lung function decline in older adults as PM2.5 can enter the bloodstream and lodge deep in human lungs.

What are traffic hazards and their impacts?

- Common causes include:
 - Speeding
 - Red-light running
 - Drink-driving
- These accidents are often caused by irresponsible motorists who put other road users and themselves at risk
 - For example, in 2021, there were a total of 969 speeding-related traffic incidents, and 153 accidents that were caused by drink-driving.
- Health impacts:
 - People may suffer serious injuries when involved in a traffic accident, which may lead to disabilities or loss of life.

- For example, in 2021, there were a total of 100 traffic accidents in Singapore that resulted in fatalities. 8 were caused by drink-driving.
- Elderly pedestrians and motorcyclists typically account for a high percentage of traffic accident victims resulting in injuries or death.

BUILDING SUSTAINABLE URBAN NEIGHBOURHOODS

What is environmental stewardship?

- Environmental stewardship refers to the actions taken by individuals or groups, to protect, care for or responsibly use the environment to pursue environmental and/or social outcomes,
- It can be practiced by individuals, organisations and/or governments.
- Actions should:
 - Seek to conserve natural resources
 - Preserve the existing natural environment
 - Repair the damages and reverse the negative impacts caused by humans to ensure its sustainability.
- Hence, environmental stewardship can help to build sustainable urban neighbourhoods.
- Environmental stewardship can be broadly achieved through 2 ways:
 - Promoting volunteerism among neighbourhood residents to share knowledge with others about the importance of healthy ecosystems. This helps residents become more aware of what they can and should do to responsibly use and protect the environment.
 - For example, the National Parks Board(NParks) promotes volunteerism in communities through ground-led initiatives such as Friends of the Parks. Participants may gain greater community ownership and stewardship of parks in their neighbourhoods.
 - Partnership involving public and private sectors contributes to environmental stewardship efforts.
 - Different stakeholders may have different perspectives, resources, and expertise to enhance the environment stewardship efforts, hence it is crucial for them to come together to steward the environment.
 - For example, urban neighbourhoods produce large amounts of waste, so it is important that waste materials are recycled.
 - Residents, public and private stakeholders must

play their part in ensuring an efficient and sustainable waste recycling process.

- A portion of waste disposed of in recycling bins cannot be recycled.

Hence, to ensure that recycling is optimised, public agencies like National



Environment Agency(NEA) should continue to engage residents on the importance of waste recycling as well as how and what they should recycle.

- Residents play a vital role in the proper recycling of their waste, public agencies enhance awareness and education, while private stakeholders provide recycling facilities. Through this partnership, environmental stewardship efforts can be enhanced and sustained.

What is disaster risk?

- Disaster risks refer to the likelihood of damage to properties, injuries, and loss of lives from a disaster in a given period of time.
- Disaster risks are the product of the interaction between 3 main factors:
 - Nature of hazard: The characteristics of the hazard.
 - Vulnerability: The conditions determined by physical, social, economic, and environmental factors, which increase the susceptibility of people and their belongings to the impacts of hazards.
 - Exposure: The situation of people and their belongings located in hazard-prone areas.
- To determine disaster risks, we cannot consider these factors in isolation. It is the interaction of all the factors that determine disaster risks.

What is disaster risk management?

- Disaster risk management refers to plans and actions that are implemented to prevent new risks from happening, reduce existing risks and manage disaster

risks.

- This strengthens community resilience.
- Disaster risk management strategies aim to reduce:
 - A neighbourhood's exposure to hazards, and
 - the vulnerability of people and properties to hazards.
 - For example, Singapore has a comprehensive disaster risk management plan. The main agency responding to disasters is the Singapore Civil Defence Force(SCDF). Town councils also have the responsibility to cooperate with other government agencies in securing public safety and preventing disease or injury.
- Singapore's disaster risk management strategies primarily focus on:
 - Improving residents' emergency preparedness to respond to natural and technological hazards.
 - For example, the SCDF conducts a Community Emergency Preparedness Programme(CEPP), which focuses on key lifesaving skills and emergency procedures.
 - Implementation of monitoring and warning systems.
 - SCDF has a Public Warning System(PWS) which is a network of sirens placed at strategic points throughout the city. It warns the public of imminent threats that may endanger lives and property such as natural and man-made disasters.

Type of response	Description	Successes	Limitations
International agreements: Kyoto Protocol	● An agreement from 2008-2012 linked to United Nations Framework Convention on Climate Change (UNFCCC) ● Measures to address climate change and to put them in practice ● Countries were obligated to reduce their combined greenhouse gases by at least 5% below their 1990 levels	● Many countries have met/ exceeded targets set by kyoto protocol ● Successful in encouraging sustainable development	● Some countries which signed did not meet their emission targets ● Does not make it compulsory for countries with low greenhouse gas emissions to provide support to other countries ● Countries which did not sign the protocol continued to contribute significantly to global emissions
National responses: Singapore	● Reduce greenhouse gas emissions by using natural gas as	● 79% of Singapore's electricity was	● Requires complex treatment plants to process and

Green Plan 2012	an energy source • Natural gas is a cleaner form of energy in comparison to coal	being generated from natural gas • Exceeded target ahead of schedule	pipelines to transport • Pipelines have high maintenance costs (laid underground, check for leakage)
National responses: Green Mark Scheme	• Allows buildings to be evaluated and certified according to how environmentally friendly they are • Encourage more new “green” buildings • Buildings which use less energy to provide the same service have greater energy efficiency • Promotes energy conservation in the long run	• Existing “green” buildings have reported energy savings of 15-35% compared to conventional buildings • Reduces use of fossil fuels to generate electricity	• “Green” buildings may cost more to build (expensive materials) • Construction companies and developers tend to be conservative about adopting new ideas and materials to build “green” buildings
National responses: Plant-A-Tree Programme	• Aims to maintain Singapore’s status as a Garden City by planting trees • Residents can donate money to buy a tree/ take part in tree planting events	• 60000 trees planted yearly throughout Singapore	• Trees take many years to mature • Positive effects of tree planting will take time to materialise (25 years for angsanas, raintrees to reach full height)

Topic 3: Geographical Methods

KEYWORDS:

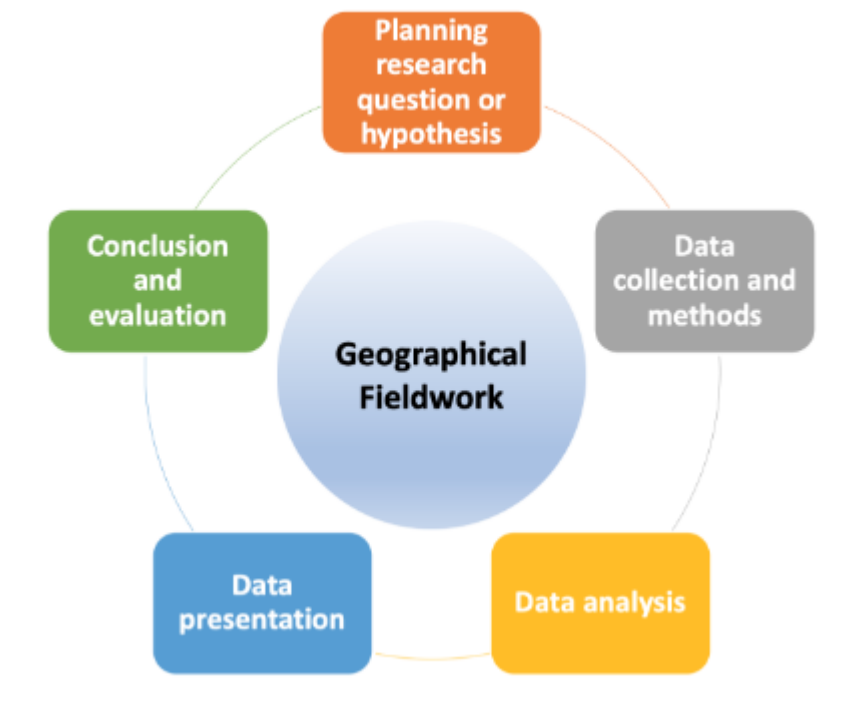
Word	Definition	Additional notes
Thesis	An idea, opinion or theory of a person expressed as a statement.	
Variable	An element, feature, or factor that can take on different values.	
Closed-ended questions	Questions that offer limited responses.	
Open-ended questions	Questions that allow participants to give free-form answers.	
Semi-structured interview	A flexible interview that does not follow a fixed set of questions and is dependent on the responses given by the participants.	
Study area	Physical area of fieldwork investigation.	
Sample size	The number of participants in a study or other units of observation.	
Measures of frequency	Measurements finding the number of times something occurs.	
Measures of central tendency	Measurements finding the central value in a set of data.	
Mean	Sum of all the values in the data set divided by the number of values in the data set.	
Median	Middle value for a set of data that has been arranged in ascending order.	
Mode	The most frequent value in a data set.	

Legend	Lists the symbols used and explains what is being mapped.	
Scatter plot	A type of chart used to observe the relationship between two variables.	
Best-fit line	A straight line drawn on a scatter plot to show the relationship between two variables.	
Correlation	The degree of association between two variables.	
Outlier	A data point that differs from the majority of the data set or does not fit the overall relationship. It need not be an extreme value.	
Spatial information	Two-dimensional information represented by points, lines and regions. In maps, spatial information makes references to a specific location or geographical area.	
Polygons	Fully enclosed areas or regions on the map.	
Aerial images	Images taken from an aircraft or flying objects like drones.	
Word cloud	Collection of words depicted in different sizes.	

DESIGNING FIELDWORK

What is fieldwork?

- Fieldwork is integral to Geography. It is a systematic approach for geographers to investigate geographical phenomena and their related issues.
- Take a look at the figure below, which shows the five stages of geographical fieldwork:
 - Craft research question or hypothesis
 - Collect data
 - Analyse data
 - Present findings
 - Conclusion and evaluation

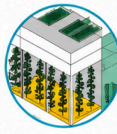


How may a research question or hypothesis be crafted?

- Fieldwork often begins with crafting a research question or a hypothesis.
- To craft a research question or hypothesis, researchers need to first find out more about a topic or a thesis from credible sources which may include textbooks, news articles and websites.
- For example, the infographic below can be used to spark curiosity about temperatures in Singapore's outdoor environment:

Making it cooler

A team involving academics and policymakers are studying how to make Singapore's outdoor environment cooler. The Straits Times looks at some of the areas they have identified to achieve this.



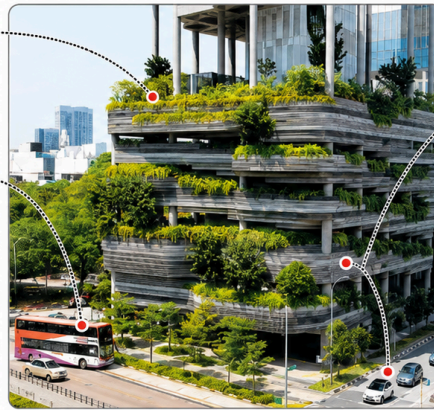
VEGETATION

Green roofs, green walls and other vegetation can help to reduce the temperature in up buildings.



TRANSPORT

Separated walkways, easier bus and train access, and cooler roads can help reduce transport heat, a major contributor to heating in our urban areas.



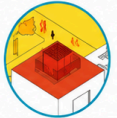
MATERIAL AND SURFACES

Using light-coloured materials and other reflective surfaces on roofs and building walls can help reflect sunlight and reduce heat stress.



WATER BODIES AND FEATURES

Ponds, canals and water features can help to absorb heat and cool our urban environment.



ENERGY

Energy-efficient designs can contribute to lower heat emissions, while reducing waste heat from air-conditioning systems.



SHADING

Shade can come from canopies, trees, foliage – even building designs that provide shade in outdoor spaces.



URBAN GEOMETRY

The geometric layout of cities can influence how heat and air flow through an area. For example, increasing building heights can increase wind flow.



- As seen above, urban areas tend to be warmer than areas that are less built-up. This is because buildings and roads absorb and trap heat in the environment. The type of material used to construct infrastructure can also affect the amount of heat in the surroundings. This can spark an interest in how different materials can be used to lower surrounding air temperatures.

Research question	Hypothesis
A question that outlines the scope of investigation.	A measurable statement consisting of one or two variables.
Often used where there is little existing research or when the relationships between the variables are uncertain.	Often used when a large body of research on the topic is available and relationships between the variables are quite certain.
Inquisitive in nature.	Predictive in nature.
Many possible conclusions may be formed at the end of the investigation.	A definite conclusion is formed at the end of the investigation.
Example: How does the temperature in the school field change over the course of a day?	Example: The temperature of the school field is highest at 3 pm.

Steps in carrying out fieldwork(Step 1-3):

- **Step 1: Coming out with the Research Question**
 - The research question outlines the scope of investigation.
 - Examples of a research question if the investigation wants to learn more about the temperature of the school field:
 - Does the temperature of the school vary throughout the day?
 - Is the school field the hottest place in the school?
- **Step 2: Coming out with the Hypothesis**
 - The hypothesis is the statement of what the investigation wants to test / measure. There can be 1 or 2 variables.
 - Example of a hypothesis if the investigation wants to find out more about the temperature of the school field:
 - The temperature of the school field is higher in the afternoon than in the morning.
 - The school field is the hottest place in the school.
 - The temperature of the school field increases when wind speed increases.
- **Step 3: Collection of Data**
 - **Investigators should decide on the type of data they want to collect for the investigation**
 - Primary Data or Secondary Data
 - **Primary data** refers to the first-hand data that the investigators collect themselves, for example from photographs, sketches, questionnaire surveys, interviews, etc.
 - **Secondary Data** refers to the data that is in existence and which has been collected by others like those in books, websites, brochures, journals, newspapers, etc.
 - Quantitative Data or Qualitative Data
 - **Quantitative data** can be measured or quantified, like the responses given in closed-ended questionnaire surveys (where choices are given).
 - **Qualitative data** is not easily measurable and is subjective, like the responses given on open-ended

questions used in semi-structured interviews.

- **Investigators need to decide the sequence of the data collection if both qualitative and quantitative data need to be collected.**
 - **Quantitative data first, followed by qualitative data**

Quantitative data helps to identify patterns and trends, and qualitative data then examines the patterns and trends in detail. *For example*, quantitative data shows that a high percentage of female students failed their test. Qualitative data is then collected to find out why more female students fail compared to male students.
 - **Qualitative data first, followed by quantitative data**

Qualitative data makes observations about a topic, and then quantitative data verifies the observation. *For example*, qualitative data can be collected to find out the features which make an area attractive. Quantitative data can then be collected to ask the respondents to rank the features.
- **Limitations during fieldwork design**
 - Investigators need to consider the limitations they might face when designing the fieldwork and then make adjustments to their fieldwork because the limitations will affect the scope of their fieldwork. The scope is determined by the research aims, study area, sample size and timeframe.
 - Considerations include:
 - How much data to collect
 - The best time to collect the data and the amount of time needed to collect the data
 - Accessibility to places for the collection
 - Availability of manpower
 - Availability of equipment needed
- **Potential risks and mitigating measures**
 - **Falls, cuts, injuries** - investigators need to wear proper footwear and clothing, and take note of their surrounding for potential hazards
 - **Traffic accidents** - investigators should avoid collecting data on the road and take note of the traffic conditions at the venue.

COLLECTING PRIMARY DATA

Steps in carrying out fieldwork(Step 5-6):

- **Step 5: Selecting the sample for the investigation**

- Sampling refers to the selection of a proportion of the population. The sample must be a representation of the population being studied for the fieldwork. Sampling is necessary because it is not possible to get the information from the whole population because it will take too long and it is also not practical to do so. Sampling also helps to reduce bias. A good sample size for a reasonable analysis of the data is about 30.
- There are two types of sampling - probability sampling and non-probability sampling.

- **Probability Sampling**

- Gives a more representative sample as it is randomly selected without the conscious decision of the researcher. A random number generator or die is used. Probability Sampling removes bias.
 - **Simple Random Sampling** - Everyone in the population is given a number. A random number generator is used to generate random numbers to select the sample or the people for the investigation.
 - **Stratified Random Sampling** - Different categories of the population are determined, like age, sex or race. A sample is then selected from each category based on the proportion of the group in the whole population. Once the number to be selected is determined, simple random sampling is done for each group.

For example, if the population is 30, and 60% are males and 40% are females, then $60/100 \times 30 = 18$ males and $40/100 \times 30 = 12$ females will have to be selected.

- **Non-Probability Sampling**

- The sample is non-randomly selected based on the

researcher's conscious decision. Tends to have bias in selection, so samples are not representative of the population.

- Done when sampling needs to be done quickly due to time limitations or when testing out a questionnaire.
 - **Convenience Sampling** - People are selected because they are convenient sources of data like friends or people walking pass the researcher along the street.
 - **Quota Sampling** - After working out the proportion to be selected from the population based on a given category like age, sex or race, select the sample by using convenience sampling.

- **Step 6: Collecting the primary data**

Primary data can be collected using questionnaire surveys or mental maps.

- **Questionnaire Surveys**

- Uses a set of questions to find out the opinions of people or organisations.
 - Especially useful for quantitative data.
 - Easy for people to answer and easy to analyse patterns and trends.
 - **Predefined Responses:** Short single phrases or single words arranged in a series or numbers. Guides people to easily answer in fixed categories.
 - **Rating Scales:**
 - **Likert Scale:** Has a range of responses with 2 extreme opposing positions (e.g. Strongly Agree to Strongly Disagree, or Excellent to Very Poor).
 - **Frequency scales:** Provide responses that have a different number of occurrences.
 - **Ranking scales:** Get respondents to compare items with one another (less than 10 items for comparison).

- **Mental Maps**

- Mental maps are used to find people's experience at a place. They can show how the respondents think visually or spatially about

their environment. They can also show the inter-relationships people have with their environment.

- There are two ways to collect data using mental maps:
 - Respondents can be given a Blank Paper to draw their features in a map. They draw what they know, believe or feel about a place.
 - Advantages of giving a free-form blank:
 - it is more representative of the respondent's perception of a place, and
 - it can be a discussion point to start semi-structured interviews where open-ended questions are used.
 - Respondents can also be given a Base Map for them to add details by labelling and annotating their perception of the place.
 - Disadvantage of giving a base map:
 - it is not easy to geo-reference and map out the features onto geographical information systems or GIS

PROCESSING AND ANALYSING DATA

Steps in carrying out fieldwork(Step 7-8):

- Step 7: Processing the primary data
 - Processing and Analysing Quantitative Data from pre-defined questionnaires.
 - Measures of Frequency – It measures how frequent a response is given
 - Count the number of times a response is given.
 - Work out the percentage or proportion of times a response is expressed as a fraction of 100.
 - Measures of Central Tendency – It shows the central value for a set of data or distribution.
 - Mean is the average or the sum of all the data divided by the

number of values in the data set.

- Advantage: all the data are taken into account and there is no data left out to show the central location.
- Disadvantage: it is influenced by outliers which will skew the result, so it does not give the central location.
- Median is the middle value in the data set when it is arranged in an ascending order.
 - Advantage: it is less affected by outliers
 - Disadvantage: it is not sensitive in showing the central location in a data set.
- Mode is the most frequent value in the data set.
 - Advantage: it is not affected by outliers and is useful for categorical data.
 - Disadvantage: it is not useful for continuous data as there might be more than one with the highest frequency.
- Processing and Analysing Qualitative Data from Mental Maps
 - When to use it – It is used to examine the respondent's sense of space and verify how well they can represent the world / reality. It verifies how well they draw the features and how well they add labels to explain the features. It can be used to see how memories of experiences are explained during semi-structured interviews.
 - Usefulness:
 - it helps the researchers to analyse differences or inaccuracies between the actual maps and the mental areas drawn
 - the drawn features help to explain the factors that influence the respondent's perceived space
 - it allows the researchers to verify through open-ended questionnaire why some places are more prominent while other places are ignored or absent.
- Different Aspects of the Mental Map and what they represent
 - Centering and Borders – features drawn at the centre tend to signify greater importance, while features drawn at the sides signify low importance. However, the disadvantage is – sometimes, the position of the features do not match the reality or the actual position on the ground.

- Scale – when features are drawn to scale or if they are the larger drawn features, it shows familiarity and greater activity of the respondent in that area. The disadvantage is – sometimes, the scale does not represent reality. For instance, the large features drawn may be smaller in reality.
 - Labels and Annotations – if the respondents can label and add annotations to their mental maps, it shows greater familiarity with the area. The use of positive or negative words also shows their knowledge of the place and the emotions they experienced at the place.
 - Colors, Legends and Symbols– different colors are used to show different places and to convey different emotions. The choice of different symbols to represent the place shows the different experiences of the people and provides researchers with more information about the place. For example, respondents can use the ❤️ symbol to indicate a positive experience or the importance of a place.
 - Perspective and Orientation – the mental maps can be drawn from different orientations and perspectives. For instance, an aerial view will show a large area with less detail while a street view will show a small area with more detail. How the places are positioned in relation to the surroundings shows the person's experience. For example, they might draw important places nearer to their home.
 - Other features – these can be added to show how familiar the place is to the respondents. It also shows the person's personal history of the place.
- Step 8: Analyzing the primary data

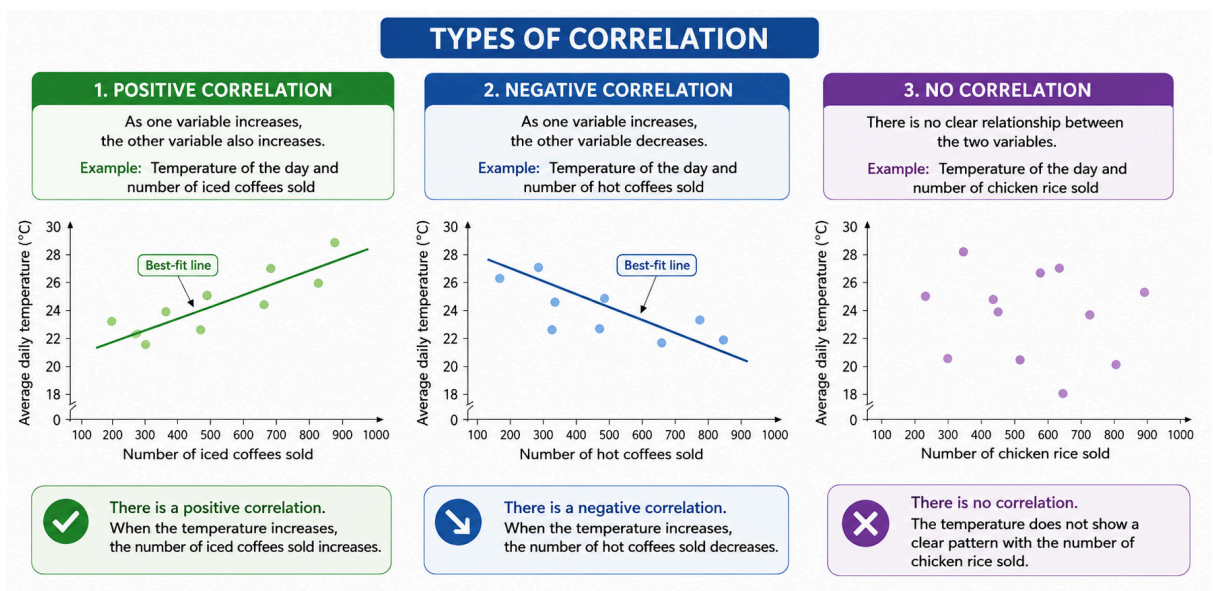
Primary data is analysed and explained by looking for patterns and relationships. Two ways to analyze data to look for patterns and relationships are through Scatter Plots and Best-fit Lines and through recognizable geometric shapes, clusters or repetition.

- Scatter Plots

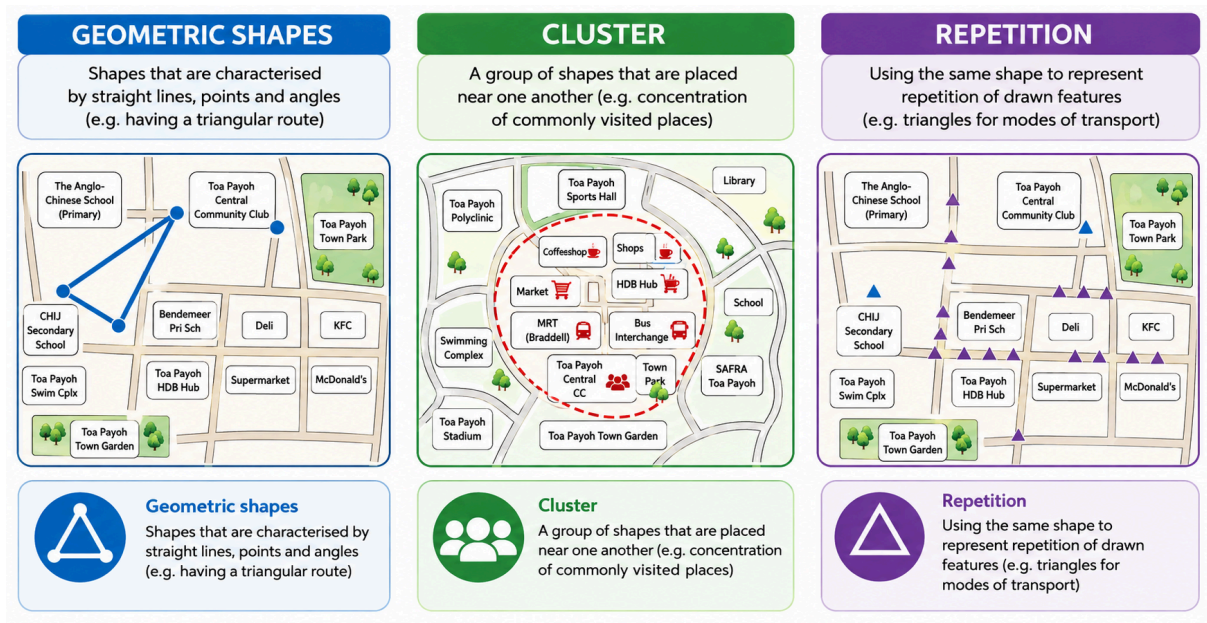
- Scatter plots are used to determine relationships between two variables. One variable is the dependent variable, while the other is the independent variable. A best-fit line is then drawn to show the correlation.
 - There can be a positive correlation when the best-fit line runs from bottom-left to the top-right of the graph. In this

case, when x increases, y also increases.

- There can be a negative correlation when the best-fit line runs from top-left to the bottom-right of the graph. In this case, when x increases, y decreases.
- There are outliers that don't fit the pattern. There is a need to find out the reason for the outliers.
- If the points are scattered or distributed, no pattern can be seen, and it is not possible to draw a best-fit line. This indicates that there is no relationship between the two variables.
- For scatter graphs, the gradients of best-fit lines show whether there is a positive or negative relationships between the variables.



- Recognizable Geometric Shapes, Clusters and Repetition
 - Patterns and relationships can be observed when we can identify recognizable geometric shapes, clusters and repetition.
 - The data can be analysed by looking for:
 - What is common or popular among the respondents, like how many times the place/object is labelled or drawn on mental maps
 - Repetitions or clusters of labelling/features/geometric shapes show the popularity and prominence of the place
 - Absence of some features which shows unfamiliarity or a lack of interaction with the respondents within the space.

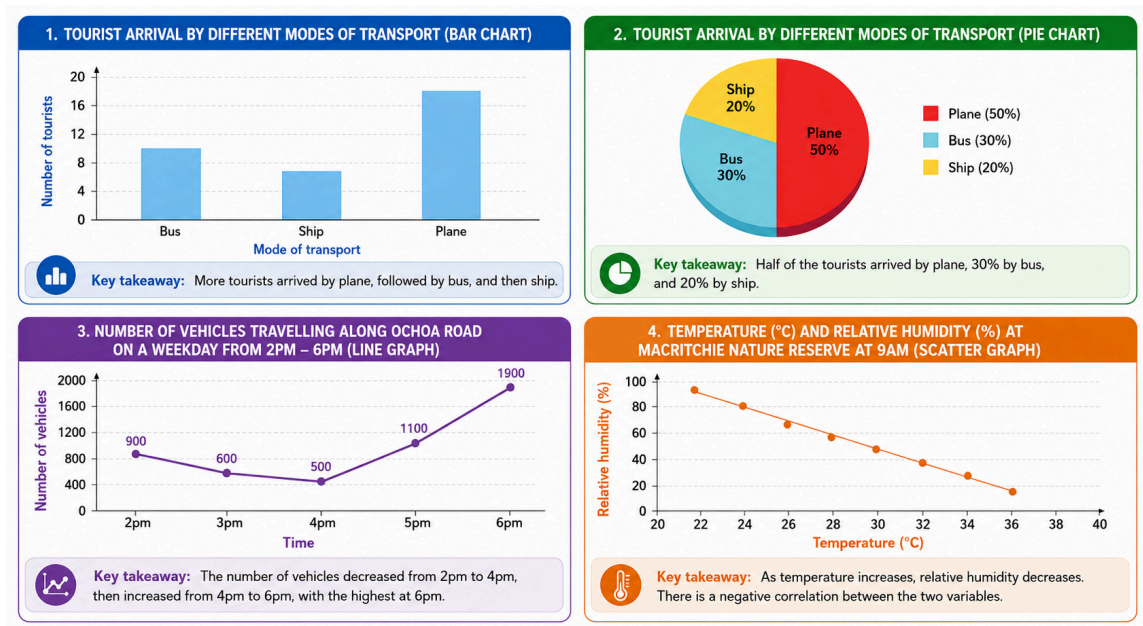


PRESENTING FINDINGS

Steps in carrying out fieldwork(Step 9):

- Step 9: Presentation of the Findings
- Qualitative findings can be presented using photographs and texts. Quantitative data can be presented by graphs. Maps are good to provide spatial information.
 - Maps:
 - Maps are visual representations of real-world spatial information using symbols, like dots, lines and polygons.
 - Maps consist of essential elements such as title, date, orientation, scale, legend, author and source(s).
 - Title – provides some detail about the map's content (could include year and data source)
 - Orientation – usually drawn to point towards the North direction
 - Scale – shows the map's relative size and distance to the actual size
 - Legends – shows the list of symbols used.
 - Others – include author, source(s) of the mapping data and the biases found in them – readers are able to gauge the reliability of the information and to explore the data further if necessary.
 - Graphs

- Qualitative and quantitative data can be presented and analysed/interpreted using graphs. The key in deciding the choice of graphical presentation depends on the type of quantitative data and how it could meaningfully communicate findings.
 - Bar graphs
 - They are used to present the total values or data by categories using rectangular bars. They compare the data between different categories. They show one point data (at one point of time) and one variable.
 - Example: Students are interested to know how tourists arrived in Singapore. They can ask about their mode of transport and use bar graphs to present their findings clearly and visually. In the bar graph, the x-axis shows information of the different categories of transport modes, and the y-axis shows the total number of tourists.
 - Pie charts
 - They are used to show categorical data in the form of a circular graph and are useful to show percentage or proportional data.
 - Line graphs
 - Line graphs are used to show data that continuously changes over time. It is also good to show trends.
 - Different aspects of the line graph - the upward and downward lines show increasing or decreasing trends.
 - Example: Students collected data on the number of vehicles travelling along Orchard Road on a weekday from 2 to 6pm. The data can be presented as a line graph, where the x-axis shows the time of day with an interval of one hour and the y-axis shows the total vehicle counts at the given time periods. The upward and downward lines drawn on the line graph show the trends or change in the number of vehicles over time.



- Photos

- Photographs, including satellite and aerial images, are useful to present fieldwork findings with spatial information. They can also capture physical and human features, and landscapes. For example, satellite photos can show the spatial distribution of
- Singapore's terrestrial ecosystems by mapping out the areas occupied by vegetation and water bodies.
- Photographs can be taken from different orientations and offer different perspectives: Ground-level images are used to present a detailed part of an area, while aerial images are used to present spatial distribution over the whole area.



A photograph showing a ground level photograph of Marina One in Singapore



An aerial photograph showing the same Marina One building

- Text

- Text-based data are qualitative, like letters, oral histories, transcripts of interviews and other secondary information.
- Disadvantage: If the text is very long, it can be challenging to interpret and represent the data as it is easy for researchers to lose sight of what they are reading.
- Some common approaches to present findings using text are:
 - Colour-coded quotations – This is useful in analysing and presenting findings from qualitative data. Colours and their accompanying meanings help to analyse the data and communicate findings.
 - Word clouds (a collection of words depicted in different sizes) – This is useful to recognise the most important points in text-based data. If the word appears bigger and bolder, and is mentioned more times within a given text, it signals its greater importance.

Student researcher: Describe your favourite breakfast food.

Mother: I usually start the day with a big glass of water and a black coffee.. Once I get to work I will have granola, yoghurt, fruit, seeds and honey or toast with avocado. The caffeine gives me the energy to start the day and I try to go healthier for my first meal.

Child: I like French toast with a lot of maple syrup and strawberries! The toast is soft and sweet! Mummy puts in the strawberries like a heart shape. It's pretty!

Yellow: Food that adults eat

Green: Food that children eat

Blue: Reasons for their food choices

What is a Word Cloud?

A word cloud is a visual representation of text data in which the **most frequent words** appear **larger and more prominent**.

How is a Word Cloud Generated?

- 1 Collect text data (e.g. interview responses).
- 2 Remove common words (e.g. "the", "and", "is") that do not add meaning.
- 3 Count the frequency of each word.
- 4 Display the words in different sizes – the more frequent the word, the bigger it appears.

Example of a Word Cloud

For example, YouthInsights (2020) surveyed youths 14 to 25 years old, and asked them to describe how they felt about the 2019 Coronavirus pandemic. 'anxious' and 'worried' are the most prominent feelings of these youths from the word cloud generated.

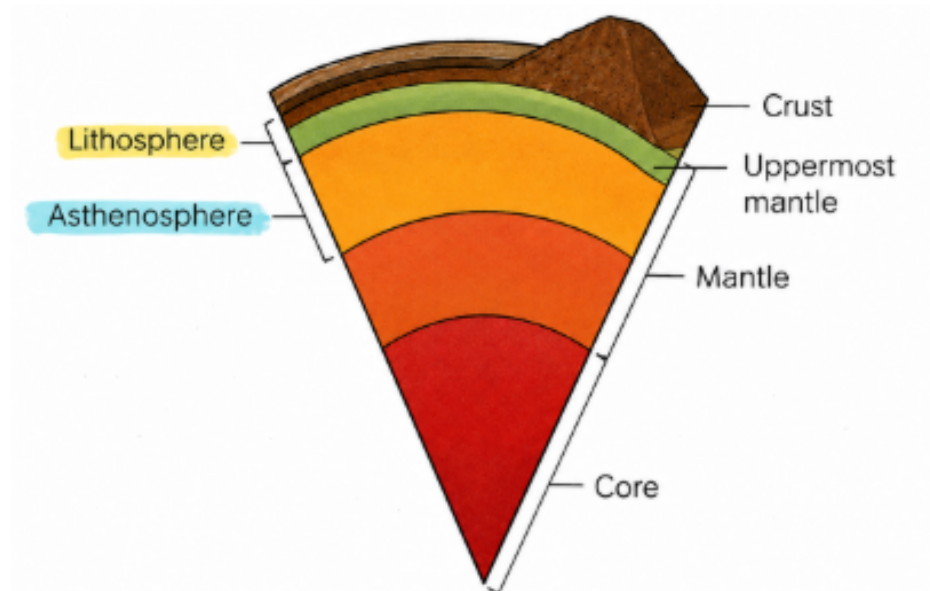
LIVING WITH TECTONIC HAZARDS

Topic 1: Why are some areas more prone to tectonic hazards?

NATURAL HAZARDS

- **Natural hazard:** a naturally occurring event that threatens human lives and causes damage to property
- Can be classified as climate-related or tectonic
 - Tectonic: Earthquakes, volcanic eruptions
 - Climate related: Floods, storms

INTERNAL STRUCTURE OF THE EARTH



Part of Earth	Description
Crust	• Outermost • Thinnest, 6-70km thick • Lowest temperature
Mantle	• In between • 2900km thick • Comprises of mostly solid rock that flows under high temperature/ pressure • Temperature between 1000°C-3700°C
Core	• Innermost

	• Comprised of mostly nickel and iron • Temperature: Between 4400-6000°C, highest • Thickness: 3300km, thickest
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- **Lithosphere:** Crust + uppermost mantle
 - Makes up earth's rigid outer shell
 - Rocks in lithosphere melt to form magma

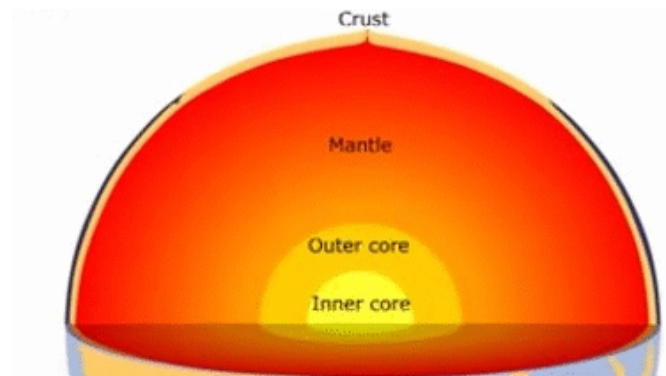
TECTONIC PLATES

The crust is broken into **tectonic plates**, which move in relation to one another. Tectonic plates are lithospheric mantle overlain by either oceanic or continental crusts. There are tectonic plates which contain both oceanic and continental crusts.

WHY DO TECTONIC PLATES MOVE?

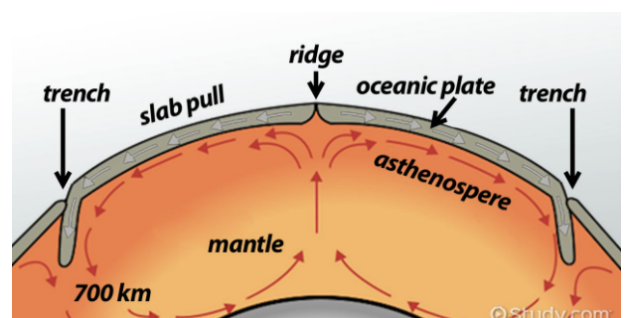
Convection currents are movements of heat within the mantle:

1. Heat from the earth's core causes the mantle material to become less dense.
2. Mantle material rises towards the surface.
3. The rising mantle material then spreads beneath the tectonic plates and drags them apart, causing divergent plate movement.
4. The mantle material then loses heat and sinks towards the core.
5. Convergent plate movement occurs where the convection currents collide.
6. The materials then get heated up again, and the process repeats. The rising and sinking of the mantle material forms convection currents.



The **slab-pull force** also causes tectonic plates to move:

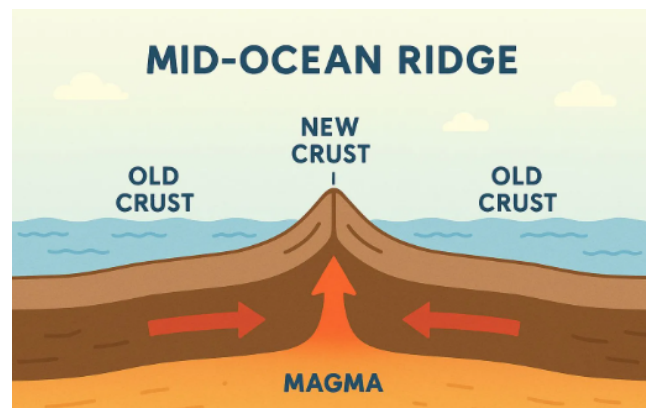
1. When two plates converge, the denser oceanic plate is pulled down by gravity as it subducts under a less dense crust.



2. The denser oceanic crust sinks deeper into the mantle under its own weight, pulling the rest of the plate with it, contributing to further convergence.

Seafloor Spreading also causes tectonic plates to move:

1. Where two plates move away from each other at divergent plate boundaries, seafloor spreading occurs.
2. Magma from deep within the earth rises through the mid-ocean ridge.
3. New oceanic crust is formed.



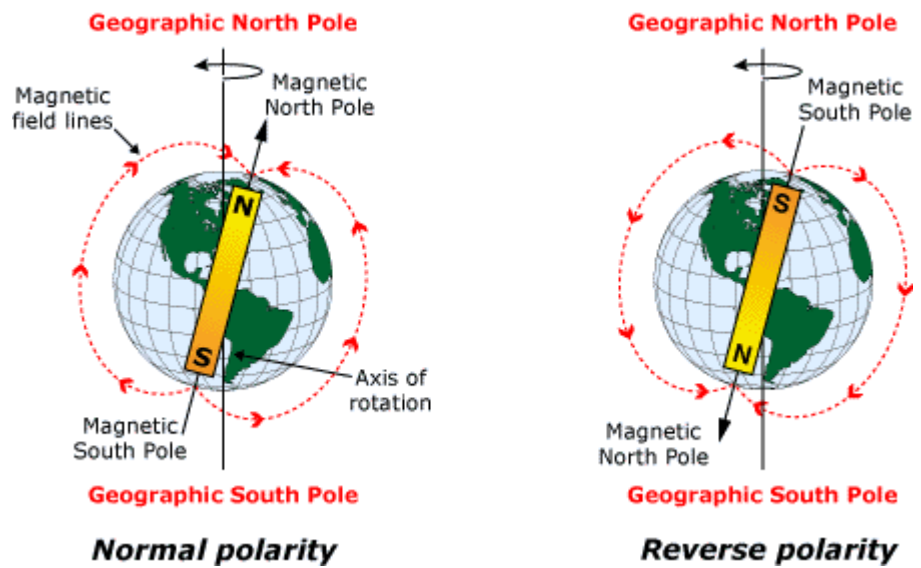
- How does seafloor spreading support plate tectonic theory?
 - The age of rocks at the seabed shows a pattern:
 - Rocks nearer to the crest (centre) of the mid-ocean ridge are the youngest.
 - Rocks further away from the ridge are progressively older.
 - This shows how new oceanic crust is created at divergent boundaries and then moves out laterally on both sides of the mid-ocean ridge as seafloor spreading continues.
 - Little sediment accumulation is found at oceanic trenches, as older oceanic crust is being destroyed at oceanic trenches.
 - As a result, oceanic crusts are usually younger than continental crusts.
 - This proves that new crust is continually formed at divergent boundaries at the mid-ocean ridges, and as plates move, older crust is destroyed further away at oceanic trenches.

Magnetic stripping

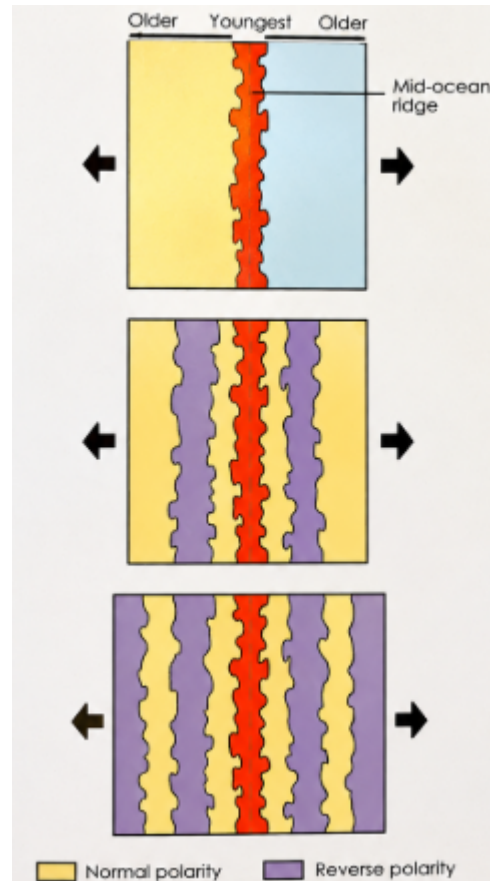
- What it is:
 - Earth has a geographic North and a geographic south as well as a magnetic north and magnetic south.
 - The geographic north and geographic south do not change.
 - However, the magnetic north and magnetic south can shift, and they have reversed multiple times over geological time.
 - Currently, the magnetic north points roughly to the geographic north, and the magnetic south points roughly to the geographic south.
 - This is known as normal polarity.
 - Reverse polarity happens when the magnetic north points roughly towards the geographic south, and the magnetic south points roughly

towards the geographic north.

- Over geological time, the Earth's polarity has flipped multiple times alternating between normal and reverse polarity.



- Magnetic stripping is the zebra-like pattern where there are strips of normal polarity rocks alternating alongside strips of reversed polarity rocks on the seafloor.
- It is symmetrical on both sides of the mid-ocean ridge.



- Magnetic stripping occurs because:
 - Basaltic rocks from the oceanic crust are volcanic rocks formed from iron-rich lava.
 - They contain magnetic materials.
 - When iron-rich lava erupts, it cools and solidifies.
 - Its magnetic materials points towards Earth's magnetic north, recording evidence of Earth's polarity at that time.
- How does magnetic stripping support plate tectonic theory?
 - This zebra-like pattern is symmetrical on either side of mid-ocean ridge, showing that this is not a random or isolated occurrence.
 - Provides evidence that plates move as:
 - Oceanic plates move away from each other.
 - Iron-rich lava erupts from the centre of the ridge.
 - Lava cools, solidifies and forms new oceanic crust.
 - The crust is then pushed in both directions away from the ridge when new lava erupts and solidifies as plates move apart.
 - When Earth's polarity reverses, the rocks record the reversals.
 - Over time, as more lava moves away from the ridge due to plate divergence, a symmetrical zebra-like pattern forms.

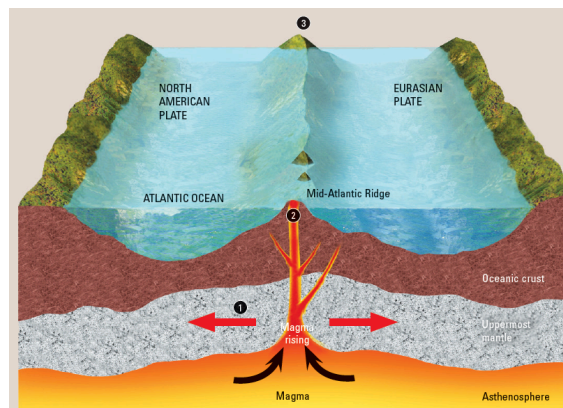
TYPES OF PLATE BOUNDARIES

Divergent boundaries: Plates move away from each other

Convergent boundaries: Plates move towards each other

Transform boundaries: Plates move past each other

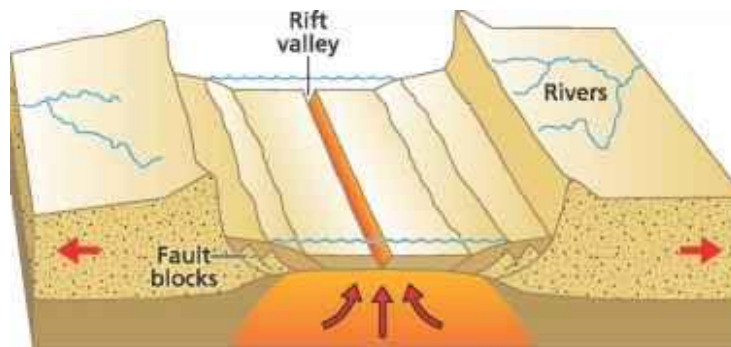
Oceanic-Oceanic plate divergence



- Two oceanic plates move apart.
- The decrease in overlying pressure causes parts of the underlying mantle to melt, forming magma.
- Magma rises through weak areas in the crust to the Earth's surface and fills gaps caused by the spreading plates.
 - Lava cools and solidifies to form basaltic rocks.
 - The rocks make up a new oceanic crust.
 - An extensive underwater mountain chain, the mid-ocean ridge, forms.
 - At the centre of the ridge is a deep rift valley with steep sides.

Example: Mid-Atlantic ridge found in the middle of the Atlantic ocean, which cuts across Iceland. Iceland is an example of a volcanic island. This occurs at the divergent boundary between the North American plate and Eurasian plate.

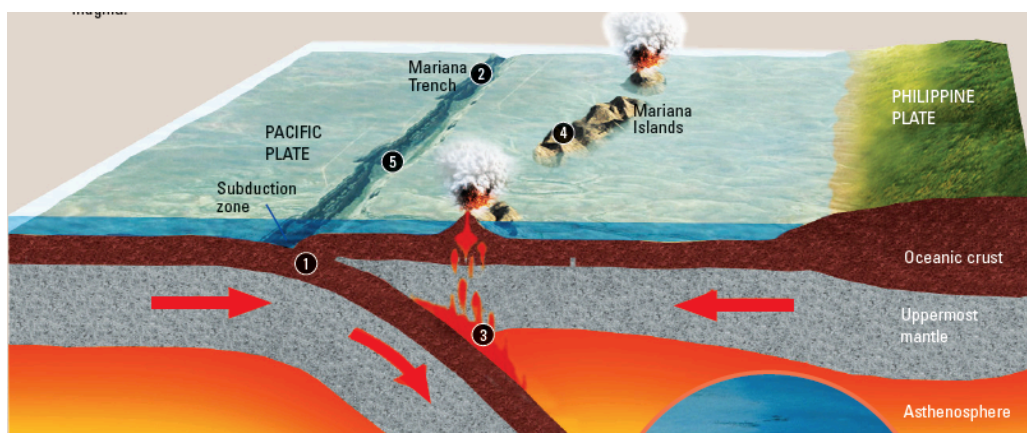
1) Continental-continental plate divergence (C-C)



- Two continental plates move apart.
- Rocks eventually fracture to form parallel forms.
 - *Fault: a fracture in the rocks along which the rocks are displaced at weak areas of the crust*
- The rock between these faults collapses to form a deep rift valley with steep sides.
- As the plates move apart, the decrease in overlying pressure causes parts of the underlying mantle to melt, forming magma. Magma rises through weak areas in the crust to the Earth's surface, forming volcanoes.
 - Earthquakes occur as stress and tension are released when plates move.

Example: East African rift valley. It is a lowland with steep sides and a flat valley floor. It is formed by the Somali boundary of the African plate moving away from the Nubia plate boundary of the African plate. It is 6000km long and between 30-100km wide. There is evidence of tectonic activity as active volcanoes and earthquake fracture can be found.

2) Oceanic-oceanic plate convergence

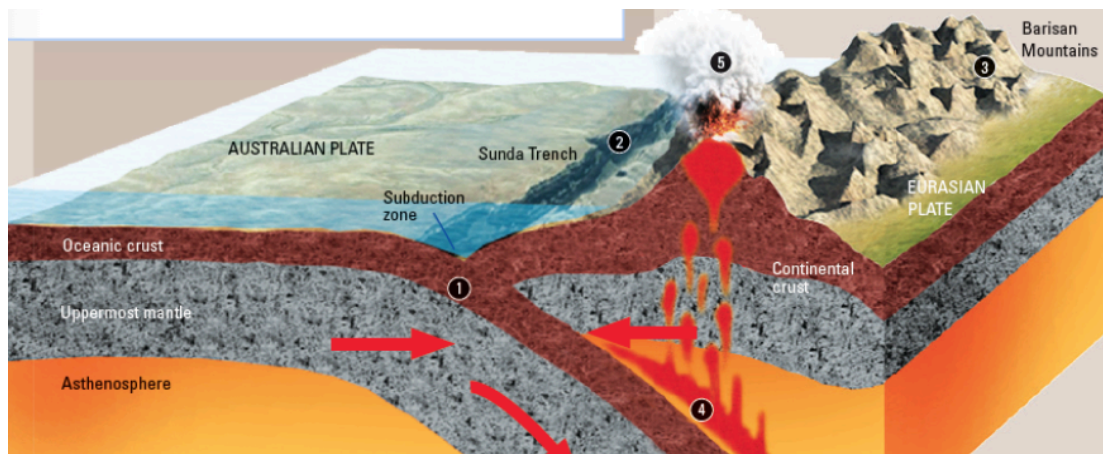


- When 2 oceanic plates converge, the older and denser plate subducts under the less dense plate.

- Occurs at area called subduction zone
- This forms a deep depression known as an oceanic trench.
- As the subducting plate sinks into the mantle, the high pressure forces water out of its oceanic crust. Water lowers the melting point of the overlying mantle, causing it to melt, forming magma.
- Magma rises through weak areas in the crust to the Earth's surface.
- This forms a chain of volcanoes, known as a volcanic island.
- *Note: Friction along the subducting oceanic plate also causes earthquakes to occur.*

Example: The Pacific Plate subducts beneath the Philippine Plate forming the Mariana Trench and the Mariana Islands (volcanic arc).

3) Oceanic-Continental plate convergence (O-C)

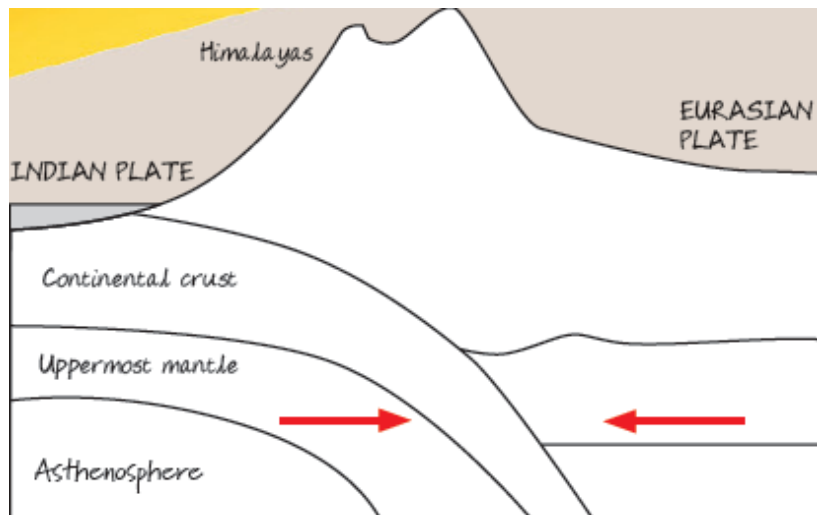


- An oceanic plate collides with a continental plate.
- The denser oceanic plate subducts beneath the continental plate.
- This forms an oceanic trench in the subduction zone.
- As the subducting plate sinks into the mantle, the high pressure forces water out of its oceanic crust. Water lowers the melting point of the overlying mantle, causing it to melt, forming magma.
- Magma rises through weak areas in the crust to the Earth's surface, forming volcanoes on the continental plate.
 - Friction along the subducting oceanic plate causes earthquakes to occur.
- Enormous pressure at this plate boundary causes rocks on continental plate to be uplifted and buckled, forming fold mountains.
 - Stratovolcanoes are formed
- *Note: Deep-focus earthquakes may also occur due to the massive amount of friction generated by the movement of the 2 tectonic plates*

Example: The Australian Plate subducts under a section of the Eurasian plate, forming

the Sunda Trench and Barisan Mountains. The Andes Fold Mountains and Peru-Chile Trench are formed from the subduction of the Nazca Plate beneath the South American Plate

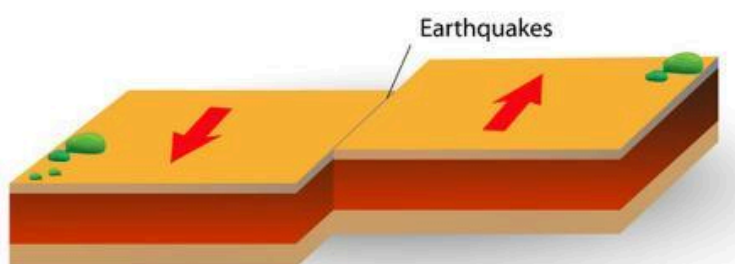
4) Continental-Continental Plate Convergence (C-C)



- When 2 continental crusts collide subduction does not occur as continental plates are too buoyant to subduct.
- Enormous pressure causes the rocks to be uplifted and buckled to form fold mountains.
- Note:
 - *Friction along the convergent plate boundary also causes earthquakes to occur.*
 - *Magma does not rise to the surface, hence no volcanoes are formed.*

Example: The Himalayas (found in Nepal) formed due to the convergence of the Indian Plate and Eurasian Plate. It is also the tallest mountain range in the world.

5) **Transform Plate boundaries**



- Plates slide past each other
- No crust is created or destroyed.
- Stress caused by the plate movement produces a fault, which is a zone of fractures.
- Earthquakes occur here as one plate suddenly slips past another.
- Magma does not rise to Earth's surface, hence there are no volcanos.
 - Transform boundaries are a result of the movement of tectonic plates at convergent and divergent boundaries

Example: San Andreas Fault between Pacific Plate and North American Plate. North Anatolian Fault found between the southern section of the Eurasian and Anatolian plate

Summary:

Type of plate boundary		Tectonic phenomena	Examples
Divergent	Oceanic-Oceanic	• Mid-ocean ridge • Volcanoes • Rift valleys • Earthquakes	• Oceanic North American plate moving away from oceanic Eurasian plate forming: ◦ Mid-Atlantic Ridge(mid-ocean ridge) ◦ Surtsey Island(Volcanic island)
	Continental-Continental	• Rift valley • Volcanoes • Earthquakes	• Nubian plate moving away from Somalian plate forming: ◦ East African rift valley(rift valley) ◦ Mount Kenya, Mount Kilimanjaro(volcanoes)

Convergent	Oceanic-Oceanic	• Oceanic trench • Volcanoes • Earthquakes	• Pacific plate converging with Philippines plate, forming: ◦ Marina trench(Oceanic trench) ◦ Marina Islands(Volcanic islands) ◦ Guam, an island near the Mariana Trench, commonly experiences earthquakes.
	Continental-Continental	• Fold mountains • Earthquakes	• Indian plate converging with Eurasian plate, forming, ◦ Himalayas(fold mountain range) ◦ 2015 Nepal earthquake.
	Oceanic-Continental	• Oceanic trench • Volcanoes • Fold mountains • Earthquakes	• Oceanic Nazca converging with continental South American plate, forming: ◦ Peru-Chile trench(oceanic trench) ◦ The Andes Mountains(fold mountain range) ◦ Nevado del Ruiz(volcano) ◦ 2010 Chile earthquake
Transform		• Faults • Earthquakes	• North American plate sliding past Pacific plate, producing: ◦ San Andreas fault,

		California, USA ○ Earthquake in California, USA
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Topic 2: What landforms and associated tectonic phenomena are found at plate boundaries?

LANDFORMS AT DIFFERENT PLATE BOUNDARIES

1) Fold Mountains(fyi)

- Layers of rocks compressed and folded over millions of years form fold mountains
- Formed along convergent plate boundaries
 - Compressional force creates immense pressure, causing rocks to buckle and fold
 - Process is called folding
- Folding involves the compression of rock layers into wave-like structure known as folds
 - Upfold is called anticline
 - Downfold is called syncline
- When there is increasing compressional force on one limb of a fold, rocks may buckle until fracture forms
- Young fold mountains are found near plate boundaries. Older fold mountains are found further away from the plate boundaries

Example: Himalayas have formed millions of years ago when the Indian plate and Eurasian Plate collided

2) Rift Valleys and Block Mountains(fyi)

- Formed at divergent plate boundaries where plates are pulled apart
 - Gives rise to faults
 - *Fault: a fracture in the rocks along which the rocks are displaced*
- Tensional forces from these movements result in parts of the crust being fractured
 - Called faulting
- A **rift valley** is a valley with steep slides
 - When sections of the crust extend along fault lines, tensional forces can cause a central block of land to subside between a pair of parallel faults (link back to continental-continental divergence)
 - East African Rift Valley. (Nubian Plate & Somalian Plate)
- A **block mountain** is a block of land with steep slopes left standing higher than

the surrounding land

VOLCANOES

- A **volcano** is a landform formed by magma ejected from the mantle onto the earth's surface
- **Magma** is molten rocks found under the earth's surface and builds up within the crust to form a magma chamber
 - **Magma chamber:** a reservoir of molten rock beneath the earth's crust
 - **Lava:** magma ejected onto the surface
 - **Vents:** openings in the earth's surface with a pipe leading into the magma chamber
- **Viscosity:** measurement of a fluid's resistance to flow
 - Higher viscosity; more resistant to flow
 - Lower viscosity; less resistant to flow
 - Different levels of silica content present in rocks affect viscosity
- Measurement of volcanoes:
 - Volcanic Explosivity Index(VEI):
 - Measures the magnitude of volcanic eruptions using:
 - Volume of ejected material(greater volume=higher VEI)
 - Height of eruption of cloud(greater height=higher VEI)
 - Duration of eruption(longer=higher VEI)
 - Measured on a scale of 0 to 8:
 - Effusive eruptions usually are given a value of 0 or 1, as they are non explosive with less than 0.0001km³ of material injected.
 - One example is the ongoing effusive eruption of Kilauea, Hawaii, which is non explosive.
 - A value of 8 represents a mega-colossal explosive eruption that can eject more than 1000km³ of tephra, with an eruption cloud column height of over 25km.
 - For example, the Toba volcano in Northern Sumatra, Indonesia, 74000 years ago erupted approximately 2800km³ of material, which covered India and parts of Southeast Asia in over 15 cm of ash.
 - It is logarithmic:
 - An increase of 1 on the scale indicates an eruption 10 times more powerful than the number before it.

There are 2 common types of volcanoes:

1. Shield Volcanoes
2. Stratovolcanoes

Ways to describe volcanoes:

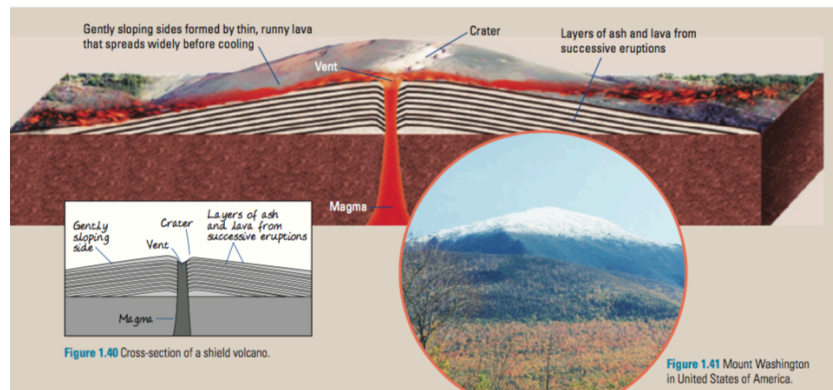
1. **Slope** → Steep, concave /Gentle, convex
2. **Height** → Tall/Low
3. **Size** → Large/Small Area
4. **Eruption** → Non-violent, long duration/ Violent, short duration

Magma (still from the ground)/ Lava (at the surface) characteristics:

1. **Type of Magma** → Basaltic/ Andesitic
2. **Temperature** → High/Low
3. **Silica Content** → High/Low
4. **Viscosity** → High/ Low
5. **Gas Content** → Low, Less gas trapped in Magma; High, more gas trapped in Magma

Pressure → High/ Low

1) Shield volcanoes



Characteristics	● Gentle sloping sides (convex) ● Broad summit
Eruption	● Low silica content in magma* ○ Less viscous magma ● Eruptions are gentle, effusive ○ Magma does not trap much gas ● As magma rises towards the Earth's surface, the dissolved gases in the magma cannot escape easily. ● More pressure builds up until gases escape explosively.
How they form	1. Low viscosity magma rises through the weak areas in the crust to the Earth's surface and erupts effusively. 2. Over successive eruptions, a volcano consisting of layers of lava develops. 3. As the less viscous lava travels a longer distance before cooling and solidifying, the volcano has gently sloping sides with a broad summit.
Examples	● Mount Washington, USA ● Erta Ale, Ethiopia

**Note: Silica content affects magma viscosity, Silica=Sticky*

2) Stratovolcanoes

Characteristics	• Secondary cones • High volcano • Slightly concave profile ◦ Steeper at the top, gentler at base
Eruption	• High silica content in magma ◦ More viscous magma • Eruptions are violent, explosive • As magma rises towards the Earth's surface, the dissolved gases in the magma can escape easily. • Less pressure builds up.
How they form	1. High viscosity magma rises through weak areas in the crust to the Earth's surface and erupts explosively as lava, ash and rocks. 2. The ash and rocks settle on the sides of the volcano, and are later covered by lava. 3. Over successive eruptions, a tall volcano consisting of alternating layers of ash and lava develops. 4. As the highly viscous lava travels a shorter distance before cooling down and solidifying, the volcano has steep sides and a narrow summit.
Examples	• Mount Pinatubo, the Philippines • Mount Mayon, the Philippines • Mount Merapi, Indonesia

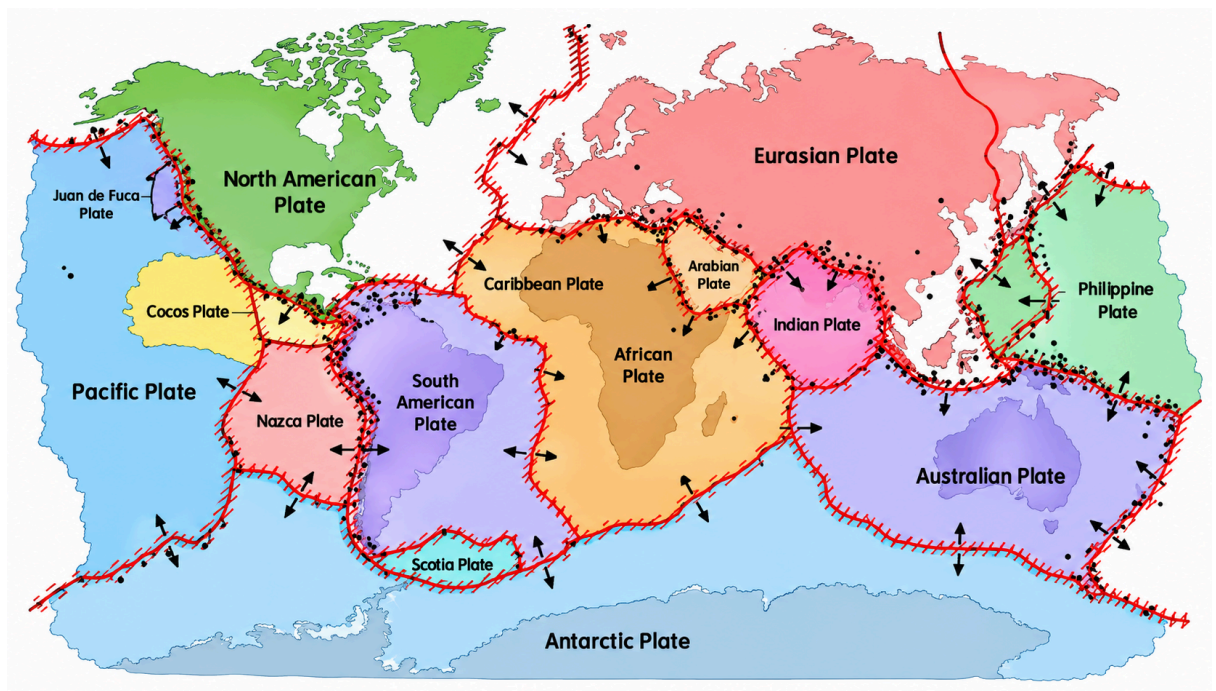
However, there are volcanoes with viscous magma that do not result in explosive eruption as the magma rises in a way that allows gases to escape. Example: While Mount Merapi is a stratovolcano, its eruption in 2006 was not explosive as the viscous magma rose in a way that allowed dissolved gases to escape easily.

The **Pacific Ring of Fire** is where the most volcanic activity takes place. It is found along with several converging plates.

EARTHQUAKES

- **Earthquake:** Shaking of the Earth's ground due to the sudden release of energy in the Earth's lithosphere.
 - Generally occurs along plate boundaries, which contain systems of deep fractures called faults.
- Occur when:
 - Rock masses on either side of the fault are pushed by tectonic forces.
 - Friction causes them to get locked, and stress builds up.
 - When stress exceeds the strength of the fault(or rock), the rocks snap(or suddenly move to a new position).
 - The sudden movement causes seismic waves to be released, resulting in ground shaking.
- The point in the earth's crust where seismic waves are released is known as a focus.
 - The focus is the origin of the earthquake.
- The point on the earth's surface directly above the focus is called the epicentre.
 - Shaking is generally felt most strongly near the epicentre.
- After an earthquake event, stress from the ground within the earth's crust may cause **aftershocks** to occur along the fault line
 - Aftershocks may occur for months even after the earthquake
 - Some aftershocks may be as powerful as the original earthquake
- Measured using seismometers
 - Seismometers are sensitive instruments that detect ground vibrations and determine the magnitude of an earthquake.
 - The greater the seismic energy released during an earthquake, the greater the magnitude.
 - Scales used:
 - Richter Scale(ML)
 - The Richter Scale calculates earthquake magnitude using the height of the largest wave recorded on seismometers.
 - Thus, earthquake magnitude is measured based on the maximum seismic intensity reached, rather than the total seismic energy released throughout the earthquake.
 - The scale is numbered from 1 to 10, with 10 being the greatest magnitude.
 - Scale is logarithmic-an earthquake of magnitude 6 releases about 32 times more energy than a magnitude 5 earthquake.

- However, the Richter Scale has a limitation:
 - The Richter Scale would rate an earthquake with a single drastic spike in wave energy as having a higher magnitude than a long earthquake with many large, intense waves.
 - This underestimates the longer earthquakes which release more overall energy by rating them as having lower magnitudes even though they are likely to do more damage.
 - Hence, the Richter Scale is no longer commonly used, except for small, local earthquakes.
- Distribution of Earthquakes:



- Earthquakes occur along all types of plate boundaries.
- The largest concentration of earthquakes is at the Pacific Ring of Fire.
- At plate boundaries, plates are pushed by tectonic forces, stress builds up and is eventually released.
- Earthquakes occur more commonly along convergent plate boundaries at subduction zones as more stress is built up during subduction.
- Exception: Some earthquakes may occur away from plate boundaries such as within the Eurasian plate.
- Examples:
 - Broad belt of earthquakes along convergent plate boundaries in

the Pacific Ring of Fire.

- Narrow belt of earthquakes along the divergent plate boundary at the Mid-Atlantic ridge.
- Narrow belt of earthquakes along the transform plate boundary at the San-Andreas fault.

IMPACTS OF EARTHQUAKES ON HUMANS & NATURAL SYSTEMS

Natural systems	Human systems
Natural processes that occur on Earth — the interaction between living and non-living things (e.g. ecosystems).	Human-led processes and interconnected human activities (e.g. services, standard / quality of life, properties and infrastructure).

Earthquake hazards are often localised — generally found within the same geographic region as the earthquake. As most earthquakes occur along plate boundaries, their hazards are also usually found near plate boundaries. However, some hazards (such as tsunamis) are not localised, as they may spread far beyond the geographical region in which they occurred.

How Earthquake Hazards Lead to Impacts

Earthquakes bring about hazards such as ground shaking, soil liquefaction, landslides, and tsunamis. These hazards lead to impacts on:

- Natural systems — e.g. destruction of ecosystems.
- Human systems — e.g. destruction of properties & infrastructure, disruption of systems, and threats to public health, injuries and fatalities.

Ground Shaking

Setting	Describe with examples	Explain impact on natural / human systems
Natural	• Example: 2010 Christchurch earthquake, New Zealand. • Many trees were damaged and more than 300 damaged trees had to be removed.	• Trees may fracture and get uprooted → forests experience tree death and injury, resulting in forest and biodiversity loss. • Habitats get damaged → reduces food sources and breeding grounds for land species → loss of biodiversity and possibility of extinction. • Ruptured gas pipelines and chemical factories may leak into water bodies → polluting the water supply.

Human	• Example: 2010 Mw 7.0 earthquake, Haiti — more than 250,000 houses destroyed as they collapsed due to violent ground shaking; water pipes were ruptured; an estimated 220,000+ people were killed. • Example: 2018 Palu earthquake, Indonesia — mobile signal towers were destroyed, so people did not receive text messages about the incoming tsunami, which killed more than 1,000 people.	• Violent ground shaking, which can last from several seconds to a few minutes, weakens and eventually collapses buildings and bridges, trapping people and making it difficult to rescue them or supply emergency aid → causes injuries and loss of life. • Ground shaking may also disrupt essential services such as water, gas and electricity. It can snap water and gas pipes, electricity lines and communication cables → causing water shortages and fire outbreaks, and delaying reaction time and rescue → higher death and injury toll.
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Soil Liquefaction

Violent ground shaking causes saturated, loose soil to lose its structure and turn into a thick fluid.

Setting	Describe with examples	Explain impact on natural / human systems
Natural	• Example: 2010–2011 earthquakes, Christchurch, New Zealand. • Liquefied soil entered rivers. • Many broken sewage pipes released untreated waste into the rivers → reduced species such as caddisflies.	• Trees on liquefied soil may tip over and get damaged, causing forest and biodiversity loss. • The liquefied soil may enter rivers and smother aquatic plants, causing them to die. • Sewage pipes may break and untreated waste may pollute rivers, killing aquatic species → loss of biodiversity and possibility of species extinction.
Human	• Example: 2010–2011 Christchurch, New Zealand earthquakes — triggered severe liquefaction, as the city lies on a former swamp area where soils are loose and saturated. • More than 60,000 residential buildings and infrastructure covering about one-third of the city area were damaged.	• Liquefaction can cause buildings and infrastructure (roads, bridges, elevated highways) to sink and tip over → people may not be able to escape or get to safety, and rescue efforts may be difficult → higher injury and death toll. • Liquefaction can cause land to sink in, rupturing water and gas pipes as well as electricity cables →

		people lose access to clean water, and loss of electricity may hamper rescue and medical efforts.
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Landslides

Violent ground shaking forms cracks on steep slopes, loosening the rocks and soil, which then move downslope.

Setting	Describe with examples	Explain impact on natural / human systems
Natural	Example: 2018 earthquake, Papua New Guinea — triggered landslides that caused huge amounts of debris to enter the rivers, causing floods that destroyed forests, polluted waters and killed fish.	- Falling debris can bury huge areas of forest and wetlands, and rivers can get polluted by the huge amounts of debris carried by the waves, which can kill aquatic life. - The debris can also block rivers, causing massive floods that can damage nearby ecosystems.
Human	- Example: 2008 Great Sichuan earthquake, China (Mw 7.9) — triggered more than 15,000 landslides, destroying many buildings and infrastructure; in total, about 20,000 deaths were caused by these landslides. - Landslide at Hongyan Resort, China, after the 2008 earthquake — 51 people were killed in this landslide.	- Debris from landslides can bury villages and farms, killing many people and destroying properties and infrastructure. - Roads and railways can be blocked, making it difficult for rescue efforts → higher casualty and death toll. - Communication cables and pipes carrying water and gas can snap, disrupting essential services → people may be left without water for days → higher casualty and death toll.

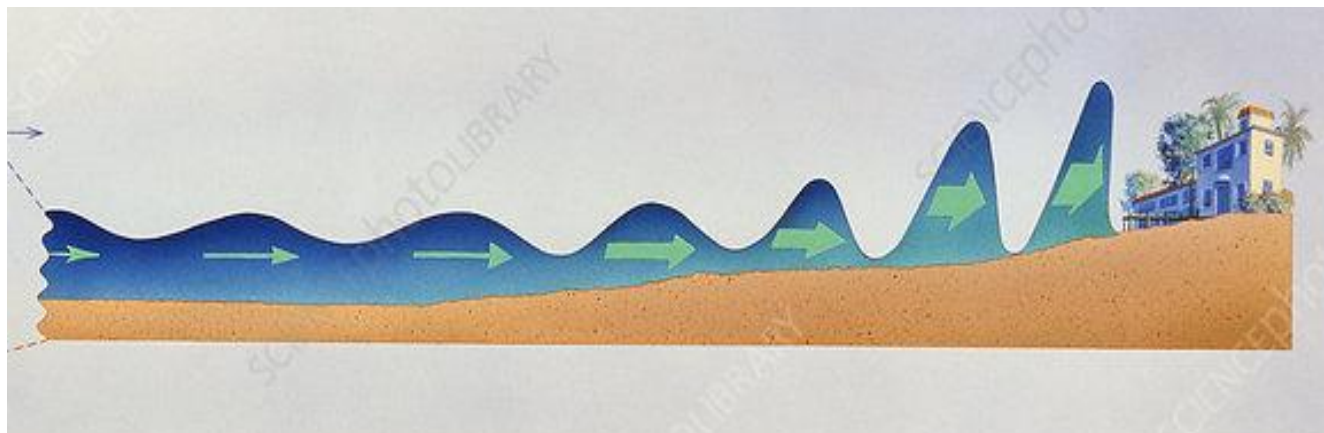
Tsunamis

Tsunamis are a series of ocean waves which can be caused by undersea earthquakes, volcanic eruptions and landslides. Tsunamis can travel over large distances and devastate huge areas of coastline.

- *Tsunami: an unusually large sea wave*
- Movement of the seafloor during a large earthquake at subduction zones
- Explosive underwater volcanic eruption
- Landslide above sea level, causing materials to plunge into the water

Formation of Tsunamis

1. An undersea earthquake causes the seabed to be displaced.
2. A large volume of water is lifted, forming waves of great wavelength and low height of less than 1 metre.
3. The waves travel towards land at high speeds around 800km/h.
4. On approaching the coast, greater friction with shallower seabed slows the waves down.
5. The waves get closer together and increase in height. Waves can reach up to a height of 15m or more, travel at speeds of 30-50km/h and devastate shorelines the waves hit.
6. Before the tsunami occurs, the sea may recede from the shore because the sea water fills in the void caused by displacement of the seabed



Tsunamis do not necessarily reach land as a series of giant breaking waves. Instead, they often look like a very rapidly rising tide, or walls of water. The waves may keep coming every 5 to 60 minutes, and the first wave is often not the largest — it is often the later waves that are biggest. Tsunamis are very destructive because of their high speed and volume: when they hit the shore, they can flood coastal areas more than a kilometre inland.

Impacts of Tsunamis

Setting	Describe with examples	Explain impact on natural / human systems
Natural	• Example: 2011 Tohoku, Japan earthquake — about 70,000 pine trees were knocked down and washed away in Iwate, leaving only one pine tree standing. • The tsunami also hit Pacific islands (e.g. Midway Atoll), where the devastation to ecosystems was severe: entire bird nesting sites were lost as four successive waves flooded huge areas of the island. • More than 100,000 Laysan Albatross chicks were killed, and thousands of Bonin petrels were buried alive; thousands of fish were washed ashore, where they eventually suffocated.	• Huge amounts of seawater flood coastal areas, damaging habitats for animals. • Huge waves may also carry debris from nearby affected areas, which may pollute the ecosystem and damage habitats → loss of biodiversity and possibility of species extinction.
Human	• Example: 2011 Tohoku earthquake (Mw 9.0) — triggered a 40 m high tsunami; the coastal city of Sendai was badly affected, with half of its people affected; many areas were flooded and polluted by debris; strong waves destroyed buildings and infrastructure. • Example: 2004 Indian Ocean tsunami, triggered by an Mw 9.1 undersea earthquake — tsunami waves hit the coasts of 11 Indian Ocean countries, from Indonesia to India and even as far away as Africa; more than 230,000 people were killed and entire coastlines and habitats were destroyed.	• Fast-moving waters and the large amounts of debris carried by the waves can snap electricity and communication cables, disrupting these services → may delay rescue efforts and hamper communication with survivors → increased casualty toll. • Roads and railways can be damaged by the water, making it difficult for rescue efforts → higher casualty and death toll. • Sweeping waters can drown people, and the large amounts of debris carried in by the waves can hit and kill people → higher death toll.

IMPACTS OF VOLCANIC ERUPTIONS ON HUMANS & NATURAL SYSTEMS

Social impact	Economic impact	Environmental impact
How people's lives are affected (health levels, death toll, ability to afford basic needs / earn income, etc.)	How the country's economy is affected; how government spending is affected.	How the environment would be affected; pollution levels.

Risks

Destruction of Materials & Landslides

When volcanoes erupt, they eject volcanic materials such as lava, ash, volcanic rocks and pyroclastic flow, which destroy houses, infrastructure like transport networks, and basic services such as power lines and water supply — negatively affecting people.

Describe with examples	Explain
• Eruption of Nevado del Ruiz in the Andes Mountains, South America, in 1985 — released a pyroclastic flow which mixed with glacial ice, resulting in lahars that covered the town of Armero and killed more than 20,000 people. • September 2014, Mt Ontake, Japan — killed over 40 people who were hiking near the volcano. • Eruption of Kilauea, Hawaii, in 1963 and still ongoing — destroyed many homes and highways (lava flows destroyed 181 residences within the first 8 years of the eruption); 12 km of highway have been covered by flows over the past 14 years, with losses estimated at US\$61 million. • Lava, at high temperatures of 500–1,400°C, may burn areas it passes through.	• Leads to loss of lives and property → survivors suffer trauma and need counselling to recover → decline in mental health → lower quality of life. • Causes damage to infrastructure → more economic losses, where more government spending needs to be channelled into repair works. • As volcanic materials can be poisonous and damaging, they cause destruction to the environment they pass through (e.g. damage to crops and trees).

- 1963 catastrophic eruption of Mount Agung, Bali — killed a thousand people, and others starved to death after ash smothered their crops.

Pollution

Ash particles release gases such as carbon dioxide, sulphur dioxide and carbon monoxide, which are harmful to people and can be carried by wind to disrupt activities in the air.

Describe with examples	Explain
• Traditional sulphur miners of East Java suffer from poisoned lungs and skin full of burns and scars. The miners have little protective gear, using only a damp cloth to cover the nose and mouth as they cannot afford gloves or gas masks, and are paid only US\$10–15 a day. • 74 miners have died after being overpowered by fumes that can suddenly swirl from cracks in the rock.	• The gases released by the volcano may be harmful and poisonous, and people in the surrounding areas are the most affected as they inhale these gases → respiratory problems → lower levels of health → lower quality of life.
• In 2015, Mount Raung in East Java ejected ash into the air for nearly a week, affecting air travel as ash melts and coats the inside of aircraft engines and affects fuel flow, which can cause engines to shut off. • In 2010, the Eyjafjallajökull volcano produced ash clouds that posed a danger to aircraft engines and structures, causing the closure of European airspace, delays to 1.2 million passengers, and costing the airline industry US\$1.8 billion.	• Volcanic ash may disrupt economic activities of a country, especially air travel → economic losses → affects economic growth.

Benefits of Living Near Volcanoes

Fertile Soil

Lava and ash from a volcanic eruption break down to form fertile soil after thousands of years, as they contain minerals and nutrients that are pure from the source.

Describe with examples	Explain
• Mount Merapi, Indonesia — villages are found along the slopes of the volcano. • Volcanic ash enriches the soil, as it contains minerals that become available after the rocks break down over thousands of years. • Volcanic soil in Java and Bali, Indonesia supports the cultivation of crops such as tea, coffee and rice; farmers on Java can harvest three crops of rice in a season.	• Fertile soil allows farmers to enjoy higher crop yields → more crops available for sale → earn more income → better purchasing power to afford goods and services → better standard of living. It also increases the food supply, so people are less likely to experience starvation and malnutrition → better health → improved quality of life.

Geothermal Energy

Geothermal energy is heat within the Earth's crust; when groundwater comes into contact with it, it heats up and erupts as hot water or steam, which can be harnessed.

Describe with examples	Explain
• Japan has some of the best natural hot springs in the world, referred to as “onsen”, scattered across the country in both indoor and outdoor facilities. • These geothermally heated waters are considered to have restorative properties, with natural minerals thought to heal aches and pains, ease illness, and maintain a healthy body.	• This allows people to relax and feel happier and more content; since the waters are considered to have restorative properties, they may improve people's health levels → improved quality of life.

Describe with examples	Explain
• Iceland — almost 90% of homes are heated by geothermal power, which does not produce soot or greenhouse gases that pollute the air and contribute to global warming. • Kumamoto, Japan — a new geothermal plant famous for its natural hot springs and volcanic activity (the first to open in Japan since 1999). • Japan, one of the world's most seismically active nations, has geothermal resources estimated to generate as much as 23 million kilowatts of energy — the third-largest amount in the world, even though its contribution to Japan's current electricity demand is small.	• This allows electricity to be provided by geothermal energy, reducing the demand for fossil fuels, which in turn reduces the amount of greenhouse gases produced → reducing the effects of climate change.

Precious Stones & Minerals

Volcanic rocks can be rich in precious stones like diamonds; diamonds are heated and pressurised carbon that is cooled in magma pipes beneath the Earth's surface, and after millions of years can be extracted.

Describe with examples	Explain
• Kimberlite is a type of igneous rock that may contain diamonds, named after the town of Kimberley in South Africa. • Diamonds were first mined there in the 1870s and are still being mined today. • South Africa's mining industry, one of the best developed in the world, forms a crucial part of the country's economy: sales of minerals and mineral products contribute about 16% of GDP, and the mining sector directly employs approximately 550,000 people.	• The diamond industry can provide jobs to people → people are able to earn money → higher purchasing power to afford goods and services → better standard of living. The diamond industry can also earn a lot of profit from diamond sales → contributing to the country's economic growth.

Tourism

Volcanic areas offer a variety of activities for tourists to engage in.

Describe with examples	Explain
• Bali — rock and sand thrown up by the eruption of Mount Agung were used to build hotels, restaurants and villas for hordes of foreign tourists, who started arriving in the 1970s. Tourism remains Bali's biggest industry. • Mount Fujiyama, Japan — a site of great natural beauty and one of the main tourist attractions of Japan. Of the 10,364,000 international tourists who visited Japan in 2013, more than 50% had planned a visit to Mt Fuji to enjoy its scenic beauty. • Hot springs of Japan, such as Kusatsu and Manza, are also highly favoured by tourists; these hot springs have minerals like sulphur, which is believed to have medicinal properties that can help cure skin-related diseases.	• These attractions, located near the volcanoes, increase tourist arrivals in Japan → increased demand for tourist-related services (e.g. guides, hotel managers) → possibly creates more jobs for locals → increase in income → economic growth for the country. As a result, locals can afford more goods and services like food → increase in standard of living.

Topic 3: How do people prepare for and respond to tectonic disasters?

Disaster risk: the potential damage / danger posed by a disaster to properties, people and infrastructure in a given period of time, before any human intervention.

Disaster risk management: plans and actions taken by humans to prevent disaster risks before, reduce disaster risks during, and manage disaster risks after a disaster occurs.

Why It Is Necessary to Manage Disaster Risk:

It is necessary to manage disaster risk in order to prevent the following consequences:

Environmental consequences

- Areas can be buried by landslides triggered by tectonic hazards.
- Damage to ecosystems.

Social consequences

- Can cause loss of lives and injuries.
- Causes homelessness and no access to basic services such as water.
- Contaminated water and food supplies may cause diseases, affecting people's physical and mental wellbeing.

Economic consequences

- Infrastructure and properties are destroyed → money is directed to repairs, leaving less money for basic needs → affects standard of living.
- The government needs to spend money to rebuild → directs money away from other spending, such as healthcare and education → affects development.

All of this can hinder the development of a country!

Why Disaster Risks Differ Across Places

(How severe the danger is, without any human intervention)

Factor 1: Nature of the Hazard

Earthquakes	Volcanic eruption
• Duration of shaking — a longer duration of ground shaking leads to a higher likelihood of building collapse. E.g. 2011 Tohoku earthquake: 6 minutes of shaking. • Timing of shaking — people can react faster to an earthquake when they are awake, as they are more alert. E.g. Oaxaca, Mexico, 2012: 7.6 magnitude at 12 pm, death toll 2. Taiwan, 1999: 7.6 magnitude at 2 am, death toll 2,415.	• Chemical composition of magma — low-silica magma is less viscous and flows more easily, leading to a gentle, effusive eruption (2018 Kilauea, Hawaii: destroyed 600 homes, 24 injuries). High-silica magma is more viscous and flows more slowly, leading to an explosive eruption (2010 Mount Merapi, Indonesia: pyroclastic flow for 3 km and volcanic bombs over 10 km).

Factor 2: Vulnerable Conditions

Earthquakes	Volcanic eruption
• Quality of building design and construction — earthquakes don't kill people, but buildings do when they collapse. Poor building design means a higher chance of collapsing and trapping / injuring people. E.g. 2010 Port-au-Prince, Haiti earthquake: most buildings were made of poor materials and poorly reinforced → 90% of buildings near the epicentre were destroyed. • Soil and rock properties — when soil is saturated and loose, ground shaking may cause liquefaction (saturated soil temporarily loses strength and behaves like a liquid) → buildings may sink or tip over. Soft, loose soil also shakes more intensely. E.g. 2010 Port-au-Prince, Haiti earthquake: most areas	• Availability of water (ground / surface) that can cause lahars — where water is available, lahars can develop and bury / destroy properties. E.g. 1991 Mount Pinatubo, Philippines: heavy rain triggered a lot of lahars → 100,000 houses destroyed. • Prevailing wind conditions spreading tephra / volcanic ash — the strength and direction of wind affects how far tephra is distributed; stronger wind causes a larger spread, over hundreds of kilometres. E.g. 1991 Mount Pinatubo, Philippines: ashfall and tephra spread over a large distance due to fast wind speeds (20 m/s).

were on relatively soft soil → more than 220,000 buildings collapsed.	
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Factor 3: Exposure to Hazard

Earthquakes	Volcanic eruption
- Population density — a higher population density means more people in buildings, so a higher likelihood of people being trapped and injured. E.g. Alaska, 1964 earthquake: population density 0.5/km², death toll 131. Indonesia, 2004 earthquake: population density 125/km², death toll 150,000. - Distance from the epicentre — the greater the distance from the epicentre, the lower the impact of the earthquake, as energy is dissipated further away. E.g. Christchurch, New Zealand, 2011 earthquake: <10 km from the epicentre, death toll 185. Rhodes, Greece, 2008 earthquake: 70 km from the epicentre, death toll 11.	The presence of human settlements near a volcano increases people's exposure to volcanic hazards. E.g. Mount Sinabung, an active volcano in Indonesia — despite its recent eruption in 2010, people continue to live and work near the volcano's restricted zone, drawn by the fertile soil despite the high risk of injury when an eruption happens.

Why Do People Continue to Live in High-Risk Areas?

Even though they know the risks, people continue to live there because they can respond to hazards in various ways:

Fatalistic approach	Acceptance approach	Adaptation approach
Accept the risk and resist evacuation. Typical of less developed countries, which have limited access to resources and knowledge.	Choose to live with the risk because of the potential benefits offered by the area.	Being well prepared for the hazard (e.g. for earthquakes).

Measures to Manage Disaster Risk

1. Land-Use Planning to Reduce Exposure

- Minimise development in high-risk areas.
- Strict guidelines or laws to control development.
- Hazard mapping to identify at-risk areas, based on past tectonic disaster data.

Describe with examples	Explain how this helps manage disaster risk	Success / Limitations
• Example: Japan. • Strict zoning regulations and building codes ensure new construction projects adhere to seismic safety standards. • In high-risk seismic zones, Japanese authorities impose land-use restrictions to limit development and occupation; certain areas may be designated as no-build or restricted development zones. • After the 1933 tsunami, residential land use near coastal areas was shifted to higher ground.	Fewer buildings are at risk of collapsing, as authorities ensure new buildings are built on 'safer' areas → lower risk of people being trapped under debris → able to escape → lower death toll and minimised damage. Reduced risk of damage → reduced spending on rebuilding.	• Costly, as the government needs to acquire land over unsafe areas. • Existing owners might be reluctant to give up land. • Countries with limited land may find this not feasible.

2. Hazard-Resistant Building Design & Monitoring / Warning Systems to Reduce Vulnerability

- Earthquake-resistant building design that can withstand ground shaking, such as shock absorbers and dampers to absorb vibrations.
- Reinforcing buildings with diagonal cross braces to retain building shape.

Describe with examples	Explain how this helps manage disaster risk	Success / Limitations
• Example: Taipei 101, Taiwan. • The building has a weighted damper (a massive pendulum-like device) installed near the top of	With such fittings installed, damage during earthquakes can be minimised, as the building can withstand ground vibrations → less likely	• Expensive.

the tower. It counteracts the building's sway caused by wind and seismic activity, reducing structural stress and minimising the risk of damage during earthquakes.	to collapse or be damaged → protects people and property inside → reduces death toll and possibility of property damage.	Costly and untested until an earthquake actually occurs.
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- Use of devices to detect seismic waves and ground deformation.
- Earthquake early warning systems use earthquake science to alert devices and people when the shaking waves generated by an earthquake are expected to arrive at their location.

Describe with examples	Explain how this helps manage disaster risk	Success / Limitations
• Example: Japan. • 1. Japan Meteorological Agency (JMA) — operates a large seismic network of seismometers, accelerometers and other instruments positioned across the country, detecting ground motion and seismic waves generated by earthquakes and providing real-time data. • 2. J-ALERT — one of the world's most advanced seismic early warning systems, using data from seismic sensors to detect the initial tremors of an earthquake and issuing automated alerts to government agencies, emergency responders, and the public via television, radio and smartphone apps, providing seconds to minutes of warning before strong shaking reaches populated areas. • 3. Earthquake Early Warning (EEW) systems — a network of sensors and monitors that sends	With such warning systems, people get a few seconds to minutes of advance warning, allowing them to take protective action such as seeking shelter and stopping trains and industrial processes → able to get to safety → reduces the likelihood of being hurt or killed → reduces death toll.	• Limited predictability. • Short warning times. • Technological and infrastructure limitations. • False alarms and issues of public trust. • High costs of installation and maintenance.

alerts to smart devices, informing people and providing advanced warning. • 2011 Tohoku earthquake — a signal was sent to stop bullet trains, saving thousands of passengers.		
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3. Increasing Preparedness for Response & Recovery, for Community Resilience

- Raising public awareness through education (posters, signs, workshops).
- Carrying out frequent evacuation drills.
- First aid training.

Describe with examples	Explain how this helps manage disaster risk	Success / Limitations
• Provides people with knowledge of hazards and how to respond (e.g. seeking shelter away from hazards, sealing windows and doors). • Drills help people become familiar with evacuation routes. E.g. 2011 Tohoku earthquake: 3,000 students of Kamaishi City survived, as their schools had disaster-prevention education programmes that included drills. • Example: Japan — a nationwide drill is held annually on 1 September, known as Disaster Prevention Day, which marks the anniversary of the 1923 Great Kanto earthquake that killed more than 100,000 people and levelled Tokyo.	Through such drills, people are prepared and know how to act during an earthquake → able to evacuate on time → reduces loss of life, hence lowering the death toll.	• Lack of resources, especially in developing countries. • Lack of capability of the community to organise itself. • Lack of effort to educate and train the community.

Response Strategies — Short-Term Responses (Immediately After the Earthquake)

Response	Describe with examples	Explain how this helps manage the impacts	Success / Limitations
Search & rescue efforts	- Search and rescue efforts deployed by the government immediately after an earthquake, to help find people trapped in collapsed buildings. The aim is to rescue people in the shortest time with minimal risk to survivors, usually using skilled rescuers and specialised equipment such as heat sensors and listening devices. - Example: Japan, 2011 Tohoku earthquake — 100,000 members of the Self-Defence Forces were sent out; rescue workers had a limited time of 3 days to rapidly search two towns for as many survivors as possible.	Able to reach survivors fast → people do not need to endure being stuck under debris → reduces the likelihood of crush syndrome / dehydration → reduces death toll.	Able to save people trapped in collapsed buildings and debris, but the time available to rescue people is limited — people may not survive for very long.
Timely evacuation	- Moving people from areas at risk of hazards as quickly as possible to safer locations, to reduce loss of life. - Evacuating people to temporary shelters where food, water and medical supplies are provided, or to higher ground. - E.g. 2011 Tohoku earthquake: 3,000 students of Kamaishi City survived, as they were able to evacuate to higher ground. - E.g. Mount Merapi 2020: a warning was issued, leading to a mass evacuation of local communities involving more than 700	Moving people from areas at risk of hazards as quickly as possible to safer locations reduces the loss of lives.	Cooperation from people may be an issue.

	evacuation centres, saving more than 10,000 lives.		
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Provision of Basic Social & Psychological Services

Governments and various agencies set up emergency shelters to provide temporary accommodation for those who are homeless, as they lost their homes to the earthquake.

Describe with examples	Explain how this helps manage the impacts	Success / Limitations
• Example: Japan, 2011 Tohoku earthquake — established emergency shelters in schools, community centres, temples and other public buildings in the affected areas. • Swiftly organised the distribution of emergency supplies, including blankets, bedding, clothing, hygiene kits and basic household items, to residents in emergency shelters. The Japanese Red Cross Society and local governments coordinated the distribution. • Deployed mobile kitchen units and food distribution centres to affected areas, preparing and distributing hot meals, ready-to-eat food packs and drinking water to survivors in emergency shelters and makeshift settlements. • Collaborated with international humanitarian organisations such as the United Nations World Food Programme (WFP) and the International Federation of Red Cross and Red Crescent Societies (IFRC), which provided additional resources, expertise and logistical support.	• These shelters provided temporary accommodation for displaced individuals and families, and the provision of food and medical supplies allowed those affected to continue surviving while navigating their situation → fewer people homeless and hungry → slightly improves health levels and lowers casualty toll. • Provision of mental health services and counselling support addressed survivors' mental health needs, allowing them to express emotions and share experiences → reducing feelings of isolation, promoting healing and recovery, and facilitating the restoration of social cohesion and	• Helps survivors cope with the disaster, and provides shelter for the homeless. • May not be sufficient, as some countries may not have the means to provide extensive aid. • Survivors may be subjected to cramped and unhygienic conditions. • Can help injured or psychologically disturbed victims cope with trauma and restore their livelihoods, though depending on the extent of the trauma,

Describe with examples	Explain how this helps manage the impacts	Success / Limitations
Medical teams and emergency responders were deployed to provide medical care, psychosocial support and counselling services to survivors experiencing physical injuries, trauma and emotional distress.	community bonds — essential for rebuilding communities.	this may be challenging.

Recovery Strategies — Long-Term Responses (Weeks or Months After the Earthquake)

Response	Describe with examples	Explain how this helps reduce the severity of damage	Success / Limitations
Rebuilding of infrastructure	- Rebuilding affected areas after the earthquake, to allow life to return to normalcy. - Example: Japan, 2011 Tohoku earthquake — the Bank of Japan pumped US\$183 billion into the economy, providing emergency funding to banks and financial institutions to ensure continued operation and prevent disruptions to the flow of credit. - This funding supported lending to businesses and households, facilitated reconstruction efforts, and bolstered economic recovery in affected regions, including financing infrastructure projects, housing construction, and the revitalisation of local economies.	This funding helped affected businesses and individuals recover from the disaster, through employment opportunities provided. Helping reconstruction efforts also helped affected people rebuild their homes and properties → helped displaced individuals and families regain stability, improve living conditions, and rebuild their lives after the disaster.	Stricter building codes ensure higher safety levels. Able to help stimulate the economy and restore the normal functions of society, though it may take a long time to rebuild and is not fully protected from all kinds of hazards.
Retrofitting surviving buildings with	Example: Japan, 2011 Tohoku earthquake — by 2016, the majority of residents were	This allows affected communities to rebuild their lives after the disaster,	Lack of resources; lack of cooperation

hazard-resistant features	rehoused in settlements enhanced with tsunami-resistant features. • In one port town, the ground level of new house sites was raised by 10 m, and two more seawalls were built.	and minimises their vulnerability and exposure to hazards → able to continue and move on with life after the disaster.	between various stakeholders.
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Summary: The Disaster Risk Management Framework

Disaster risk is shaped by three factors — the nature of the hazard, the vulnerability of those exposed, and their exposure to the hazard. Disaster risk management addresses these through mitigation (before a disaster), response (immediately after), and recovery (weeks to months after).

1. Nature of Hazards

- Earthquakes: duration of shaking; timing of shaking.
- Volcanic eruptions: chemical composition of magma.

2. Vulnerability

Vulnerability can be reduced by hazard-resistant building design and by monitoring & warning systems (predictions and timely warnings that allow people to evacuate).

- Earthquakes: quality of building design & construction; soil & rock properties (saturated / loose soil may cause liquefaction → higher disaster risk / damage).
- Volcanic eruptions: availability of surface & groundwater (can cause lahars → higher disaster risk); prevailing winds (can spread volcanic ash / tephra further away).

3. Exposure

Exposure can be reduced through land-use planning: minimising development in high-risk areas, setting strict guidelines to control development in such areas, and ranking areas by risk level (high / medium / low).

- Earthquakes: population density (higher density → higher disaster risk / damage); distance from epicentre (closer distance → higher disaster risk / damage).
- Volcanic eruptions: presence of human settlements (an eruption near human settlements → higher disaster risk / damage).

4. Community Resilience

Community resilience helps communities build the capacity to resist, adapt, and recover from impacts in a timely way. It is achieved by increasing community preparedness through:

- Public awareness through education.
- First aid training.
- Conducting evacuation drills.

Together, these help achieve mitigation efforts — preparing before any disaster occurs.

Possible challenges in building community resilience:

- Extent of resources — developing countries may lack the resources to invest in hazard-resistant buildings and land-use planning.
- Capability of the community to organise itself — lack of effort to educate and train people; political instability; corruption leading to loss of funding.

5. Response Strategies (Short-Term — Immediately After)

- Search & rescue efforts.
- Timely evacuation.
- Provision of basic social & psychosocial services to affected communities.

6. Recovery Strategies (Long-Term — Weeks to Months After)

- Restoring and improving the facilities and living conditions of affected communities.

Possible challenges in response & recovery:

- Lack of resources and finances.
- Difficulty in getting relevant stakeholders to collaborate and integrate disaster management practices into their own practice

TOURISM

Topic 1: Tourism Activity

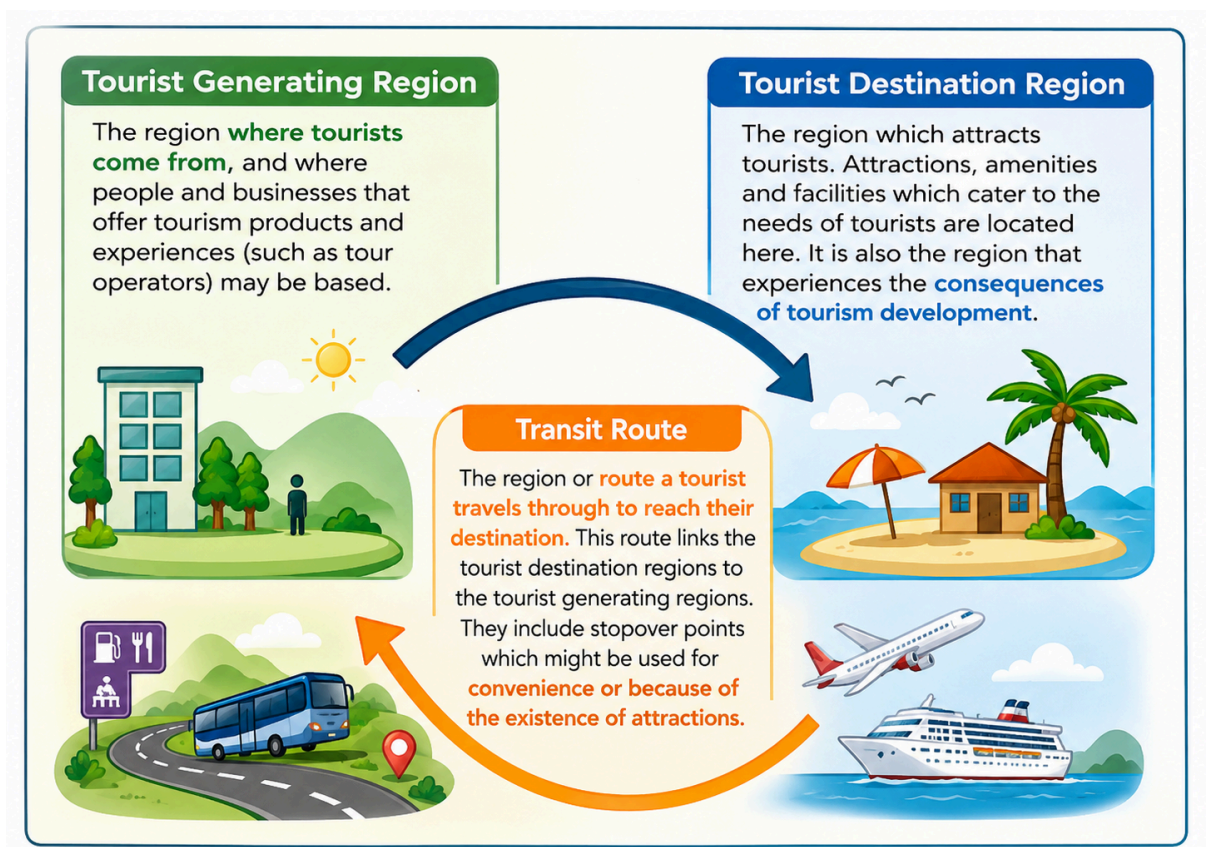
TOURISM SYSTEM

A tourist

- A tourist is a person making a trip outside his/her usual environment for leisure or personal purposes.
- The trip may be completed within the same day or may last several days, requiring overnight stays.
- **International tourists** refers to tourists who travel outside their own country.
- **Domestic tourists** refers to tourists who travel within their own country.

Definition of a tourism system

- A tourism system comprises three interconnected components:



- These components function to enable people to travel from the tourist generating to destination regions.

- They are interconnected-each component can affect and be affected by other components.

Characteristics of a Tourism System

1. The availability of transit routes influences travel between the tourist generating region and destination region. It affects the volume and direction of travel.
 - The volume of travel might be low if there are limited transit routes, while the volume might be higher if there are more transit routes. When the transit routes are inconvenient for the tourists, the volume might also be lower.
 - Also, if the transit route is attractive, the direction of the travel might change. For instance, tourists might travel via the transit route instead of travelling directly to the destination region.
 - i. For example, the lack of direct flights between Singapore and Brazil and the inconvenient transit routes between the 2 places have resulted in fewer tourists travelling from Singapore to Brazil.
 - ii. For example, some travellers may find the eight-hour direct flight from New Delhi, India to Singapore too tiring. Also, there might not be direct flights that suit their schedules. Thus, they may choose to take a shorter transit route to Bangkok, Thailand before continuing their journey to Singapore.
2. The tourist generating region and the destination region are interdependent. There are two relationships between the two regions.
 - The movement of tourists from generating to destination regions or the decision to travel occurs because of a combination of push and pull factors.
 - i. Push factors are found at the generating regions, and they push or cause a tourist to want to leave the generating region. These factors are usually negative in nature and may be due to the environment in the generating region, like a stressful work environment, or an unpleasant living environment which may be overcrowded or polluted, or a lack of recreational and entertainment options.
 - ii. Pull factors are found at the destination regions. These regions have certain qualities which attract or pull tourists and are only found at the destination and not found at the generating region.

They are usually positive in nature and include scenic beauty, special events like concerts and festivals, and attractions, facilities and amenities that provide positive experiences.

The interplay between push and pull factors creates the need for tourists to travel. For example, a tourist might travel because of stress from work (push factor) as well as the relaxation activities found at the destination region (pull factors)

- Tourists, business and organisations in the tourist generating and destination regions are mutually dependent /interdependent on each other.
 - i. For example, tourists need tour operators in tourist generating regions to help them plan their trips. Tour operators depend on hotels in the tourist destination regions to provide accommodation for tourists. Hotels depend on tour operators to direct tourists to their hotels so they can earn profits.
- 3. Tourism interacts with nature, communities and economies, and this results in positive as well as negative consequences. (These are environmental, social and economic impacts). It affects the local community as well as beyond.
 - The interaction between tourism and nature, communities and economies can be positive or negative. A negative example is when tourists visit a nature park and irresponsibly leave behind waste. As a result, the environment may be damaged. A positive example is when tourists pay local villagers to teach them how to create traditional pottery and generate revenue for the villagers. This contributes to the local economy and helps preserve local traditions.
 - Tourism is a global industry and influences both the local economies and global economy.
 - For instance, in 2020, tourism contributed more than US\$4 trillion to the global economy.
 - Tourism activities also impact the global environment. For example, tourism contributes 8% of global greenhouse gas emissions and contributes to global climate change and its impacts on the global environment.
 - Changes in nature, communities and economies within the local environment can affect the tourism system. For example,
 - i. Events occurring in tourist generating regions like an economic recession may reduce the desire to travel among potential tourists. This reduces the number of tourists travelling. As a result, there will be a decrease in income (negative) and less damage to the environment (positive).

- ii. Changes in the tourist destination regions also affect the tourist generating regions and transit routes. For example, if a new attraction opens at the destination region, tourists who have visited it will return to the tourist generating region and share their positive experiences at the new attraction. This will motivate more tourists to travel there, resulting in an increase in income for both the transit routes and destination region.

REASONS THAT LED TO THE GROWTH OF TOURISM

Reason 1-The motivation to travel:

The motivation to travel refers to a set of needs that can be satisfied by travelling. These needs are created by a combination of push and pull factors, like the need for:

- a. relaxation, and to
- b. discover unique travel experiences and
- c. achieve personal growth and self-fulfillment. The motivation to travel has increased because of
 - i. globalisation where the world becomes more connected and \
 - ii. the greater access to the media causing people to become more aware of different travel opportunities

Tourists are often motivated to travel to fulfil not just one need, but a mix of different needs. At the same destination, different tourists may participate in the same activities to fulfil different needs. A single tourism activity can also fulfil multiple needs.

Not everyone has the same motivation to travel, because individuals have varied needs and their motivation to travel is unique. There are 3 motivation needs:

1. Need for relaxation
 - The need for relaxation is due to the increasing pressures of work and hectic lifestyles which motivate people to travel to relieve stress. Nowadays, many people today work long hours and they view travelling as a way to rest and rejuvenate.
 - Different people travel to different destinations to engage in different tourist activities to relax:
 - Some seek nature to escape their urban environment, rest, and enjoy scenic views. For example, one of the main reasons tourists visit Phuket, Thailand, an island famous

for its scenic beaches, is to rest and relax.

- Others prefer recreational activities like visiting theme parks because the activities at theme parks provide them with a different routine from their daily lives and enable them to escape from their stress and worries. For example, Universal Studios Singapore, which attracted 18m visitors in 2019, is a theme park that features rides, shows and attractions. It allows visitors to experience a completely different setting from their usual lives.

2. Need to achieve personal growth and self-fulfilment

- People are increasingly travelling for self-growth and to achieve their fullest potential.
- Travelling allows them to develop themselves further by learning something new or improving their existing knowledge and skills. They choose a destination where they can pick up a new skill such as cooking local cuisines or learning about farming methods from the locals. For example, many cooking schools have opened in Bali for tourists to learn more about Balinese cuisine. Another example is tourists travelling to sacred religious sites for pilgrimage tourism to learn more about their religion and grow spiritually. For instance, more than two million Muslims travel to Mecca in Saudi Arabia for pilgrimage every year where they perform rituals for spiritual growth.
- Some also participate in activities that are challenging or adventurous such as mountain climbing or skydiving to fulfil their potential. They feel that they are being stretched physically and emotionally to achieve personal growth.
 - For example, in the last few decades, the number of tourists climbing Mount Everest has increased as they are motivated to challenge themselves to climb the high mountain.

3. Need to discover unique travel experiences

- Some people travel to gain unique travel experiences to satisfy their curiosity about the world. They want to explore different environments and cultures that are not widely known, so they often seek places that are less travelled to, remote and unique. They also participate in special or uncommon tourism activities like trekking along the slopes of a volcano.
 - Social media has raised interest in unique destinations and activities, especially among younger travellers.

- Development in transportation has also connected remote places to major cities, making many places more accessible. For example, the number of tourists going to Antarctica has increased significantly in the last two decades as many of these tourists seek to satisfy their curiosity about one of the world's last uninhabited regions.

Reason 2-Increase in ability to travel:

The increase in ability to travel refers to the conditions that allow a person to travel. There are five conditions that allow tourists to travel:

1. Increase in disposable income
 - With more disposable income, people have more money to spend on luxuries like travelling, and this has led to tourism growth.
 - After World War II, economic development led to an increase in disposable income and there was more travelling in North America, Western Europe and Japan. Since the 1990s, rapid economic growth has been taking place in developing countries like China and India and this has led to the creation of a fast-growing middle class with more disposable income to spend on travelling. For example, in China, the gross domestic product (GDP) quadrupled resulting in an increase in international departures from China from 9 million in 1999 to 154 million in 2019.
2. Increase in leisure time
 - Since the 1950s, governments and businesses in both DCs and LDCs have given people more leisure time. There has been an increase in paid leave, more public holidays and shorter working weeks, which give people more time to travel. For example, in 2015, the Chinese government encouraged employers to give workers half a day of paid leave on Fridays during the summer months to help boost domestic tourism.
 - The increase in paid leave also increases the ability of workers to finance their travel.
3. Business Innovations in tourism-related industry
 - Business innovations have provided value-for-money experiences, including offering more affordable travel options which have resulted in an increase in demand for tourism.
 - For example, tour operator Thomas Cook invented tour packages during the Industrial Revolution. This brought tourism to the masses. Such tour

packages made travelling affordable for many people because tour companies purchase transport and accommodation in bulk at discounted prices. Thus, they can sell them off as tour packages at competitive prices.

- Nowadays, tour operators are being replaced by travel websites and applications that provide more personalised and value-for-money travel experiences. Travellers can plan their own holidays and search for more affordable options.
- For example, websites such as Expedia and Trivago have search engines for travelers to compare prices, read reviews and book their trips directly on the website. Often, these websites also offer promotional prices for transport and accommodation which make it even more affordable to travel.

4. Lower transport costs

- Air transport has become more affordable. Budget airlines have resulted in a significant drop in air fares by offering cheaper air tickets. It helps to lower transport costs. This is because they use fuel-efficient planes which reduce fuel cost, and they also fly to smaller airports which charge cheaper fees. For example, budget airlines such as AirAsia have become increasingly popular for travel within Southeast Asia because of their lower fares.

5. Lower accommodation costs

- There is an increase in the variety of accommodation types which include rented properties, hotels and bed and breakfast stays. Business innovations have made it possible for property owners to rent their properties out to tourists at different prices. The wide variety of accommodation can cater to the different budgets of the tourists. It has lowered the cost of accommodation and has made travelling more affordable.
- For example, AirBnB is a business innovation that offers accommodation at competitive prices. It connects people who want to rent their homes out to tourists, increasing the variety of accommodation that tourists can choose from. In 2019, it was estimated that more than 2 million people stayed in an Airbnb property every day.

Reason 3 – Increase in Mobility in travel:

Mobility in travel refers to the ability to move around easily and conveniently to tourist destinations.

1. Expansion of public transport services and infrastructure.

- The construction of more transport infrastructure such as roads, railways and airports has increased the connectivity between different parts of a country, as well as between countries. As a result, tourists can travel to more places in much shorter times.
 - For example, the opening of Changi Airport's Terminal 4 has increased the number of flights from other parts of Asia to Singapore, making travel within the region more convenient.
 - Many countries have also expanded their network of public transport services by increasing the number of public bus and train routes. This has made travelling within the destination region more convenient for tourists, leading to tourism growth. For instance, public transport services and infrastructure in Singapore have expanded in recent decades. For example, the Downtown MRT line was developed to increase the accessibility of tourist attractions such as Gardens by the Bay.
 - There are also clear maps and signages available in multiple languages at MRT stations, which help tourists navigate their route.
2. Introduction of new modes of travel.
- The rapid development of transportation technology has resulted in new modes of travel which allow tourists to travel faster and further via land, sea and air transport. For example, in 1965, a conventional train would take 6 hours and 40 minutes to travel from Tokyo to Osaka, but with the introduction of the Shinkansen or bullet train, the trip has been shortened to 3 hours and 10 minutes. This has increased tourism in cities that are served by the Shinkansen network.
 - Commercial air travel has also helped tourism. Since the 1950s, technological developments enabled the production of aircrafts which can travel faster and further and are more fuel-efficient. This has resulted in:
 - A reduction in travelling time,
 - greater convenience of travelling long distances, and
 - lower travelling costs. For example, in the early 1950s, a commercial flight between Singapore and London took 2-4 days, with many stopovers in between. But nowadays, the modern aircraft has reduced the travelling time between Singapore and London to about 14 hours, without any stopover.
 - Planes are also more fuel-efficient, and this has reduced the price of air tickets, making it cheaper to travel.
3. Increased private car ownership
- Private car ownership allows families to travel comfortably and

conveniently in their own cars to nearby attractions for leisure, especially within their own country. With their own private cars, there is more freedom in deciding on which destination to visit, the number of destinations to visit and the time spent at each destination. As a result, there has been an increase in domestic tourism.

- For example, private car ownership in the USA increased significantly in the 1950s. It led to an increase in domestic tourism as American families started travelling more around the country in their own cars. This led to the expansion of the hotel and motel business in the country along main highways between towns.
- Another example is India where the number of cars has grown exponentially. As a result, Srinagar City in India has seen an increase in the number of tourists visiting its holy sites and snow-clad mountains by car in summer.

DEVELOPMENT OF TOURIST DESTINATION REGIONS OVER TIME

Stages of Tourism Development

- Tourism is very dynamic, and tourism destinations evolve over time. They progress through six different stages. However, not all destinations go through all six stages in a linear fashion; some destinations may skip certain stages.
- Summary: A tourist destination grows in popularity when investors, tourists and tour operators move into a newly discovered location. But over time, it may lose its popularity and start to decline. The destination can regain popularity if measures are taken to rejuvenate it. If nothing is done, then the tourist destination declines.

7 Stages of tourism development:

Stage	Tourist Arrivals	Tourists' contributions to the local economy	Features of the destination	Example
Stage 1: Exploration	- There is a small number of adventurous tourists who are keen to experience something new. They travel there individually. - The visits are irregular and do not occur throughout the year.	Tourists make minimal contributions to the local economy as they tend to visit the destinations for their natural and cultural attractions which do not bring in much income.	- The main attractions are: - natural attractions which have beautiful scenery or an attractive, un-spoilt natural environment like beaches - cultural attractions with rich historical (eg castles, ancient temples) and heritage value(eg indigenous tribal villages) - There is a lack of tourist facilities like hotels, restaurants, and shops.	- Jaco Island in Timor Leste - There are few international visitors because it is: - inaccessible - there is a lack of tourist facilities - The main attraction is one single national park with attractive beaches
Stage 2: Involvement	Tourist arrivals increase as awareness about the destination spreads by	Tourists' contributions to the local economy begin	There is an increase in goods, services and facilities to cater to the tourists' needs	- Kuang Si Waterfalls in Laos - There are more tourists now

	○ word of mouth ○ Advertisements ○ the government and media ● Tourist arrivals vary at different times of the year, leading to peak and non-peak tourist seasons	to grow	● Goods and services are usually provided by the locals like food and drink vendors. They also provide leisure services like boat rentals.	because the local authorities invested money to improve the facilities at the waterfall. As a result, there was an increase in travel agencies and transport providers who provided transportation between the waterfall & town area.
Stage 3: Development The destination becomes recognized as a tourist destination	● Tourist arrivals increase rapidly.	● Many local workers are employed, and this contributes significantly to the local economy ● Workers from other parts of the country and from other countries are attracted to the destination to find work	● There is a faster pace in the development of: ○ tourist facilities like tourist information centres, ○ infrastructure like airports, ○ amenities like shopping centres, ○ Attractions like amusement parks ● Large businesses start to build elaborate facilities and man-made attractions ● There is heavy advertising of the destination	● Phu Quoc island in Vietnam ● Tourism is growing rapidly, and the island has become known for its beautiful beaches ● The country invested in building an international airport and seaport ● As a result, it attracted major tourism businesses. ● In 2019, there was a rapid increase in

			There is an increase in the number of large and medium businesses in retail and leisure.	tourist arrivals to 5.1 million, and tourism now provides 70% of jobs for the local population.
Stage 4: Consolidation	- The total annual tourist arrivals at the destination outnumber the local population. - The growth in annual tourist arrivals started to slow down.	- The tourism industry dominates the local economy. - It continues to employ many workers and contributes significantly to the local economy.	- There is a slowing down in the number of attractions and facilities built. - Majority of tourist facilities and hotels are owned by large multinational companies	- Goa in India – Its attractions range from Portuguese culture and architecture to natural landscapes. - Tourism employs 35% of the state's population. In 2019, foreign tourists (7m) outnumbered locals (1.5m). - Many large multinational companies such as Marriott International own hotels like Westin Goa and the W Goa.

Stage 5: Stagnation	• Arrivals peaked and began to decline as the destination reached or exceeded its carrying capacity • Negative effects that make the destination less attractive begin to show. It discourages • tourists from visiting ◦ For example, the high number of tourists result in more littering. There is a struggle to clean up, resulting in land and water pollution which discourages more tourists from visiting.	• The contributions to the economy start to stagnate.	• The destination may no longer be attractive, and the facilities and attractions start to decline as they become old and run down. • Tourists start to feel that the location no longer has anything new to offer in terms of experience or interest.	• Hawaii, USA (1990s to 2000s) – Tourism arrivals and expenditures began to decline in the late 1990s and early 2000s. • Waikiki, a major tourism spot, had become very crowded and the facilities and attractions were getting old and run down and in need of major renovations.
Stage 6: Post-Stagnation – Decline	• Tourist arrivals decline significantly if nothing is done to revive the destination	• Contributions to the local economy decline significantly	• Local businesses are badly affected and may close down. This negatively affects the economy and livelihoods. • There is less money to	• Blackpool, UK (1990s): • It lost its attractiveness as a popular coastal tourist destination

			maintain and improve the facilities, and they deteriorate even further.	because of competition from other European coastal locations with more competitive pricing. • With fewer tourists and less income, many old inns deteriorated or shut down.
Stage 7: Post-Stagnation – Rejuvenation	• Tourist arrivals increase as the destination becomes more attractive again due to investments and funding to develop new attractions and facilities • The authorities re-brand the area	• Contributions to the economy increase again.	• The government provides funding to: ◦ Redevelop the area (e.g. building new facilities and attractions) to make it more attractive, ◦ re-brand the revamped destination by advertising about it. • This stage may not occur for all destinations.	• Blackpool, UK (Present): • Local authorities engaged the private sector to invest £300 million to build Blackpool Central, a world-class leisure development which aims to attract 600,000 visitors annually. • The area then re-marketed itself as a Muslim-friendly and disabled-friendly

				destination
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DIFFERENT PERSONALITY CHARACTERISTICS OF TOURISTS

Spectrum of Personality Characteristics

- The 2 personality types at each end of the spectrum are the dependables and venturers. Only a small group of tourists belong to these two extremes; most tourists fall between the extremes and have a mixture of personality characteristics of both extreme groups.
 - Dependables are people whose daily lives are predictable.
 - Spending pattern – They are cautious about how they spend their money.
 - Source of influence – Their travel decisions are guided by authority figures. For example, they follow the travel trends set by venturers and public figures.
 - Preference for travel activities – They like structure and routine, so they prefer mass tourism or packaged tours because of the predictability and routine nature of the activities as there is a fixed itinerary. For instance:
 - They travel in groups as they like to feel comfortable and secure.
 - For their convenience, they also tend to visit popular and familiar destinations which have well developed tourism facilities and amenities.
 - They are more likely to return to the same place.
 - Venturers are people who want to explore the diversity in the world.
 - Spending pattern – They spend their money readily.
 - Source of influence – Their travel decisions are guided by their personal judgement.
 - Preference for travel activities – They prefer niche tourism where they can make their own plans. This is because they:
 - prefer to be spontaneous and participate in a diversity of activities. \

- They like to explore less developed, unique places which allow them to participate in new experiences and activities.
- They also like to visit a new place each time they travel.
- They usually travel alone, and
- set travel trends for others to follow.

Influence of Personality Characteristics on Travel Patterns

- The personality characteristics of tourists can determine their travel preferences and patterns such as their choice of destinations and tourist activities.
- This is because the features of a tourist destination may appeal more to specific personality characteristics. Also, tourist activities that cater to certain personality characteristics may only be found in certain destinations.
- For example, Mongolia mostly attracts Venturer-type tourists who are comfortable with fewer tourist amenities. They visit the more undeveloped areas like the plains or grasslands, which may not have convenient tourist facilities. However, there are still some Dependable-type tourists who visit the urban attractions in Mongolia.

Influence of Personality Characteristics on Tourist Destinations

- Planners and stakeholders can develop tourist destinations in a way that attracts certain personality characteristics. They can develop certain features or make available certain activities that cater to the preferences of the selected type of tourist. For instance, to attract more Dependable-type tourists, more facilities and amenities that offer convenience can be developed.
- Personality characteristics can influence the way a tourist destination evolves over time. While a destination may be more appealing to certain personality characteristics at one moment, the destinations are dynamic. As they evolve, their features change, and the type of tourists they attract will also change. For instance, tourist destinations may evolve from one that appeals to more Venturer-type tourists to one that appeals to more Dependable-type tourists. This is because Venturer-type tourists often set travel trends that influence the travel decisions of Dependable-type tourists.
- An example is Costa Rica. It used to attract mainly Venturer-type tourists because of the natural environment. However, it has evolved over time and began attracting more Dependable-type. Hence Costa Rica began losing its appeal to Venturer-type tourists. To remain profitable, tourist authorities were advised to protect its natural environments as well as promote adventurous tourist activities to attract Venturer-type tourists.

Topic 2: Why has tourism become a global phenomenon?

TRENDS IN TOURISM

Influence of Globalisation on Trends in International Tourism

Before globalisation, information was not easily shared due to physical distance, and the world was less connected as there were also few modes of transportation to get around. But with globalization, the physical barrier of space has been reduced. The advancements in technology and transport have allowed people across the world to communicate easily with one another, while efficient transportation has allowed people to travel easily to different parts of the world.

Globalisation has 2 effects on tourism:

1. Globalisation has resulted in the continued growth of international tourism.
 - Globalisation has increased the ability to travel:
 - People now have greater ability to search and buy tourism-related services from anywhere.
 - This has increased the competition among businesses to get their customers, which results in the incentive to create more value-for-money travel experiences to attract more tourists.
 - As a result, tourists can enjoy more affordable tours which will increase their ability to travel.
 - Globalisation has increased the motivation to travel because people have greater access to new ideas on tourism destinations and experiences from all over the world, especially with new online media (e.g. social media and the internet). For example, London's Kings Cross Station has become popular with tourists due to the Harry Potter film series.
 - Globalisation has increased the mobility in travel. As places become more connected because of the availability of different transport modes, travelling has become more convenient, increasing tourists' mobility in travel. For instance, nowadays, tourists can find more direct flights between cities.
2. Globalisation has made tourist generating and destination regions more diverse:
 - Tourist generating regions have become more diverse. While most tourists come from developed countries in Europe and North America, there has been an increasing number of tourists coming from rapidly

developing countries in the Asia Pacific and South America such as China, India and Brazil.

- Destination regions have become more diverse. Before the 1980s, European countries were among the most popular tourist destinations. However, in recent years, while European countries are still the most popular tourist destinations, there has been a shift in the popularity of tourist destinations. The less developed countries, especially in the Asia Pacific region, have seen a rapid increase in tourist arrivals. Today, China, Thailand and Malaysia are among the world's most popular tourist destinations.

Change in the Demand for Tourism

There have been 2 changes/trends in the demand for tourism:

1. There is Increasing popularity of remote destinations and 'second cities'

Tourists are increasingly looking for new destinations to fulfil their need to discover unique travel experiences. They look at remote destinations and 'second cities' for these experiences.

Previously these remote destinations and 'second cities' were not accessible or not easily accessible. However, globalisation has brought many improvements:

- a. The advancements in communications and transportation have reduced the barriers previously posed by physical distance. Advancements in transportation, such as new modes of travel and the expansion of transportation infrastructure, like airports, have also resulted in remote destinations becoming more accessible.
- b. Globalisation has also facilitated a greater flow of information about these destinations. Tourists can easily share their novel travel experiences in remote destinations or 'second cities' to entice other tourists to visit.
- c. These travels can now be more easily planned and booked online.
- d. For example, remote destinations, like Antarctica, have become more popular as it is one of the world's last untouched regions. The increased availability of cruise services to Antarctica has also made it more convenient to travel there.
- e. With better connectivity in transport such as through domestic flights or rail networks, access to 'second cities' is also enhanced. 'Second cities' refer to the lesser-known destinations in a country that offer tourism experiences.
- f. These places are often promoted to avoid exceeding the carrying

capacity in the more popular tourist hotspots. They aim to divert tourists away from tourist hot spots and enable their environments to recover.

- g. Tourists are also increasingly visiting 'second cities ' to fulfil their need for unique travel experiences in less crowded environments. They are also cheaper, so they can enjoy lower travelling costs compared to those at tourist hotspots.
 - h. Visiting 'second cities' is becoming popular, especially among younger travellers, as new online media increases tourists' awareness of these places.
 - i. For example, instead of going to London in the UK, tourists are increasingly visiting the city of Manchester to experience its arts and unique architecture. Many fans of the world-famous football clubs. Manchester City and Manchester United, also visit the city to view the home stadiums and watch their favourite teams play.
2. There is the emergence of new experiences including adventure, heritage, sports and health tourism.

Tourists are looking for different or exclusive tourist experiences or activities to satisfy their interests. Hence, new forms of tourism based on a specific area, interest or activity have emerged. Globalisation also increased the popularity of these novel experiences as people are able to easily share and get more information about them through online media.

a. Adventure Tourism

- Motivation and Type of Activity: It is a form of tourism where tourists travel to natural environments and participate in challenging physical activities like mountain climbing and skydiving. They attract tourists who seek to achieve personal growth and self-fulfillment.
- Location: They usually occur in places of natural scenic beauty.
- For example, trekking on Mount Everest is becoming more popular with adventure tourists who want to challenge themselves and achieve their full potential by climbing the highest mountain in the world.

b. Heritage Tourism

- Motivation and Type of Activity: It is a form of tourism where tourists participate in activities to experience the culture and learn about the history of a place. Heritage tourists want to fulfil their need for unique travel experiences and understand the rich and diverse global cultures outside their own country,

- Location: It occurs in places with rich history and culture, especially those which are UNESCO World Heritage Sites.
- An example is Machu Picchu in Peru. It is the ancient city of the Incas and attracts a million tourists every year who want to learn about its unique history and culture.

c. Sports Tourism

- Motivation and Type of Activity: It is a form of tourism where tourists observe or participate in sporting events. Sports tourists participate in the events to achieve personal growth and self-fulfillment, while those who observe the events just want some enjoyment and escape from the stress of work.
- Location: It occurs in places where sporting events are held, and which have sporting facilities like stadiums, courts and race tracks.
- For example, during the English Premier League, thousands of overseas football fans visit the city of Manchester to watch their favorite football teams play.

d. Health Tourism

- Motivation and Type of Activity: Health tourists travel to seek medical care or procedures to enhance their physical, mental or spiritual wellness. These medical procedures help them achieve a greater sense of self-fulfillment as they improve their well-being and self-esteem. Besides going for medical procedures, health tourists also seek activities that will help them relax and enhance their overall health, like yoga retreats and hot-spring tours.
- Location: They visit locations that provide medical care and procedures which are not available in their own country. It is also relatively cheaper compared to their own country, and there is a shorter waiting time for these medical care and procedure. These places have renowned medical services and wellness facilities.
- For example, Bali, Indonesia is famous for its numerous yoga and wellness resorts that are surrounded by scenic views.
- Another example is South Korea which is renowned for its advanced medical technology and services. More than two million health tourists visited the country in 2018 for cosmetic as well as non-cosmetic procedures.

Change in the Supply of Tourism

There are two changes/trends in the supply of tourism:

1. Small specialist operators are adding onto the services of mass market tour operators. Most tourism experiences and services today are supplied by mass market tour operators in the form of tour packages. However, small specialist operators are increasingly adding onto the services of mass market operators. Often, they supply tours for niche travel.
 - Mass Market Tour Operators
 - These are people or companies that supply tour packages to cater to large groups of people.
 - The tour packages include other tourism services like transport and accommodation.
 - Tour packages are attractive to some tourists because:
 - They are relatively cheaper as tour operators can buy the services in large quantities at low cost.
 - They are also more convenient as the tourists do not have to book the different tourism services individually.
 - Tour operators have better knowledge about the destinations and are able to provide the necessary help to the tourists when it is needed.
 - For example, Klook is one of Singapore's largest mass-market tour operators. They offer a large variety of tours to many destinations around the world at relatively affordable prices.
 - Specialist Tour Operators
 - These are people or companies that supply tours for niche travel.
 - Niche tours are not widely purchased as compared to package holidays as they specialize in specific destinations or tourism experiences that many market tour operators do not usually offer.
 - The specialist tour operators are experts in these experiences at specific destinations and are able to give advice and recommendations to tourists. These tours are often customisable as they cater to small groups of tourists.
 - Niche travel are becoming popular and there is greater interest in it due to the increasing use of online media
 - For example, Quark Expeditions specialises in tours to the Arctic and Antarctica offering experiences ranging from sea kayaking to iceberg cruising.

2. Tourism marketing is changing from traditional print and broadcast media to new online media.
 - Traditionally, tourism is marketed through traditional print (e.g. newspapers) and broadcast media (e.g. television).
 - However, with advances in information technology, these traditional media platforms are increasingly being replaced by new online media as more tourists begin researching for their trips online.
 - Up to 70% of tourists use the internet to research and plan their own trips. As a result, many tourism-related businesses are turning to online media to market their tourism services.
 - For example, Klook promotes its tour packages on multiple social media platforms, including Facebook and Instagram.

ECONOMIC IMPACTS OF TOURISM

A region can experience both positive and negative economic impacts of tourism at the same time. They tend to be more significantly felt in the destination regions as they are directly impacted by tourist spending.

Positive Economic Impacts of Tourism:

1. Employment opportunities in formal and informal tourism sectors
 - As the tourism industry is labour intensive, it creates a large number and wide range of employment opportunities for people of varying skills in both the formal and informal tourism sectors in the tourist generating and destination regions. For example, they can find jobs in transportation like transport operators and service staff on board the vehicles. There are also many jobs in leisure activities like tour guides and staff at tourist attractions, and in accommodation like hotel and food service staff.
 - Tourism employment can be found in the formal and informal sectors. Employees in the formal sector have:
 - fixed work hours,
 - a stable monthly income,
 - sign a written contract that gives the terms and conditions of their work,
 - contribute income tax.

- Employees in the informal sector, like a street-side performer or food vendor, have
 - irregular work hours,
 - fluctuating wages,
 - do not sign a written contract, and
 - do not contribute income tax.
 - The tourism industry helps to reduce the national unemployment rate. For instance, in 2019, there were 330 million formal tourism jobs worldwide which makes up about 10% of the global workforce. Between 2015 and 2019, about 25% of all new jobs were in the tourism industry.
2. Income generation from tourists' spending on consumer goods and services
- ▪ Tourism generates income for both the locals and governments in tourist destination regions. Locals can earn an income when tourists spend money on consumer goods and services offered by the locals such as accommodation and food. Governments can earn revenue from taxes on tourism spending, like the goods and services tax.
 - ▪ The money earned from tourism can be used to improve the infrastructure, pay for education and health services, which can benefit local communities. For instance, tourism contributes 4% to Singapore's GDP.
 - ▪ The income from tourism can help to alleviate poverty as it transfers wealth from wealthier to poorer regions. For example, in the 1980s, Maldives was one of the world's poorest countries. Today, its economy has grown significantly, and the lives of the locals have improved. It has developed into a middle-income country with low poverty rates. This is due to the tourism opportunities offered by its natural landscape.

Negative Economic Impacts of Tourism:

1. Economic leakages resulting in less tourism revenue.
- An economic leakage happens when revenue generated by tourism is lost to foreign-owned businesses for the import of goods and services to support the tourism industry. It includes import tax. Economic leakage also occurs when fees are paid to the foreign owners of the facilities, or when wages are paid to foreign workers.
 - Economic leakage is serious because governments will have less revenue to improve the country's standard of living. In some LDCs, economic leakages may be so significant that they can wipe out the economic benefits of tourism.
 - Economic leakages affect LDCs more than DCs because of the lower

incomes that people in LDCs generally have. According to the United Nations Environment Programme (UNEP), for every US\$100 spent by a tourist on a holiday to a LDC, only US\$5 remains in the local host community. There is a tourism leakage of 95%. Thus, a country may appear to be thriving from tourism, but it is actually not making any profit at all.

- An example is a safari holiday in Kenya. 83% of the income leaks out of the country through a foreign-owned hotel chain, the Western tour operator as well as the airline company. What remains is 17% of the income that goes to the safari company and the Kenyan government. The local community earns nothing from the formal tourism sector. Most of the local community may only earn some money informally, such as by selling arts and crafts or through cultural performances in hotels.
2. Overdependence on tourism, which increases vulnerability to a sudden fall in tourist numbers.
- A country which is over dependent on tourism for its income and employment is vulnerable to a sudden fall in tourist numbers. This may occur due to unexpected events like natural disasters, unfavourable political situations, economic downturn and the outbreak of diseases that affect the movement of people. It may cause the economic benefits from tourism to fluctuate and affect the livelihoods of people who depend on tourism for their income. Below are some examples:
 - Natural Disasters
 - Natural disasters, such as earthquakes, can cause (a) significant damage to tourism infrastructure such as airports, roads, hotels in destination and generating countries. It causes a lot of disruption and can hinder people from travelling. (b) People also fear for their safety and may postpone or cancel their travel plans.
 - For example, in 2017, parts of the Caribbean Islands were struck by a succession of powerful hurricanes. About 95% of the buildings were destroyed resulting in one million fewer tourist arrivals and an estimated loss of revenue of over US\$700 million.
 - Unfavourable Political Situations
 - Unfavourable political situations can lead to riots and protests in a country. This can have a significant negative impact on tourism because it can cause a shortage of food, looting, violence and the closure of hotels and tourist

attractions.

- Tourist arrivals will drop because tourists are dissuaded from visiting these places as they fear for their own safety. Governments may choose to close off the affected area or issue a travel advisory to discourage travelling to the affected areas to ensure their safety.
- For example, in 2020, there were protests in Thailand against military rule. Several countries issued travel advisories to its citizens to dissuade them from visiting Thailand, which reduced tourist arrivals in Thailand.

■ Economic Downturn

- During an economic downturn, the economies of countries are negatively affected. There are usually large-scale retrenchments as companies try to cut costs, resulting in massive loss of jobs. It will lead to unemployment and a drop in the income levels of the people in the affected countries. As a result, there will also be a reduction in disposable income for spending.
- People may choose not to travel to cut back on their spending. Hence destination regions may see a reduction in tourist numbers.
- For example, the Maldives suffered a drop of 4% in tourism arrivals in 2009 due to the global economic downturn.

■ Outbreak of Diseases

- When there is an outbreak of diseases like a pandemic, people may be afraid to travel as they worry for their own safety. They may be infected by the disease and become sick or even die.
- Governments may choose to close off the affected area or issue travel advisory to discourage travelling to the affected areas to ensure safety, reducing the number of tourist arrivals.
- For example, during the COVID-19 pandemic which started in 2019, over 205 million people were infected and over 4 million people died. Many countries responded by going into a 'lockdown', causing international travel to shut down completely. In the first half of 2020, tourist arrivals globally fell by more than 65%. In the Maldives, tourism arrivals in 2020 were only about a third of

arrivals in 2019.

SOCIAL IMPACTS OF TOURISM

Tourism affects the tourists as well as the local community. These impacts on society can be both positive and negative.

Positive Social Impacts of Tourism:

1. Cultural Preservation.

- Many tourists are interested to visit places with rich cultural heritage and to learn more or participate in activities and festivals. Hence, there is an increased interest to preserve traditional cultural practices and art forms.
- Tourism can lead to cultural preservation because:
 - The planning authorities see it as an incentive to protect traditional cultural practices and art forms, as it attracts tourists who will bring in revenues that will boost the local economy.
 - The planning authorities will invest money to encourage such traditional practices, such as through the building of museums, or provide grants to encourage certain art forms to improve so they can attract more tourists.
 - As a result, the tourist destinations will be more appealing to tourists. It will also protect the traditional heritage and build up the locals' sense of belonging to their community.
 - By preserving culture, it ensures the passing down of knowledge and cultural practices from generation to generation as well as ensures the protection of cultural diversity for the local communities.
- For example, in China, shadow puppetry is an ancient art form which is culturally important to local communities as it passes on history and traditions through the stories told in the puppet shows. With tourists showing greater interest in shadow puppetry, the locals started to innovate to attract more viewers. For instance, they are now able to watch a shadow puppetry show using Virtual Reality (VR). As a result, this has helped to preserve and revitalise the art form.

2. Enhancing cultural ecosystem services.

- Protecting the environment for tourist activities and experiences can enhance the cultural ecosystem services offered by nature.
- This provides tourists and locals with many benefits: There are:
 - aesthetic benefits that provide opportunities to appreciate the

- beauty of nature,
 - education benefits that provide opportunities to learn through nature,
 - recreational benefits that offer opportunities to participate in relaxing and leisure activities in nature, and
 - spiritual benefits that provide opportunities to connect with their feelings and beliefs, especially their spiritual beliefs.
- For example, tourists are attracted to visit Sanjiangyuan National Park in China because of the sightings of the rare snow leopards. As a result, the villagers in Angsai village run a community-based tourism programme which allows tourists to stay with local families and have a chance to view these snow leopards in the wild. Sanjiangyuan National Park provides cultural ecosystem services such as:
 - Aesthetic benefits where the locals and tourists get to appreciate the beauty and scenery of the protected National Park.
 - Educational benefits where the tourists get to learn about the conservation of snow leopards and experience the traditional culture of the villagers.
 - Recreational benefits where the locals and tourists get to engage in relaxing recreational activities like snow leopard viewing, as well as other activities such as hiking or camping.
 - Spiritual benefits for locals who are Buddhists to connect spiritually as tourism provides an incentive to continue protecting the mountains and snow leopards which are sacred to them.

Negative Social Impacts of Tourism:

1. Commodification of Cultural Practices and Art Forms

- As the demand for heritage tourism increases, traditions may undergo commodification and lose their authenticity. The cultural value of the destinations for the tourists and local community weakens. This happens when the cultural rituals and art forms are turned into a commodity that can be bought and sold.
- For instance, cultural rituals may be exaggerated, staged, condensed or simplified to suit the needs and requests of tourists. For example, rituals or performances may be shortened to fit into a tourist's schedule. Art forms may also be mass produced for the consumption of tourists, reducing their cultural significance and authenticity
- Hence, cultural practices and art forms weaken in meaning and significance for both the local community and tourists.

- There may also be conflict among locals as some support using their culture for tourism while others fear losing the authenticity of their cultures.
- For example, in Kenya, many national parks are the traditional homes of African tribes such as the Maasai, who have a rich cultural heritage living in the savanna landscapes for generations. However, tour companies often organise interactive experiences enabling tourists to meet the local Maasai people. These are highly staged performances in hotels or less formal visits to open-air markets which sell traditional craft pieces.
- On the surface, these interactive experiences may appear to be valuable in reinforcing local traditions. However, they can be unsatisfying and even demeaning for both the Maasai and the tourists. Staged entertainment events are often highly exaggerated, and tourists rarely have a chance to interact in a personal and meaningful way.
- Both tourists and local Maasai people feel cheated and exploited by such inauthentic experiences and commodification. This can result in a loss of local values and even lead to possible conflict within the local communities as there may be disagreements over the commodification of local cultural practices.
- Another example is in Vancouver, Canada, where tourists can see totem poles that were created by indigenous people in Canada to represent their family histories. However, tourists can easily purchase miniature totem pole magnets as souvenirs. The magnets make no reference to the original indigenous artists, and are in fact mass produced in other countries, without any collaboration with the native tribes.
- Hence, the cultural significance of totem poles is diluted as it becomes just another item a tourist can buy off the shelves. This creates tension between locals who sell souvenirs for a living, and locals who feel that their culture is being diluted.

2. Cultural Clashes

- Tourists can be insensitive to local norms, including religious customs and traditions, which can result in resentment and negative sentiments towards tourists. This can lead to cultural clashes.
- This is commonly associated with over-tourism, where the number of tourists exceeds the carrying capacity of a tourist destination. It will bring negative impacts on the local communities and their environments (e.g. congestion, pollution), which increases the negative attitude towards the tourists.
- Some locals may also feel that tourism threatens their sense of identity

and increases their cost of living.

- The negative attitudes of local communities towards tourists may turn violent if it escalates. As a result, tourists may find themselves being victims of crimes.
- For example, in Hawaii, USA it was found that most locals did not want Hawaii to be opened up to the public after months of COVID-19 lockdown. Many tourists did not follow public safety guidelines such as wearing masks properly. This reinforced the negative attitude towards the tourists because for a long time, many locals have felt that tourists do not respect them, nor do they understand the complex Hawaiian culture of the indigenous people.
- Another example is across Europe, where some locals feel that tourism has threatened their sense of identity, and increased their cost of living. It has resulted in anti-tourist vandalism and protest. For instance, in Venice, Italy, there have been many protests against cruise ships entering the city because the local feels that the cruise ships cause pollution as well as damage the mud and sand foundations the city is built on, making the city more prone to flooding. They feel that it is a threat to the foundations of many historic buildings and artworks in Venice.

3. Rise in Crimes

- Destination regions may experience a rise in crime rates, such as pickpocketing, as tourists often carry large sums of money and other valuables, making them lucrative targets. Tourists are more likely to be relaxed and off guard, making them easier targets. Tourists may also find themselves being targeted if negative sentiments from the locals towards them continue to build up.
- The increased crime rates may also make locals feel less safe.
- For example, in 2017, a tourist bus in Barcelona, Spain was attacked by anti-tourist protestors who punctured the tyres and sprayed anti-tourism graffiti on the bus.

The nature of interaction between the local communities and tourists influence the social impacts of tourism:

- Tourists and local communities at tourist destination regions mutually affect each other. Their encounters with each other determine the nature of the social impacts of tourism.
- The relationships between tourists and local communities are often unequal because the tourism industry tends to focus more on the needs and wants of the tourists rather than the locals. The tourists are often in a position of power

and privilege, and the local communities have to accommodate and meet the needs of the tourists at their own expense. Negative social impacts are therefore usually more significantly felt by local communities at tourist destinations.

- The greater the difference in power between the tourists and the local community, the more likely that negative social impacts would occur.
- There is a dilemma because, although tourism brings about negative social impacts, the local communities also benefit from tourism and they would be seriously disadvantaged if tourists stopped visiting. There is also a dilemma for tourists as they are keen to support local communities and learn about their cultural heritage but do not want to be involved in exploitation.
- For example, in Thailand, tourists have to pay to enter the villages of the Kayan Lahwi women who traditionally wear gold coils around their necks. Some women are happy to wear the gold coils because they can showcase their culture as well as earn tourism revenue. However, many women also feel exploited by the tourism industry because some tourists view these women as exhibits that they have paid to view and pose with and take photographs of them without their permission. Since they are reliant on tourism revenue, the women may have no choice but to let themselves be photographed.

ENVIRONMENTAL IMPACTS OF TOURISM

How does tourism impact the environment?

The expansion of the tourism industry brings about impacts on the environment in both tourist generating and destination regions. Environmental impacts of tourism may be positive or negative, and they vary across places. Generally, impacts on the environment due to tourism are more significantly felt in the destination regions where the local communities live.

Positive Environmental Impacts of Tourism:

1. Conservation of Natural Environments and Preservation of Biodiversity
 - Local communities and governments in destination regions aim to maintain a pristine environment to attract tourists to visit. This is because tourism revenue generated from the natural environment may be used to fund the protection of the aquatic and terrestrial ecosystems, which in turn will protect biodiversity.
 - This could be done through:
 - Establishing protected areas or National Parks where development is restricted in order to ensure the habitats are

undisturbed.

- Employing and training specialised staff to run the national parks to care for these ecosystems.
 - Setting up environmental education programmes for tourists to encourage them to care for these ecosystems.
 - For example, visitors are charged an entrance fee of US\$100 to enter the Galapagos National Park in Ecuador. The revenue generated from the fees is channeled to the conservation and upkeep of the park, including the hiring of park rangers.
2. Restoration of Degraded Aquatic and Terrestrial Ecosystems
- Aquatic and terrestrial sites have the potential to be tourist attractions. This provides the motivation to restore degraded aquatic and terrestrial ecosystems to create new natural attractions, such as marine or national parks.
 - Ecosystem restoration is the process of stopping and reversing degradation, which results in improved ecosystem services and recovered biodiversity.
 - There are many ways to do this, such as through forest regeneration or reforestation. For example, Costa Rica has doubled its forest cover since the 1980s because of restoration. Due to reforestation, the provisioning and regulating ecosystem services provided by the rainforest have been restored.
 - Another example is in Mauritius and Seychelles, where coral reefs have been negatively affected by overfishing, unsustainable fishing methods and improper waste disposal. However, as coral reefs are economically significant for local livelihoods as well as the tourism industry, a regional project led by the United Nations Development Fund was introduced to restore the coral reef ecosystem.

Negative Environmental Impacts of Tourism:

1. Pollution

Tourism can result in pollution because of:

a. Greenhouse Emissions

- Tourism contributes a significant amount of greenhouse gases like carbon dioxide and nitrogen oxide, as travelling by air, sea or land requires large amounts of fossil fuels to be burned. In addition, services provided by tourism such as air-conditioned accommodation also contribute to the increase of greenhouse gases which can lead to enhanced greenhouse effect.

- Besides contributing to the enhanced greenhouse effect, these gases also contribute to air pollution.
 - Gases like Sulphur dioxide and nitrogen oxide also cause respiratory illnesses, such as asthma.
 - Air pollution can impact a large area and many people. It does not stop at the boundaries of the tourist destination regions because the air pollutants can circulate globally and can impact areas far from their sources.
- b. Inadequate Sewage Facilities and Improper Waste Disposal
- The tourism industry generates a large amount of waste. Some places do not have proper waste disposal systems, so tourists simply leave the litter behind. Some tourists may also not be aware how littering may impact the environment.
 - Leaving behind litter also leads to land and water pollution. For example, climbers that climb Mount Everest discard tents, food containers and even human waste on the slopes and glaciers in the area. This improper waste disposal means that trash is left to degrade out in the open. The chemicals from the trash can contaminate the soil and groundwater, thus leading to land and water pollution.
 - Many accommodations in tourist destination regions may not have proper sewage systems, such as wastewater treatment facilities to treat the sewage generated by tourists. The untreated sewage is simply disposed of into the sea, causing water pollution. For example, Boracay Island is a popular tourist destination in the Philippines. More than 200 local businesses, including accommodations, were not connected to the underground sewage line. So, the sewage was not treated and was dumped directly back into the sea, leading to a degradation of the water quality in the sea, threatening aquatic ecosystems along the coast.

2. Depletion of natural resources and threats to wildlife habitats

The construction of the tourist facilities and attractions to accommodate more tourists in the destination regions can lead to the following problems:

1. Depletion in Natural Resources
 - Tourism may result in an overuse of natural resources leading to a depletion of natural resources. These may lead to negative environmental impacts which may harm people and terrestrial and

aquatic ecosystems.

- An example is the depletion of water. The booming tourist industry in Bali uses approximately 3 million litres of water per day. Hotels and resorts take water from the public water supply system and large amounts of groundwater to meet the tourists' demand. This leads to the rivers in the regions drying up, reducing the amount of water resources available for locals, and terrestrial and aquatic species. Due to the limited supply of water to meet the rising demand, water prices have increased. The locals find that carrying out agriculture is increasingly unprofitable due to the rising water costs. As a result, many farmers face a loss of livelihood.

2. Threats to Wildlife Habitats

- Tourism may also threaten the habitats of flora and fauna and destroy the natural environment when tourist facilities are constructed. This is because tourist facilities and attractions may encroach (intrude) on natural areas.
- Careless tourists may trample on plants or make too much noise which can disturb and frighten off animals.
- For example, the government in the Maldives built large-scale facilities for accommodation, food and recreation for tourists. The construction of these facilities threatened the coastal environment because when rocks and sand are dumped into the sea during construction, they cover and suffocate the corals resulting in a lack of big corals near the newer resorts. In the long term, marine life is affected as the destruction of coral reefs causes animals that are dependent on the coral reefs for food and shelter like reef sharks to lose their habitats and source of food.

Topic 3: How to develop tourism sustainably?

ACHIEVING SUSTAINABLE DEVELOPMENT THROUGH TOURISM DEVELOPMENT

What is sustainable tourism development?

Sustainable development refers to development that meets the needs of the present population by achieving high standards of living for all and ensuring the ability of future generations to meet their own needs. Sustainable development will also help to address the negative impacts of tourism. For tourism development to be sustainable in the long term and meet the needs of all stakeholders, the three aspects of tourism, economic, social and environment, need to be balanced.

The needs of the three dimensions need to be balanced to guarantee tourism's long-term sustainability. An over focus on one dimension may lead to a neglect effect of the others. For example, if the government chooses to only focus on providing employment opportunities in the tourism sector, it may encourage more hotels or attractions to be built, without caring for the natural environment. This may then lead to the destruction of the environment, and tourism development ends up being unsustainable. Instead, while developing the economic dimension, it is important for the government to ensure that the environmental and social dimensions are also considered. For example, while building a new attraction, governments can consider: locating it in an area which requires minimal forests to be cleared. Locals can also be roped into this development so that their perspectives are considered.

The approach to sustainable tourism development varies from place to place. Not all three dimensions of sustainability are always balanced. While all three dimensions should be considered, greater emphasis might need to be placed on one dimension over others. For example, a tourist destination located in an untouched forest might require greater environmental consideration as compared to economic and social considerations. On the other hand, a tourist destination in an indigenous village that has a rich culture might require greater social and environmental consideration than economic consideration.

How can Tourism Development ensure Economic Sustainability?

There are two ways in which tourism development can ensure economic sustainability:

1. Tourism should continually provide employment opportunities and income growth
 - To ensure economic sustainability, tourism development should

continually provide employment opportunities and income growth. They have to ensure that tourism provides stable employment and a source of income.

- To ensure this, skills training on tourism management should also be provided to local employees to ensure their career progression.
 - Benefits of skill training:
 - It ensures that locals are able to have career growth in the tourism industry and income growth in the long term.
 - For locals who are seasonally employed, such skills training can provide them with a greater variety of skills so they can find employment during the off-peak season. This ensures that they have stable employment and income, leading to economic sustainability.
2. Tourism helps to result in more social services that raise the standards of living amongst locals
- Tourism development results in the provision of more social services (such as education, healthcare and job training) for the local communities. For instance, tourism revenue could be used to build schools or clinics for local communities in tourist destinations.
 - In the long term, social services allow local communities, particularly the disadvantaged communities, to receive quality healthcare and education opportunities. This raises their standard of living.
 - With more education opportunities, local communities could also seek better employment and income, thus further improving the standard of living. This will ensure economic sustainability.

EFFECTIVENESS OF STAKEHOLDERS IN INFLUENCING SUSTAINABLE TOURISM DEVELOPMENT

In tourism, stakeholders may include governments, international organisations, tourists, local communities and businesses.

- They need to work together to bring about sustainable tourism development.
- There must be a common understanding of what sustainable tourism development is and how it can be measured.
- All stakeholders should then have a say in tourism development and reach a consensus on what should be done.
- As the process to achieve sustainable tourism is continuous, they need to constantly monitor the impacts to ensure that the strategies minimise any negative impacts that may arise

Stakeholders:

Stakeholder	Role of Stakeholder in Sustainable Tourism Development	Effectiveness in influencing Sustainable Tourism Development
Government It is one of the most important stakeholders in influencing sustainable tourism development.	They do two things to influence sustainable tourism development: 1. They establish policies and create plans, like the overall framework for tourism development that facilitates sustainable tourism development. All stakeholders need to take action to adhere to the framework. This will minimise damage to the environment while maximizing benefits to the locals, like using part of the tourism revenue to set up and expand national parks and provide social services. ○ An example is the Singapore Green Plan 2030 which aims to make Singapore a sustainable tourism destination. The government will invest \$68.5m into the Tourism Development Fund. Tourism businesses can tap on the Fund to explore ways to be sustainable. In line with the Singapore Green Plan, one of Singapore's popular tourist destinations, Sentosa, plans to transform itself into a globally recognised sustainable tourism destination. ■ The Sentosa Sustainability Framework brings different stakeholders together to develop a series of plans, including conserving Sentosa's rich heritage, protecting the island's biodiversity and achieving carbon neutral status by 2030. ■ Businesses in Sentosa have also created their own plans in alignment with the framework. For example, Resorts World Sentosa has implemented strategies to reduce water consumption such as collecting and storing rainwater and using it to water its plants, and reducing single-use plastics. 2. The government also enforces regulations as they have a regulatory role in managing sustainable tourism by ensuring that policies and plans are adhered to. For instance, they can decide on the type of tourism activity to	The effectiveness of the government may be reduced due to two things: 1. 1.Poor enforcement In order for regulations to be effective, their active enforcement is required. However, some governments lack resources or political influence, or face corruption. They may not be able to ensure that regulations are adhered to, and this will hinder sustainable tourism development. 2. 2.Some governments decide to prioritise economic development instead of sustainable tourism development. They neglect the environmental and social dimensions of sustainability, which hinders sustainable tourism development. For example, every year, Mount Everest receives hundreds of tourists who wish to climb up the mountain, but poor enforcement of waste disposal has resulted in the mountain becoming

	have as well as the number of tourists who can enter the tourism attraction. An example is Bhutan. Tourism is controlled and the government ensures sustainable tourism development: ○ Tourists can only enter the country by organizing their trip with a licensed tour operator. ○ The tour operator must ensure that tourists adhere to the laws and regulations, like trekking on only designated tours. ○ There is a minimum spending per day that covers the tourists' accommodation, food, transportation and tour services. Part of the spending goes to the Sustainable Development Fee that provides free education and healthcare and alleviates poverty in the country.	more polluted. Tighter regulations have not been imposed by the authorities as it might cause the flow of tourists to be reduced, affecting the revenue received.
International Organisations They consist of governmental organisations (IGOs) and non-governmental organisations (INGOs)	● They help to coordinate efforts and initiatives across countries because of their knowledge, financial and technical expertise. They influence sustainable tourism development by: ○ a. Offering consultancy to countries on how sustainable tourism development can be achieved. ○ b. Providing financial assistance to different stakeholders. ○ c. Raising public awareness on how they can contribute to sustainable tourism development. ● ▪ One example of an IGO is the United Nations World Tourism Organisation (UNWTO). It worked with Ha Tay Province in Vietnam where handicraft villages were developed to create employment and provide more income to poor families. UNWTO helped by: ○ a. Providing consultancy and technical assistance. They came up with a marketing plan with the villagers to encourage independent travelers and tour operators to visit the village. The locals were also given skills training in making handicrafts to sell. ○ b. They also provided financial aid to carry out small-scale	The effectiveness of international organisations may be reduced due to two things: 1. There is a lack of understanding of local contexts because international organisations may comprise members from various countries and backgrounds. Hence, they may have different perspectives about certain issues, and they may also not understand the specific local context of the places they work with. Their actions therefore may not receive support from the locals, thereby hindering sustainable tourism development.

	infrastructural improvements like building public toilets and a village information board to support tourism. • Another example of an IGO that promotes sustainable tourism development is UNESCO. It introduced the People Protecting Places programme, which provides information for travelers on how to protect UNESCO World Heritage Sites as tourists. • For example, Wadi Al-Hitan in Egypt sees large tourist arrivals which threatened the safety of highly delicate fossil remains. With the help of UNESCO, visitors were informed to stay on footpaths while walking to key sites. This helped to preserve the integrity and natural beauty of Wadi Al-Hitan. • INGOs promote sustainable tourism as a solution to issues they are concerned about, like poverty or the environment. • An example of an INGO is ActionAid International that has established community-based tourism in Myanmar. In 2019, after years of engagement with local communities, as well as dialogue with the Ministry of Hotels and Tourism, a local travel group has been taking small groups of tourists on exclusive adventure tours of villages in the Myaing area. Community members are trained in hospitality skills and employed in the tourism industry. A community fund was created from part of the tourism revenue to invest in community development projects.	2. There is a lack of funding as many international organisations tend to be non-profit. This makes it challenging when it comes to choosing projects to provide financial assistance for. Without funding, some of their plans may not be able to be implemented, thereby hindering sustainable tourism development.
Businesses	• Businesses play a critical role in influencing sustainable tourism development as they often have the financial resources to do so, and they have the capacity to offer sustainable tourism experiences for tourists. • They have incentive to promote sustainable tourism as it will bring in profits. For instance, if they promote environmental sustainability, it will attract tourists to return to the destination which will allow their business to survive. • To influence sustainable tourism, they should get advice from the other stakeholders about implementing sustainable tourism practices, and	The effectiveness of businesses may be reduced due to two things: 1. Compromise: Businesses may compromise on sustainable practices to survive because they are organisations that aim to make a profit. Hence, they may prioritise making profits above sustainability. This can

	participate in decision-making for sustainable tourism development. • There are small-scale informal businesses, like local eateries, and large-scale international corporations like international chain hotels. Small tourism businesses allow locals to participate in the tourism industry, while large tourism businesses bring investment funds, expertise and opportunities to small tourism businesses. • An example is Quicksilver Cruises in Australia, which specialises in tours of the Great Barrier Reef. It focuses on ecosystem conservation. It also sees environmental protection as a way to ensure that their business continues to survive. Its efforts in sustainable tourism development include: ◦ Working with the planning authorities to promote ecotourism ◦ Putting together a research team of marine biologists that observe and monitor the marine ecosystem. The research findings help the planning authorities in managing the Great Barrier Reef. ◦ Conducting school visits and educational tours to promote marine conservation ◦ Working with other stakeholders through events to support local charities ◦ Investing resources and manpower to improve the local community.	hinder sustainable tourism development by, for instance, in order to make profits, they would not stop polluting the environment or exploiting resources. 2. Different Understanding Businesses have a different understanding of the term ‘sustainability’ and how to define and measure it. They may be greenwashing or marketing themselves as “sustainable” when their practices may not necessarily be so; they make people believe that their company is doing more to protect the environment than it really is.
Locals	Without the locals’ participation in the local tourism industry, sustainable tourism development cannot be achieved. Locals can do two things to influence and promote sustainable tourism development: 1. Seeking advice from other stakeholders regarding sustainable tourism practices ◦ Locals may not have the necessary knowledge and experience which other stakeholders such as governments, businesses and international organisations have, to pursue sustainable tourism. By seeking advice from other stakeholders, locals can adopt	The effectiveness of the locals may be reduced due to two limitations: 1. Lack of financial or technical assistance ◦ Some locals may not have sufficient financial resources or technical expertise to carry out the plans for sustainable tourism development. Often,

	sustainable tourism practices that have already been tried and tested. This will help to protect the environment and ensure that sustainable tourism can continue to grow and thrive. ○ For example, in Singapore, locals can seek guidance from the National Environment Agency to pursue sustainable tourism practices such as waste management and recycling when hosting international events, meetings and conventions. 2. Participating in decision-making for sustainable tourism development ○ The local people's local knowledge and experiences are critical in decision-making to ensure that sustainable tourism development is successful. For instance, they can minimise the potentially harmful environmental impacts of tourism by campaigning against over development or protecting the flora and fauna in their local community. ○ One way this can be done is through community-based tourism, a form of tourism where the local community seeks advice from and engages in decision-making together with other stakeholders. ○ This form of tourism prioritises the participation and empowerment of the local community to ensure that the benefits gained from tourism stay mainly with the local community.	this may also be due to them not having the information on how they can apply for financial or technical assistance. 2. Prioritising economic benefits over sustainability ○ Some locals may see personal economic benefits as more important than promoting sustainable tourism development. Hence, they may pursue tourism practices that may not be sustainable because it brings in a high income to support themselves and their families.
Tourists Tourists influence sustainable tourism development through their participation in tourist activities,	Tourists can influence sustainable tourism development by: 1. Developing a genuine interest in the tourist destination and seeking to enhance its environment, culture and economy ○ Tourists can choose tours or services which prioritise sustainable tourism or channel their revenue toward environmental conservation efforts. ○ An example is the Tiger Tops Elephant Camp in Nepal, an ethical elephant camp where tourists can live in tented camps near elephants. The elephants are allowed to walk around freely in the jungle with no routine imposed on them, and tourists can observe the elephants interacting in their natural state. The revenue	The effectiveness of the tourists may be reduced due to two limitations: 1. Some sustainable tourism options may be out of the tourist's budget ○ Tourists may find that it may cost more to choose a more sustainable option, like a sustainable tour operator. This may be due to the costs required to ensure the tourism experiences are

behaviour, actions, and Interactions with the locals and the environment.	generated by tourists in the elephant camp goes into a few areas, such as: ■ The conservation and upkeep of animals like tigers and elephants in the region ■ The investment in the education of local students, including providing school supplies and hiring teachers. ○ Tourists can also get involved in environmental conservation or community projects that benefit the tourist destination, like monitoring wildlife species, repairing buildings or maintaining footpaths. ○ An example of a project that tourists can participate in is the sea turtle volunteering conservation programme in Costa Rica. Tourists help care for injured sea turtles and patrol the beaches for sea turtles and their nests to protect them from poachers. 2. Interacting responsibly with the environment and people when they travel ○ Tourists can read about the local practices and culture and be mindful of their attire or behaviour when travelling. This allows them to show their respect to the local customs and cultures. ○ For example, in Bali, Indonesia, tourists should be aware that they need to dress modestly when visiting religious sites. They can also look after the environment when travelling, for example, by not littering or vandalising the areas they visit.	sustainable, such as fees to conserve the environment. Thus, some tourists may not wish to pay more to be part of the sustainable tourism development. 2. Lack of clear information, which may confuse tourists on the sustainable choices available ○ There are varied understandings of “sustainable tourism” and varied ways of measuring it. There is no standardisation. ○ Hence, tourists may be confused about whether a tourist business or their tourist practices are truly sustainable.
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Challenges faced by Stakeholders in influencing sustainable tourism development:

1. Stakeholders may have different understanding and measurements of sustainable tourism development. The understanding and measurement of “sustainable tourism” vary from place to place, as well as among stakeholders themselves. This can lead to a conflict of ideas between stakeholders, which may make coming to an agreement on sustainable tourism development difficult.
2. Stakeholders have differing amounts of control over resources. Different stakeholders have varying degrees of power and influence. Those with more power and control over certain resources like financial resources, might have more “say” over the final decision made. They may hinder sustainable tourism development.
3. Stakeholders have different priorities which can make negotiation challenging. Stakeholders often have different priorities. Thus, they may also have different strategies to achieve sustainable tourism development. This can make negotiations among them challenging. For example, locals may want to limit the number of tourists in their neighbourhood to minimise congestion, but governments may oppose this as it might reduce tourism revenue. In the end, there could be economic, socio-cultural, and/or environmental trade-offs that stakeholders may have to compromise and accept.

An example of how conflicts between stakeholders hinder sustainable tourism development is in the Isle of Man, United Kingdom. The Isle of Man used to be a popular tourist destination, but from the 1960s onwards, it began to decline in terms of its attractiveness as a tourism destination, eventually reaching a stage of stagnation:

- Conflicts and a lack of collaboration between planners, businesses and locals have made it more difficult to revive the island as a tourist destination.
- To boost tourism numbers, planners wanted to capitalise on the rugged landscapes as a motorcycle racing destination to boost tourism numbers. However, locals were against motorcycle racing as it could potentially damage the environment. They felt that their views were not considered seriously by the planners.
- Ultimately, these poor negotiation processes led to greater miscommunication and mistrust, which hindered sustainable tourism development.

EFFECTIVENESS OF DIFFERENT APPROACHES IN ACHIEVING SUSTAINABLE TOURISM DEVELOPMENT

There are 3 approaches in achieving sustainable tourism development: Ecotourism, Community-based tourism (CBT) and Pro-poor tourism (PPT). These can co-exist in the same tourist destination region and may even overlap at times.

ECOTOURISM:

What is ecotourism?

- Ecotourism is a form of sustainable tourism that often takes place in natural areas which are scenic and allows for tourists to experience nature.
- It aims to conserve the natural environment while benefiting the local community, therefore ensuring environmental, economic and social sustainability.
- Ecotourism often involves many stakeholders depending on the projects undertaken.
- Ecotourism experiences within a destination can vary across a spectrum. It ranges from hard ecotourism to soft ecotourism. Both hard and soft ecotourism may be found in the same tourism destination.
 - Hard ecotourism involves:
 - a smaller number of tourists
 - who have a stronger commitment to environmental conservation.
 - The places they go to have few or no services provided, so they are more physically challenging places.
 - Hard ecotourism tours are supplied by specialist tour operators that organize niche travels or the hard ecotourists make their own travel arrangements.
 - For example, hard ecotourists in the Galapagos Islands prefer challenging activities such as camping and hiking. Often, they plan their own tour schedule with an accompanying guide. Their accommodation includes staying in the locals' homes
 - Soft ecotourism involves:
 - a larger number of tourists who have
 - moderate commitment to environmental conservation.
 - They prefer places where services are provided so they are physically more comfortable.

- These tours they go on are supplied by mass market tour operators.
 - For example, soft ecotourists in the Galapagos Islands have a higher preference for less challenging activities such as guided trail walks. Many of the tourists rely on travel agencies to plan their entire tour schedule. They also prefer to stay in high-quality accommodation including yachts and cruises.

Strategies used to achieve the aims of ecotourism:

1. Educate and increase tourists' appreciation of nature

- In ecotourism, tours are organized to take place within natural areas for tourists to experience and interact with nature. This will increase the tourists' knowledge and appreciation of nature, which can encourage tourists to take action to conserve and minimise damage to the environment. This ensures environmental sustainability, which will allow the environment to continue to attract tourists, thus ensuring sustainable tourism development.

2. Put in place measures to minimise the negative impacts on the environment

- Tourism revenue is channelled into the conservation of the natural environment such as by hiring local park rangers. Park rangers ensure that laws set up to protect the environment are adhered to so that damage to the environment is minimised, and thus ensuring environmental sustainability. This enables the environment to continue to attract tourists, thus ensuring sustainable tourism development.
 - An example of a successful ecotourism destination is the Galapagos Islands in Ecuador. The islands are known for their unique flora and fauna and were declared a World Heritage site by UNESCO in 1979. To conserve the island's unique biodiversity, 97% of the islands' total area was declared a national park, with only 3% for humans to live on. The authorities implemented some rules and regulations to protect the environment:
 - Only a limited number of visitors is allowed in the park on any given day to minimise disturbances to wildlife.
 - Tourists are required to pay an entrance fee of USD\$100 when visiting the park, and the revenue earned is used to fund conservation projects.
 - Tourists are not allowed to explore the islands on their own. A guide, who educates tourists, is required at each site.

- Locals are also involved in the ecotourism industry by offering day tours and homestays to small groups of tourists.

Limitations of Ecotourism:

While ecotourism is a possible approach to ensure sustainable tourism development, there are limitations:

1. Uncertainty over the continuity of efforts in conserving nature

- Ecotourism needs to take place at a small scale if it is to be successful. This is because ecotourism does not work when ecotours are overwhelmingly popular with tourists. This is because the presence of a large number of tourists interacting with nature may destroy the environment that ecotourism seeks to protect.
- For example, in the Galapagos Islands where ecotourism is carried out, oil spills from the large number of boats have resulted in serious water pollution. The large increase in the number of tourists has also resulted in erosion along some trails, as well as disturbances to animals and plants.
- Since ecotourism sites need to be carefully managed, there is a limit as to how many local ecotourism projects can take place. But because of the strong desire to earn profits from ecotourism, some aims of ecotourism are compromised and nature may not be conserved.

2. Uncertainty over involving local communities

- A challenge for ecotourism is the uncertainty in the efforts to conserve nature and involve local communities.
- As ecotourism sites become popular, demand for manpower to meet the needs of tourists may prompt some tourism- related businesses to hire non-locals. This is especially when locals are not sufficiently equipped with the skills and knowledge required, and authorities or businesses do not put in place measures to train locals. As a result, benefits to local communities are not maximised.
- For example, in Kufri, India, the jobs go to the non-locals as the locals do not have the necessary skills. This has resulted in economic leakages.

COMMUNITY-BASED TOURISM (CBT):

What is community-based tourism?

CBT is a type of innovative small-scale tourism experience that is managed by local communities. It includes homestays and agricultural tourism. CBT aims to maximise local communities' involvement in tourism and the benefits to them, therefore ensuring economic and social sustainability.

Strategies used to achieve the aims of community-based tourism (CBT):

1. Encourage local community to participate in decision-making on tourism development in their community

- The tourism industry should empower the local communities, in consultation with other stakeholders, to make decisions on how tourism should be developed in their community. As the local communities have greater knowledge of their own economic, social, and environmental needs, their decisions can help to ensure these needs are met in a sustainable way, thus ensuring sustainable tourism development.
- For example, local communities can suggest cultural and nature-based experiences that can be developed without disrespecting the heritage and damaging the local environment.
- This ensures that locals continue to support and be involved in the tourism industry, and the environment continues to thrive and attract tourists, thus ensuring sustainable tourism development.

2. Put in place measures to increase social and economic benefits to local communities

- One social benefit is revenue from tourism can be directed to community projects such as funding schools and clinics. This can increase the social well-being of the local community as they receive better education and healthcare.
- Some economic benefits are:
 - Locals are encouraged to innovate, set up businesses (such as restaurants) and offer tourism experiences (such as homestays) to cater to the needs of tourists. These provide employment to locals which will minimise leakages while benefiting locals economically
 - An example of a type of tourism experience innovated and offered by many local communities is agricultural tourism. Agricultural tourism refers to tourists visiting local farms to

purchase local produce, and to participate in activities for education and enjoyment purposes. These activities include farming using local techniques, harvesting crops and cooking them.

- As such, local farmers benefit economically from higher incomes generated. It ensures that locals continue to support and be involved in the tourism industry, thus ensuring sustainable tourism development.

Limitations of Community-based Tourism (CBT):

1. Loss of culture

- Without sufficient measures, CBT can lead to a loss of local cultures. For instance, when local communities offer tourism experiences of their cultures, it may result in commodification and a loss of authenticity of their cultures.
- For example, CBT projects in Kyrgyzstan have observed the commodification of local traditions to suit tourists' preferences. Traditional yurts have been modified, such as the inclusion of beds and modern furniture such as dining tables and chairs which are not usually found in yurts. Although these were introduced to improve the tourists' comfort and meet the standards expected by the tourists, they have caused a loss of culture.

2. Competition with large-scale tourism developments

- Local communities lack the necessary skills and finances to further develop the local tourism industry. Many face difficulties in communicating with tourists and are poorly equipped to undertake marketing campaigns (e.g. advertisements) to compete with other tourism developments, especially the large-scale ones. They also lack the finances to start new tourism experiences or tourism-related businesses such as restaurants.
- On the other hand, large-scale tourism developments such as resorts, often have greater finances to undertake marketing campaigns to attract more tourists.
- For example, the Thanh Ha Pottery Village in Vietnam has been successful in attracting tourists who are keen to learn more about local culture and pottery practices. The Village also receives support from the government and international organisations. However, it faces competition from other more established pottery villages in Central Vietnam in attracting tourists, especially because they do not have enough highly skilled pottery artisans.

PRO-POOR TOURISM (PPT):

What is Pro-poor Tourism (PPT)?

Pro-poor tourism (PPT) is an approach that focuses on improving the livelihoods of the poor through training and access to micro-finance. It aims to generate net benefits (benefits outweigh the costs to the poor) and improve the livelihoods and well-being of the poor. Any type of tourism such as CBT and ecotourism can be classified as PPT if they focus on improving the livelihoods of the poor and reducing poverty. For instance, if an ecotourism project targets poverty and generates benefits for the poor, it can be classified as PPT.

An example of successful pro-poor tourism can be found in the villages around China's Three Parallel Rivers Region, a UNESCO World Natural Heritage Site. Tourists are attracted to visit to enjoy the scenic views offered by the mountains and rivers, as well as to experience village life. With the financial assistance offered by the authorities, many villagers here have set up tourism businesses such as homestays and restaurants. Some put up cultural performances for tourists for a living. As a result, the local community has experienced an increase in income and standard of living.

Strategies used to achieve the aims of Pro-Poor Tourism:

1. Training

- With training provided, locals will be able to learn new skills which they can use to gain employment in the tourism sector. For instance, locals can learn how to bring tourists around or how to manage a tourism business.

2. Increasing access to micro-finance

- Access to micro-finance enables the poor to set up businesses such as homestays and restaurants so they can benefit economically from tourism. This can be done through well-designed communication materials (e.g. brochures, posters, videos) so that locals are able to understand how they can go about applying for micro-finance.

Limitations of Pro-Poor Tourism:

1. The inability to significantly reduce poverty as compared to direct investment in social services

- One key limitation of PPT is that it may be difficult to channel benefits to the poor as compared to direct investment in social services. This could be because

the poor may be reluctant to participate in PPT or may lack the skills, finances and knowledge to establish and sustain their business and tourism experiences.

- For example, in the tourism destination village of Abr, Iran, PPT has not resulted in significant economic benefits for the poorest locals.
 - Many of them lack the self-confidence to undergo training provided by the authorities. They believe that they cannot learn the necessary skills to engage in tourism-related businesses.
 - In addition, some of the training classes require the participants to pay a small fee. Many refrain from paying as they do not see a bright future for themselves in the industry.
 - As such, many of them continue to lack the necessary skills to participate in the tourism industry, resulting in low participation among the poor. In contrast, the non-poor locals are dominating the training and employment in the local tourism industry.

2. The economic benefits may be highly unevenly distributed, with most of the benefits being channelled to non-poor locals.

- Another reason is that economic benefits may be highly unevenly distributed, with most of the benefits being channelled to non-poor locals. They have greater access to micro-financing or financial grants used to support the local tourism industry as they are seen to be more reliable by banks, donors and authorities.
- As a result, the non-poor become wealthier while the poor benefit marginally. As such, PPT can lead to further income gaps between the poor and non-poor.
- Hence, the benefits of PPT may not be substantial enough to significantly improve the lives of the poor.
- It would be more effective if authorities and NGOs choose to directly provide social services such as education and healthcare.

WAYS FOR TOURISM TO CONTINUE DEVELOPING SUSTAINABLY

How can tourism continue to develop sustainably?

Sustainable tourism development will continue when there is sustainable tourism production, sustainable tourism consumption and equitable distribution of tourism benefits.

SUSTAINABLE TOURISM PRODUCTION:

What is sustainable tourism production?

Sustainable tourism production is achieved when the following two situations are present:

1. The demands on ecosystem services do not exceed the supply of resources
 - Tourism is heavily dependent on ecosystem services to supply resources for the industry. Hence, there is a need to ensure that the demands on ecosystem services do not exceed the supply of resources available. Otherwise, the ecosystem services will be negatively affected, and this will in turn negatively affect the tourism industry.
 - However, the tourism industry has not always recognised the need to conserve resources.
 - For example, in Bali, Indonesia, the extensive development of hotels and tourist resorts has led to a depletion of water supplies. In the long run, water supply may be depleted, negatively impacting the tourism industry and rice farming which requires a lot of water.
 - These farms are also tourist attractions, and if affected, tourists may be less keen to visit Bali.
 - Hence, this may hinder sustainable tourism development.
2. Different stakeholders work together and adopt a long-term responsible and coordinated approach instead of prioritising short-term profit
 - In order to preserve ecosystem services and ensure sustainable tourism development, different stakeholders have to work together and adopt responsible long-term approaches instead of pursuing short-term profits.
 - When stakeholders are only focused on maximising short-term economic rewards, resources such as water and energy may be used extensively. This may result in long-term harm to the environment or society. However, if stakeholders ensure energy and water conservation, demands on ecosystem services will not exceed the supply of resources available.
 - For example, in Sentosa, Singapore, the authorities bring together different stakeholders, including businesses, the authorities and locals to develop a series of long-term plans to enable the island to become more sustainable. To achieve carbon-neutral status, the authorities are working together with businesses and locals to increase the use of locally-sourced produce, as well as adopting renewable energy solutions

SUSTAINABLE TOURISM CONSUMPTION:

What is sustainable tourism consumption?

To ensure that tourism development continues to be sustainable, it must be consumed sustainably. Tourism may be consumed sustainably when the following two things are done:

1. Destination regions manage demand and tourism is consumed responsibly by tourists
 - a. Destination regions must manage demand.
 - This can be done by controlling access to or limiting the number of tourists to the destination region to ensure that the carrying capacity of the destination region is not exceeded. This will minimise the damage to the environment.
 - For example, Maya Bay in the Phi Phi Islands, Thailand is a very popular tourist destination. As a result of its popularity, there was a lot of pressure placed on its resources.
 - Its fish stocks declined significantly due to the destruction of the coral reef ecosystem by pollution from boat engines, damage by anchors and trampling by tourists.
 - Increased waste in the sea reduced the provision of cultural ecosystem services, specifically tourism products and services.
 - As corals were damaged, the regulating ecosystem services provided by the coral reefs (e.g. protection of the coasts) were diminished as well. Faced with this unsustainable situation, the local authorities closed the beach completely in June 2018 to allow it to recover. The environment recovered tremendously after three years of closure. When Maya Bay reopened on 1 January 2022, the corals and blacktip reef sharks were able to grow and thrive as tourist boats are no longer allowed to enter the bay. Tourists were also reminded to be responsible and adhere to the rules.
 - All these strict measures ensure that tourism demands on the bay's ecosystem services are managed. This will help ensure sustainable tourism development so tourists are able to enjoy the natural environment, and local communities can continue to reap economic benefits.

- b. Tourism must be consumed responsibly by tourists
 - As the primary consumers of tourism, tourists play an important role in promoting sustainable tourism by the decisions they make about their travelling habits and practices.
 - Through social media and other media platforms, tourists are now more aware of potential threats to the planet, such as the use of plastics, deforestation and climate change.
 - Tourists can ensure tourism is consumed sustainably by
 - making responsible choices about where they visit and stay
 - For example, tourists can choose to stay in hotels that promote sustainability and have sustainability principles. They can also be selective in the food they eat and places they visit.
 - They can also choose to purchase tour services and products from tour operators that have a low carbon footprint and prioritise local communities when employing staff.
 - One example is the Inkaterra Hotel chain in Peru which seeks to conserve Peru's natural environment that is vulnerable to overtourism. The luxury hotel lodges have eco-friendly designs and are built with local materials. The company invests in environmental conservation and education efforts, as well as training locals in hospitality and environmental care.
 - making responsible choices about the type of resources they use
 - Tourists can make responsible decisions about their use of resources, like energy, water and food. For instance, they can choose to switch off the lights and air conditioning when they are not in the hotel rooms and purchase locally-sourced produce rather than imported ones.
- 2. Policies give local communities primary attention while considering the needs of tourists
 - a. It is important that policies on tourism consumption prioritise the needs of local communities, while balancing the need to meet the demands of

tourists. This can minimise the harmful impacts on the environment and local communities.

- b. This can be done by involving the local communities in the planning and implementation of tourism policies. For example, by empowering locals to be tour guides, they can share the knowledge they have about their environment to educate tourists. This may enhance tourists' appreciation of the natural areas and encourage them to minimise damage to the environment.
- c. There are many ways in which policies can support and empower local communities. For example:
 - There can be rules and regulations to protect the needs and practices of local communities, like enforcing a strict dress code for tourists when entering sacred places. Tourists can learn more about other cultures, while ensuring locals customs are not disrespected.
 - There can be policies that promote and support proactive and meaningful encounters between tourists and locals, so that there can be a greater shared understanding of local cultural practices and create more meaningful encounters. This may minimise the tensions between the locals and tourists and at the same time, promote a shared understanding of local cultures and practices.

EQUITABLE DISTRIBUTION OF TOURISM BENEFITS:

To ensure that tourism development can continue to be sustainable, there must be an equitable distribution of tourism benefits. There are two ways of doing this:

1. Implementing effective tourism management to ensure the tourism benefits are enjoyed by all stakeholders.
 - Tourism may not always benefit all the different stakeholders involved. When tourism does not benefit one or a few stakeholders, it may lead to tensions. This may cause some stakeholders to not support future tourism policies and regulations.
 - For example, while pro-poor tourism aims to reduce poverty and improve the livelihoods of poor communities, it can be difficult to channel the benefits to the poor. It may even result in a widening of the income gap between the poor and non-poor. Hence, governments must ensure that the benefits of tourism are enjoyed by all stakeholders. This can be done through effective tourism management.

2. Minimising negative trade-offs within or between economic, social and environmental dimensions.
 - As a result of conflicting priorities as well as different understandings and strategies for sustainable tourism development, negotiations between stakeholders may often be challenging. Often, there are no perfect negotiations between stakeholders in deciding how to develop a tourism site.
 - An example is Maya Bay. The locals in the tourism industry, as well as tourism businesses, had to accept the trade-off of a decrease in economic activity in exchange for a healthier environment brought about by the implementation of a quota on visitor numbers.
 - Therefore, stakeholders may often have to compromise to minimise the negative impacts and accept the economic, social, and/or environmental trade-offs.