

Units 1-4: Major Geological Processes, Climate
Change, Resource Conflict, Population Policies
Grade 12 Geography - Advanced Notes (Detailed)

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Unit 1: Major Geological Processes Associated with Plate Tectonics

- **Unit Introduction:** Our planet is dynamic, affected by internal and external forces (earthquake, volcanism, etc.) often linked to plate boundaries. This unit covers Continental Drift, Plate Tectonics theory, geological processes, and land-forms.
- **Learning Outcomes:** Explain Continental Drift/controversies; describe lithospheric plate movement; explain plate boundaries/interactions; describe forces influencing plate motion; explain plate movements relate to boundaries; explain major geological processes formation continents; explain effects major geological processes on human lives.
- **Key Terms:** Continental Drift, Pangaea, Laurasia, Gondwanaland, Plate tectonics, Plate boundary, Asthenosphere, Lithosphere, Convergent, Transform, Divergent, Conservative, Constructive, Folding, Faulting, Anticline, Syncline, Vents, Fissures, Craters, Tsunamis, Weathering, Erosion, Deposition, Denudation, Physical Weathering, Chemical Weathering, Solution, Hydrolysis, Exfoliation, Frost Action, Scree, Plants and Animals Action, Running Water Erosion, Sheet Erosion, Rill Erosion, Gully Erosion, V-shaped valley, Gorge, Waterfalls, Interlocking spurs, Rapids, Flood plain, Meanders, Ox-bow Lake, Delta, Wind action, Sand dunes, Barkhan, Loess, Sea work, Beach, Spit, Lagoon, Mass wasting, Benioff zones, Volcanism, Shield volcanoes, Strato volcanoes, Cinder cones, Calderas, Intrusive igneous rocks, Batholith, Dyke, Sill, Epicenter, Focus, Seismic waves (P, S, Surface).

1.1 Continental Drift Theory

- **Concept:** Continents moved over geological time, "drifted" across ocean floor. Proposed by German meteorologist Alfred Wegener in 1912.
- **Pangaea:** Wegener's idea of a single supercontinent existing 350 million years ago (Carboniferous period) near the South Pole.
- **Breakup:** Pangaea started breaking in the Triassic period (Mesozoic Era) into northern Laurasia and southern Gondwanaland. Both further subdivided into present continents.
- **Geological Evidences Supporting Continental Drift:**
 - **Coastline Similarity:** Matching shapes of coastlines, especially Africa and South America across the Atlantic.
 - **Rock Type and Structural Similarities:** Similar rock types and mountain belts found on opposing continents when fitted together (e.g., Appalachian Mts. in N. America and Caledonian Mts. in Europe; similar rocks/age in Africa/South America).
 - **Fossil Evidence:** Same fossil species (e.g., Mesosaurus, a small reptile) found on continents now separated by vast oceans.

- **Paleoclimatic Evidence:** Evidence of similar past climates (e.g., glacial deposits) found in areas now far apart.
- **Why Wegener's Theory Was Not Easily Accepted:**
 - Wegener was a meteorologist, not a geologist (seen as outside expertise).
 - Most influential geoscientists were in Northern Hemisphere, key evidence from Southern Hemisphere.
 - Difficulty believing scale of drift occurred in relatively "short" time (Cenozoic Era).
 - **Lack of direct evidence for the mechanism** driving continental movement. This was the biggest problem.
- **Legacy:** Introduced idea of lateral mobility (mobilism) of continents, sparked search for mechanism → Plate Tectonics theory.

1.2 Plate Tectonics Theory

- **Development:** Developed in the late 1960s, building on continental drift and new seafloor mapping data. Explains movement/deformation of outer Earth layers.
- **Statement:** Earth's **lithosphere** (uppermost mantle and crust, 100 km thick) is divided into rigid **plates** that move around on the underlying ductile layer, the **asthenosphere** (100-700 km deep).
- **Plates:** About a dozen large plates and smaller ones. Move a few centimeters per year. Can be continental, oceanic, or mixed. Edges do not always align with continent/ocean boundaries (e.g., North American Plate includes part of Atlantic seafloor).
- **Plate Movements and Plate Boundaries:** Plates move in different directions relative to each other, interacting at their edges.
 - **Convergent Boundary (Destructive):** Plates move towards each other. Denser plate (usually oceanic) subducts under less dense plate (oceanic or continental). Subducted crust destroyed in mantle. Associated with trenches, volcanic arcs (continental or islands), and earthquakes (including deeper Benioff zones). Examples: Nazca Plate subducting under South American Plate (Andes Mts. volcanoes); Oceanic-oceanic convergence (Mariana Islands); Continental-continental convergence (collision, uplift, fold mountains - Himalayas from Indo-Australian/Eurasian collision).
 - **Divergent Boundary (Constructive):** Plates move away from each other. Magma from asthenosphere rises to create new crust. Primarily at mid-oceanic ridges (seafloor spreading). Associated with rift valleys (undersea or on continents) and shallow earthquakes. Example: Mid-Atlantic Ridge; East African Rift Valley (potential future ocean).
 - **Transform Boundary (Conservative):** Plates slide horizontally past each other along fractures (**transform faults**). Crust is neither created nor destroyed. Associated with earthquakes (plates stick and slip). Examples: San Andreas Fault (California), many on seafloor near oceanic ridges.

- **Driving Force:** Plate motion is ultimately driven by the Earth's internal energy, primarily via **convection currents** in the mantle (asthenosphere). Rising hot material at divergent boundaries, sinking cool material at subduction zones drag plates.
- **Impacts on Human Lives:** Plate movements and boundaries cause significant geological events that directly affect human lives, such as earthquakes, volcanic eruptions, and tsunamis.

1.4 Major Geological Processes

- **Definition:** Natural forces shaping the Earth's physical makeup (plate tectonics, erosion, weathering, sedimentation). Constant, some visible (volcanoes, earthquakes), others invisible.
- **Study Purpose:** Geologists study processes to understand Earth's history, locate resources (metal ores), predict disasters (earthquakes, tsunamis, volcanic eruptions).
- **Classification:** Processes causing surface change divided into: **Endogenic forces** (internal) and **Exogenic forces** (external).

1.4.1 Internal (Endogenic) Forces

- **Source:** Originate inside the Earth (pressure). Create irregularities/unevenness on crust (breaking, bending, folding).
- **Folding:** Rock layers bend sideways due to compression (uni- or bidirectional). Upfolds = **anticline**, downfolds = **syncline**. Continued compression → asymmetrical folds, overfolds (one limb over other), overthrust folds (fracture, one limb pushes forward).
- **Faulting:** Cracks (**faults**) in crust formed by tension/compression. Rocks displaced up/down along fault line. Series of parallel faults create landforms:
 - **Rift valleys** (Graben): Land between two parallel faults sinks down. Blocks on sides form plateaus. Example: East African Rift Valley.
 - **Block mountains** (Horst): Land between two parallel faults is pushed upward. Example: Afar Horst.
- **Earthquakes:** Sudden ground shaking by rock masses changing position releasing strain energy along faults (ruptures). Generates seismic waves (shock waves).
 - *Seismic Waves:* Travel through rock.
 - * **Body Waves:** Travel inside Earth. P (**primary**) waves: Fastest, compress/expand rock (longitudinal), travel any medium. S (**secondary**) waves: Slower, vibrate perpendicular wave direction (transverse), travel solids only. Originate at **focus** (point of rupture below surface).
 - * **Surface Waves:** Travel along Earth's surface (Love, Rayleigh). Slower than body waves, larger amplitude, cause most destructive shaking far from **epicenter** (point on surface immediately above focus).

- *Causes*: Generated by rapid release strain energy in crust rocks (ruptures along faults).
- *Effects*: Ground movements, landslides, mudflows, damage buildings/infrastructure, fires, **tsunamis** (giant waves from underwater earthquakes - travel fast, gain size near shore).
- *Occurrence*: Most common two belts: Circum-Pacific Belt (**Ring of Fire**) 80% energy (volcanic activity, young mountains); Mediterranean-Asian Belt 15% energy (less active); Mid-oceanic ridges & East African Rift Valley (remaining belts). Focus depth varies (shallow < 60 km most seismic energy). Benioff zones (dip down mantle) associated deeper earthquakes at convergent boundaries.
- *Measurement*: Richter scale (logarithmic, 0-9) measures effect.
- **Volcanism**: Process molten rock (**magma** underground, **lava** surface) forced out surface (slow/sudden).
 - *Openings*: **Vents** (pipe-like → volcano cone) or **Fissures** (cracks → lava plateau).
 - *Volcanoes*: Form/structure from erupted material. Classified by shape/size/material: **Shield volcanoes** (broad, low profile, fluid basaltic lava ~7° slope, e.g., Hawaiian Is.), **Strato volcanoes** (steep cone, alternating lava/pyroclastics, viscous lava, explosive eruptions, e.g., Mt. Kilimanjaro), **Cinder cones** (conical hill, cinder-sized pyroclastics, angle of repose).
 - *Other Landforms*: **Craters** (depression at summit or collapse/explosion), **Calderas** (large basin-shaped depression after magma chamber drains/cone collapses, e.g., Mt. Rinjani caldera).
 - *Intrusive igneous rocks*: Magma cools/solidifies *within* crust. Landforms: **Batholith** (very large dome intrusion deep in crust, forms mt core), **Sill** (horizontal intrusion between layers), **Dyke** (vertical intrusion through cracks).
 - *Occurrence*: Mainly near plate boundaries (tension/divergence, compression/convergence). 1900 active/historically active. Pacific Ring of Fire 90%. Also Great Rift Valley of East Africa. Activity alternates active/dormant periods. Extinct volcano (not erupting, unlikely in future, e.g., Mt. Zuqualla). Dormant (inactive but erupted historically, likely future, e.g., Mt. Kilimanjaro). Active (erupted/thought erupted last 500 yrs, e.g., Erta Ale).

1.4.2 External (Exogenic) Forces

- **Source**: Act on Earth surface from outside (atmosphere). Running water, wind, ice, sea waves. Usually level up/down surface. Process occurs two ways: **Denudation** and **Deposition**.
- **Denudation**: Lowering land by wearing away surface (i) **Weathering** and (ii) **Erosion**.
 - **Weathering**: Gradual breakdown rock pieces *in place* (on surface).

- * **Physical (Mechanical) Weathering:** Rocks broken smaller pieces without chemical change. Fragment has similar chemical traits.
 - **Thermal expansion/contraction:** Temp changes (hot/dry areas) cause surface layers expand/contract → peel off (**exfoliation**).
 - **Frost action:** Water in rock cracks freezes → expands → widens/deepens cracks. Common cooler areas. Fragments collect lower slopes (**screes**).
 - **Plant and animal action:** Roots grow in cracks, force them wider. Animals (worms, moles) burrow, break up rocks.
- * **Chemical Weathering:** Complete change *internal structure* rocks via chemical reactions.
 - **Rain action:** Water dissolves O₂/CO₂ → acidic rain. Rusting (Fe + O₂), **Solution** (rocks dissolved acidic rainwater, e.g., limestone), **Carbonation** (limestone + dissolved CO₂).
 - **Hydrolysis:** Acidic water breaks down rock → clay + soluble salts.
 - **Plants and animals action:** Decaying vegetation → organic acid. Bacteria break minerals.
- **Erosion:** Movement soil/rock particles from one place to another. Major agents: Running water, Underground water, Wind, Sea waves, Glaciers.
 - * **Running water erosion:** Most powerful external force. Ability to erode/transport related speed. Steeper slope = powerful. Reduced by vegetation cover. Landforms associated runoff: **Sheet erosion** (wide flow, removes topsoil evenly); **Rill erosion** (small channels/ditches); **Gully erosion** (floods join, cut wider/deeper, severe if vegetation removed).
 - * **River Course Landforms:** Vary along river length.
 - **Upper course:** Swift/strong. **V-shaped valley** (narrow, steep-sided). **Gorge** (deep, narrow, steep/vertical walls). **Waterfalls** (river flows over hard rock, softer rock eroded faster). **Interlocking spurs** (fingers land jut out, force river flow around). **Rapids** (fast turbulent section, steep gradient).
 - **Middle course:** Valley wider/larger. Volume increases (tributaries join at **confluence**). River winds (**Meanders**). Cut-off meander channel → **Ox-bow Lake**.
 - **Lower course:** Flows slowly. Wide, flat-floored valley. Deposition dominates (material carried in suspension).
 - * **Wind action:** Powerful desert/semi-desert. Features: **Sand dunes** (hills sand collected obstacles); **Barkhan** (crescent/quarter moon shape hill). **Loess** (fertile wind-deposited soils).
 - * **Sea work:** Erosion/Deposition coastlands. Features: **Beach** (strip land along coast, varied sediments); **Spit** (low narrow sand/silt attached land, extends into sea); **Lagoon** (saltwater area separated sea loose sand banks).
 - * **Mass wasting:** Down slope movement rock, regolith, soil under gravity. Controlling factor gravity. Major factors: Water (reduces cohesion), Angle of slope (steepest ~25-40° depending particles), Activities people (farming/overgrazing steep slopes). Occurred Ethiopia, causes destruction.

- **Deposition:** Dropping/accumulation eroded material elsewhere. Creates landforms (e.g., flood plains, deltas, sand dunes).

Unit 1 Summary

- Continental drift theory: continents formed single landmass (Pangaea), broke up, drifted. Supported by geological evidences (coastline, rock, fossil, paleoclimatic).
- Plate tectonics theory: Lithosphere broken plates moving on asthenosphere. Explains earth movements (divergent, convergent, transform) and landforms (folding, faulting). Driven by convection currents.
- Earth surface changed by internal (endogenic - folding, faulting, earthquakes, volcanism) and external (exogenic - weathering, erosion, deposition, mass wasting) forces.
- Weathering breaks rock *in place* (physical/chemical). Erosion moves material (water, wind, ice, sea). Deposition drops material elsewhere. Mass wasting is gravity driven down slope movement.
- River landforms vary along course (upper, middle, lower). Wind forms features deserts/semi-deserts. Sea forms features coastlands.
- Plate tectonic processes influence atmosphere, oceans, climate, life evolution.

Review Questions

- **I. Chooses the best answer for the following questions**
 1. Which one of the following is part of the old Gondwanaland? (D. Australia)
 2. Which of the following was proposed by Alfred Wegener? (B. Continental Drift)
 3. What is the name of the huge sea that existed around Pangea? (B. Tethys)
 4. The sudden shaking of the ground... below Earth's surface is called: (A. An earthquake)
 5. Which feature is associated with the work of wind action in different areas? (D. All - Sand dunes, Barkhan, Loess)
 6. A crack on the earth's crust formed by forces of tension and compression is: (A. A fault)
 7. Instruments that can detect earthquake waves are called: (B. Seismographs)
- **II. Give Short answers to the following questions**
 1. Explain the continental drift and plate tectonic theories.
 2. Identify the major geological processes and explain associated land features.

Unit 2: Climate Change

- **Unit Introduction:** Climate change is a significant environmental challenge. Unit covers basic concepts, trends, natural/human causes, consequences, adaptation/mitigation strategies, international agreements, Ethiopia's CRGE strategy. Geography contributes understanding spatial dimensions/impacts/vulnerability.
- **Learning Outcomes:** Explain basic concepts climate change; distinguish natural/human induced change; analyze trends Ethiopia/world; recognize mitigation/adaptation strategies; assess international conventions/agreements; explain purpose/pillars Ethiopia's CRGE strategy.
- **Key Terms:** Climate Change, Global warming, Greenhouse gases, IPCC, Carbon dioxide, Reducing emissions, Deforestation, Aerosols, Human activities, Variations in Solar Output, Climate variations, Milankovitch Theory, Composition of the atmosphere, Incoming solar radiation, Sea level rise, sea ice melt, Food security, Adaptation, Mitigation, Strategies, Reactive, Anticipatory, Planned, Autonomous, Toronto Conference, Kyoto Protocol, Buenos Aires Plan of Action, Marrakesh Accords, Climate resilient, Green Economy, Carbon stocks, Energy-efficient technologies.

2.1 Basic Concepts of Climate Change

- **Definition (IPCC):** A change in the state of the climate identifiable by changes in mean and/or variability, persisting decades or longer. Due to natural variability or human activities.
- **Global Warming:** Increasing average temperature of the Earth over many years. Rising temperatures linked to other changes (hurricanes, melting glaciers/ice, habitat loss, changes precipitation). Earth's air, water, land interdependent.
- **Regional Climate:** Climate conditions in a specific area (e.g., Horn of Africa climate differs from Gondar or Gambella).
- **Severity:** Consequences are deeper than just getting hotter, should be taken seriously.

2.2 Trends in Global Climate Change

- **Evidence:** Climate changing across planet, largely human-caused. Observations atmosphere, land, oceans; ice core records.
- **GHGs Increase:** Atmospheric concentrations important **greenhouse gases (GHGs)** (carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O)) increased over centuries. Trap heat → raise air temps near ground (greenhouse effect).
- **Warming Trend:** Average global surface temperature warmed 0.80°C past century, 0.60°C past three decades. 1990s warmest decade (reported 2001 IPCC report), 1998 warmest year since 1861. 20th century likely warmest in 1000 yrs.

- **Projection:** If GHG emissions continue rising, mean global temps projected increase 1.4°C to 5.8°C by end 21st century (2001 IPCC).
- **Signs of Warming (besides temp):** Affecting sea level, snow cover, ice sheets, rainfall patterns.
- **Cause of Recent Warming:** Most of warming past 50 years attributed human activities (deforestation, emissions industry/transport).

2.3 Natural and Human Induced Climate Change

- Climate change caused by natural causes or human activities (or both). Natural changes driven by external/internal factors. Human changes by injecting gases/particles, land use changes.
- **Natural Causes:**
 - **Incoming Solar Radiation** (Changes in Sun's Energy Output): Sun's energy varies slightly. **Sunspots** (cooler dark regions) occur in 11 yr cycles. More sunspots = slightly more energy emitted. May influence climate (e.g., Little Ice Age possibly linked to reduced solar activity).
 - **Variations in Earth's Orbit (Milankovitch Theory/Cycles):** Three cyclical changes in Earth's orbit/axis affect amount solar energy received: Eccentricity (shape orbit around sun), Precession (wobbling axis), Changes in Tilt (obliquity axis). Combine produce long-term variations in solar radiation → initiate natural cycles Ice Ages (glacial/interglacial periods).
 - **Composition of the Atmosphere** (Natural Aerosols): Microscopic particles (solid/liquid) enter atmosphere naturally (volcanoes, dust storms, wildfires, sea spray). Can influence climate. Sulfur-rich volcanic eruptions inject aerosols stratosphere → combine water vapor/sunlight → reflective sulfuric acid particles → form haze → reflect incoming sunlight back space → **cools** surface air (short-term effect).
 - **Earth's Surface Changes:** Changes in Earth's surface (e.g., continental drift, mountain building) affect ocean/atmosphere circulation, long-term climate change.
 - *"Internal" Causes:* Circulation patterns ocean/atmosphere redistribute energy. Complex interrelationships within climate system.
- **Human (Anthropogenic) Induced Causes:**
 - **Aerosols Injected into Lower Atmosphere:** Human sources (factories, vehicles, power plants, furnaces, fireplaces) emit particulates/gases form aerosols. Sulfates/nitrates reflect sunlight (cooling). Soot (carbon) absorbs sunlight (warming). Overall effect can be net cooling surface air.
 - **Land use changes:** Modifying surface affects albedo (reflectivity) and evapotranspiration → affects regional climate. Examples: Clearing forests (tropical rainforests) reduces evapotranspiration → less cooling, potential warming. Overgrazing/excessive cultivation semi-arid grasslands → desertification → increased albedo, less evapotranspiration → increased desert conditions.

- **Increasing Greenhouse Gases Emission:** Human activities add vast quantities GHGs (burning fossil fuels, deforestation) → enhance greenhouse effect → **global warming**. CO₂ major contributor (from burning coal, oil, gas). Stored in trees/plants; cut/burned → CO₂ to atmosphere. N₂O and CH₄ also GHGs (diff absorption, lifetime). NH₃ causes 21x warming mass equivalent CO₂ over 100 yrs (likely typo, should be N₂O). *Natural GHGs (like water vapor) maintain Earth temp; problem is *increase* due human causes.*

2.4 Consequences of Climate Change

- **Impacts on Human Beings and Other Life Forms:**

- **Increased Temperatures:** Heat waves expected more frequent/intense → increased heat-related deaths (offset partially by fewer cold-related illnesses). Affects temp-defined climate zones → challenging for growing species.
 - **Precipitation Changes:** Not evenly distributed. Some areas more, others less. More intense wet spells, longer dry periods. Adversely affects agriculture. Warming temps dry soil faster, exacerbating drought.
 - **Sea Level Rise:** Caused by melting land-based ice (glaciers/ice sheets) and thermal expansion warming oceans. Rose 17cm (20th C), 19cm (1900-2010), pace accelerating (3.4 cm/decade since 1993).
 - * *Effects SL Rise:* Growing issue coastal populations → increased flooding risk. Storm surges higher. Damage coastal ecosystems (coral reefs). Coastal groundwater contamination saltwater.
 - **Effects on Polar Regions:** Rising temps → complex interactions. More snow Antarctica (warmer air holds more moisture, counterbalanced melting coastline). Greenland rapid melting expected continue shrink. Arctic sea ice shrinking/thinning (new record lows 2007, 2012) → could cover < 10% Arctic Ocean mid-century.
 - **Effects on Ecosystems:** Increasing CO₂ can 'fertilize' some plants → accelerate growth (limited by other nutrients). Some dominant species eliminate others. Climate change impacts crop yield (tropical may decrease, higher latitudes may increase).
 - **Climate-driven changes in species distributions:** Affect human well-being directly (emerging diseases, changes **food supply**) and indirectly (degrading ecosystem health).
- **Impacts on Physical Features:** Changes water (melting glaciers/ice sheets, sea level rise, changes precipitation patterns/droughts, changes groundwater flow/quality, landslides/mudflows from rainfall changes). Changes forest (range shifts, increased fire risk, vulnerability temp changes).
 - **Overall Impact:** Predictions global warming amplify current dangers, introduce new ones, affect people's ability support selves. Impact on agriculture/ecosystems increasingly negative later this century.

2.5 Adaptation and Mitigation Strategies to Climate Change

- **Response Strategies:** Broad spectrum policy responses/strategies needed local, regional, national, global level. UNFCCC highlights two fundamental strategies: **Mitigation** and **Adaptation**.
- **Mitigation:** Seeks **limit climate change** by reducing emissions GHGs and enhancing 'sink' opportunities (absorb GHGs, e.g., forests, oceans, soil). Examples: Reduce fossil fuel use (clean energy like wind, solar, hydro, geothermal); Enhance sinks (afforestation, reforestation, forest management).
- **Adaptation:** Aims **alleviate adverse impacts** climate change through adjustments in ecological, social, economic systems. Responses to actual/expected stimuli/effects/impacts. Changes processes, practices, structures moderate potential damages or benefit opportunities.
 - *Types by Timing/Goal:*
 - * **Reactive:** Takes place **after** initial impacts occur. Autonomous (unmanaged natural systems respond) or Planned (deliberate policy post-impact awareness).
 - * **Anticipatory:** Takes place **before** impacts become apparent. Planned (deliberate policy based on expected change) or Autonomous (unmanaged systems - none in natural systems).
 - *Types by Actors:* Private (individuals/companies) or Public (government).
 - *Examples in Ethiopia (Adaptation Strategies):* Soil conservation, Terracing, Water harvesting, Crop diversification, Changing crop planting date, Planting trees, Irrigation.
- **Mitigation vs. Adaptation:** Mitigation attacks root cause (reduce emissions); Adaptation deals with symptoms (adjust to impacts). Both needed tackle problem.
- **Policy Focus Shift:** Historically more attention to mitigation (scientific research, policy debate). Adaptation gained urgency post-IPCC Third Assessment Report.

2.6 International Conventions and Agreements on Climate Change

- **First World Climate Conference (1979):** Identified climate change urgent problem. Led World Climate Programme (WMO, UNEP, ICSU).
- **Toronto Conference (1988):** Advanced public debate. Recommended global framework convention to protect atmosphere.
- **UN General Assembly Resolution 43/53 (1988):** Recognized climate change common concern, essential for life, needing timely action within global framework.
- **IPCC (Intergovernmental Panel on Climate Change):** Established by WMO/UNEP. Assess magnitude, timing, impacts, response strategies. Reports (1990, 1995, 2001, 2007, 2013, 2021) key basis negotiations/policy. 2001 report "discernible human influence".

- **UN Framework Convention on Climate Change (UNFCCC):** Established by UN GA (INC committee). Signed Rio 1992 Earth Summit, came effect 1994. Near universal membership (197 Parties). Sets overall framework. Annual Conference of the Parties (COP).
- **Kyoto Protocol (1997/2005):** Adopted COP3 (Kyoto 1997), came force 2005. Legally binding mandatory targets GHG reduction industrialized countries (5% below 1990 levels 2008-2012). Flex mechanisms (emissions trading, Clean Development Mechanism CDM). US did not ratify. Developing nations no mandatory targets initially. Global emissions increased despite Protocol.
- **Paris Agreement (2015):** Adopted COP21 (Paris 2015), came force 2016. Adopted virtually all nations. Aim: Limit global warming "well below" 2°C, pursue 1.5°C. Voluntary Nationally Determined Contributions (NDCs). Report progress regularly. US withdrew mid-2017 (later rejoined). Focus: sustainable development, peace, dignity, opportunity.

2.7 Pillars of Climate Resilient Green Economy of Ethiopia (CRGE)

- **Climate Resilient Green Economy (CRGE)** Strategy: Ethiopia's plan for green growth, fostering development and sustainability. Follows sectoral approach. Goal: Middle income status by 2025 while emitting less GHGs (no net increase from 2010).
- **Initiatives:** Initially identified 60 initiatives.
- **Four Pillars:**
 - *Improving crop and livestock production practices* for higher farmer income/food security while reducing emissions (limit soil-based emissions, reduce forest pressure by limiting ag expansion, increase livestock efficiency/productivity → economic growth + limited emissions).
 - *Protecting and re-establishing forests* for economic/ecosystem services including carbon stocks (reverse deforestation/degradation, reduce fuelwood demand, increase afforestation/reforestation/forest management → increased carbon sequestration, area closure).
 - *Expanding electricity generation from renewable sources* (hydro, geothermal, solar, wind) for domestic/regional markets (meet 14% annual increase needed, virtually zero GHG emissions, enables green development other sectors, potential export clean energy).
 - *Leapfrogging to modern and energy-efficient technologies* in transport, industrial sectors and buildings (promote energy efficiency, use alternative fuels in cement, textile, leather, fertilizer industries, introduce stricter fuel efficiency standards, electric rail network renewable energy).
- CRGE Strategy complements homegrown economic reform (6th pillar) aimed setting path middle income country by 2025.

Unit 2 Summary

- Climate change, desertification, drought, famine major global issues of concern.
- Climate change due natural (solar output, Earth orbit, natural aerosols, Earth surface changes) and human (anthropogenic) activities (GHG emissions, aerosols, land use changes). Human activities dominant cause recent warming.
- GHGs (CO₂, CH₄, N₂O) trap heat → global warming. Global average temps risen. Predicted future rise. Signs warming (melting ice, sea level rise, etc.).
- Consequences: Impacts temp (heat waves), precipitation (drought, floods), sea level rise (coastal flooding), ecosystems (species shifts), health, food security.
- Responses: Mitigation (reduce emissions/enhance sinks) and Adaptation (adjust to impacts). Both needed. International agreements (UNFCCC, Kyoto, Paris) aim coordinate global action.
- Ethiopia's CRGE strategy aims green growth with low GHG emissions via four pillars (agriculture, forests, renewable energy, energy efficiency).

Review Exercise

• I. Multiple Choice Questions

1. Which of the following is important greenhouse gas? (D. All)
2. According to the Third Assessment Report of IPCC which decade had been the warmest decade worldwide? (A. 1990s)
3. What is a feasible method to reduce the release of the greenhouse gases without decreasing the production of these gases? (A. Mitigation)
4. The type of adaptation that takes place after the initial impacts of climate change has occurred is: (B. Reactive)
5. Which of the following country had an intention to withdraw from the Paris Agreement in mid-2017: (A. United States of America)

• II. Short Answer Questions

1. What is the state of today's average global temperature compared with the average temperature during most of the past 1000 years?
2. Describe the Milankovitch theory of climatic change by explaining how each of the three cycles alters the amount of solar energy reaching the Earth.
3. Do volcanic eruptions rich in sulfur tend to warm or cool the Earth's surface? Explain.
4. Explain how variations in the sun's energy output might influence global climate.
5. How could Climate models predict that increasing levels of CO₂ will cause the mean global surface temperature to rise?

Unit 3: Management of Conflict Over Resources

- **Unit Introduction:** Resource management critical challenge developing countries. Exploitation high-value resources/competition diminishing renewables often cited factors causing/increasing conflict. Mismanagement resource contributes conflicts. Unit deals management conflict over resources line sustainable use.
- **Learning Outcomes:** Recognize sustainable development meaning; identify main focuses, goals, principles SD; explain principles/characteristics good governance; examine land management/policy problem Ethiopia.
- **Key Terms:** Sustainable Development, Renewable resources, Non-renewable resources, Resource conflict, Transboundary, Conflict over resource access, derives of Conflict, Poor Governance, Discriminatory policies, Public participation, Unequal distribution, Agenda 21, Brundtland Report, SDGs (Sustainable Development Goals), GTP II, Economic, Environmental, Social Dimensions of SD, Good Governance, Indigenous, Conflict resolution, Shimagle 'elders', T'eer, Gadaa, Mada'a, Ogaz, Abbaa Gadaa, Kedo Abba, Nile Basin Initiative (NBI), Conflict Prevention Strategies, Livelihood diversification, Livelihood adaptation, Vulnerability context, Shocks, Seasonality, Trends, Changes, Human Capital, Natural Capital, Financial Capital, Social Capital, Physical Capital.

3.1 The Concept of Sustainable Development

- **Historical Overview:** Concept emerged development paradigm.
 - **UN Conference on Environment and Development (UNCED) - Stockholm 1972** (Brundtland Report): Introduced "eco-development". Led establishment UNEP. Mission: provide leadership/partnership caring environment, improve quality life without compromising future generations.
 - **UNCED - Nairobi 1987:** Introduced idea "sustainable development".
 - **Conference - Rio de Janeiro 1992** (Earth Summit): Further developed Agenda 21. Highlighted connection poverty/underdevelopment and environmental protection/NR management.
 - **World Summit on Sustainable Development - Johannesburg 2002:** More emphasis social/economic aspects SD.
- **Definition (Brundtland Commission "Our Common Future" 1987):** "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs".
- **Nature:** Rooted systems thinking. Stresses three interdependent/reinforcing pillars: Economic Development, Social Development, Environmental Sustainability. Conceptualized interconnected/nested rings (economy dependent on society, both dependent on environment).
- **Key Issue:** Integration different dimensions SD, holistic view, overcoming barriers (disciplines, ideologies, sectors).

- **Three Essential Dimensions:**

- **Economic:** Produce goods/services continuously, maintain manageable gov/external debt, avoid extreme sectoral imbalances (ag/ind production).
- **Environmental:** Maintain stable resource base, avoid overexploitation non-renewables, maintain biodiversity, atmospheric stability, ecosystem services.
- **Social:** Achieve fairness distribution/opportunity, adequate social services (health, education, gender equity). Focus reconciliation env/dev, governance social services.

- **Sustainable Development Goals (SDGs) (Global Goals):** Adopted UN 2015. Universal call action end poverty, protect planet, ensure peace/prosperity by 2030. 17 integrated goals, 169 targets (e.g., No Poverty, Zero Hunger, Quality Education, Clean Water/Sanitation, Climate Action). Action in one area affects others. Requires balancing social, economic, environmental sustainability. Countries prioritize progress for furthest behind. Designed end poverty, hunger, **HIV/AIDS**, discrimination women/girls. Requires creativity, knowhow, technology, financial resources.

- **Integration SDGs Ethiopia National Development Frameworks:** FDRE appreciates contribution SDGs to Ethiopia's aspirations (eradicate poverty, prosperity). Integrated into Growth and Transformation Plan II (GTP II 2015/16-2019/20). GTP II focused macro stability, fast/sustained economic dev, infrastructure, HR/tech capacity, good governance/democratic systems, env dev. Used existing institutional forms/mechanisms. New 10 yr dev plan (2021-2030) contemplates SDG pillars. Progress registered (inclusive quality education SDG 4, water/sanitation SDG 6, energy SDG 7). Progress Good Health/Well-Being (SDG 3) registered against leading death causes. Life expectancy increased, infant/maternal mortality declined, tide HIV/malaria halved.

- **Performance SDGs FDRE:** Focus poverty eradication/development interventions. Ensure inter-generational equity. Climate-Change-Resilient Green-Economy (CRGE) implemented. Paris Agreement implemented. National Policy/Strategy Disaster Prevention/Management implemented.

- **SDG Pillars in GTP II / New 10 Year Plan:** Ensure ag sector mainstay; Expedite change economic structure (manufacturing); Enhance full economic capacity (competitiveness, efficiency, productivity, quality); Correct imbalance overall demand/supply; Foster construction industry/projects mgmt; Institutionalize urban admin/mgmt (urbanization, industrialization); Create enabling env domestic investors; Support HR dev (tech capacity); Build climate resilient green economy; Eliminate rent-seeking, ensure developmental mindset.

- **Shortcomings of SD Notion (Criticism):**

- "Sustainable development" term incorrect, internal logical contradiction.
- Narrowness: Confines global problems environmental context (many scholars/activists believe env protection covers entire SD strategy).
- Absence single concept: Multiple definitions make implementation difficult.

- Benefits only part humanity?: Opinion SD benefits only certain part of humanity.
 - Controversial methods.
 - Diversity understanding: Different worldviews, cultural/social/political diversity leads diverse understanding goals.
 - Creating just/balanced world design: SD goals aimed this.
- Critics/Followers agree transition SD needs dramatic transformation current civilization → environmentalisation all major human activities.

3.2 Resource use policies and related conflicts

- **Meaning/Types of Resources:** Element/substance useful for human needs. Varied capacity/rate regeneration. Classified by regeneration: **Renewable resources** (recurrent, replenish, flow resources, regenerate reproduction/recycling, most biotic + some abiotic like solar, land, soil, water, air); **Non-renewable Resources** (do not replace/regenerate quickly, fixed/fund resources, supply limited, diminished with use, most minerals like coal, petroleum, gas, metals).
- **Categories of Resource Conflicts:** Typically categorized by primary resource (extractive, land, water) and main driver. Often interplay > 1 resource type. Drivers: Ownership, Access, Decision making (mgmt), Distribution (revenues/benefits/burdens).
- **Unique Characteristics Resource Conflicts:** Contribute complexity/influence resolution approach. Scarcity/abundance influences conflict dynamics. Natural/social factors create complexity/uncertainty (availability, quality, value). Often along ethnic/religious/linguistic lines (uneven geographic distribution). Tensions between competing livelihood groups. Seasonal cycles can escalate to violence after sudden shocks/stresses. Resources key role in generating/escalating tensions. Involve wide range actors (states, local gov, ethnic groups, communities, CSOs, private companies).
- **Resources Role Political Economy:** Often reinforce elite power (power imbalances Intl Corps vs local communities, lack formal representation). Governance often combo customary/statutory/hybrid.
- **Conflict Over Resources:** Political issue (access, control). Views on identifying issues, management goals, rates of use sources tension. Can occur local, subnational, national, transboundary levels. Involve multiple stakeholders.
- **Conflict Nature:** Not inherently negative; essential component change/development. **Non-violent resolution** possible when trust exists in governing structures/institutions manage incompatible/competing interests. Problematic when mechanisms break down → violence. Weak institutions, fragile systems, divisive social relations drawn into conflict cycles. Preventing negative spiral, ensuring peaceful resolution core interest states/societies/intl community.

Drivers of Conflict over Renewable Resources

- **Main Drivers (alone or combo):**

- **Competition over increasingly scarce renewable resources:** Supply insufficient local demand. **Resource scarcity** definition. Increases competition (user groups, economic sectors). Social responses: migration, tech innovation, cooperation, violent conflict.
 - * *Causes increasing scarcity:* **Demand-induced** (demand increases - pop growth, consumption, new tech reduces per capita availability); **Supply-induced** (env degradation, natural variation, infrastructure breakdown reduces total supply - undermines livelihoods, creates competition); **Structurally induced** (unequal resource access - poor NRM, different land use decisions/tradeoffs, cultural practices, social/economic barriers like women's restrictions). Poverty can be barrier accessing/exploiting.
- **Poor governance of renewable natural resources and the environment:** Refers norms, institutions, processes regulate mgmt, ownership, allocation, use, protection. 4 types grievances:
 - * **Unclear, overlapping or poor enforcement resource rights/laws:** Statutory, customary, informal, religious tenure forms. Disagreements/uncertainty over 'rules'. Conflicts when groups lack rights/feasible exercise rights. Unclear/overlapping institutional jurisdictions/mandates. Lack state capacity enforce laws/resolve disputes rural areas.
 - * **Discriminatory policies, rights/laws** that marginalize specific groups: One group controls access detriment others. NR-dependent communities marginalized. Violence when seeking equitable access. Struggle for equity links identity, status, political rights → harder conflict resolution. Key factor **structural scarcity**.
 - * **Unequal distribution benefits/burdens** from development projects: Extractive ind, ind sites, major infrastructure projects → benefits local comm + degrade/exhaust/pollute NR. Grievances if not compensated for damage, not share benefits.
 - * **Lack public participation/transparency** decision-making: NR policies often state + private sector, w/o active participation affected communities/transparency/consultation. Opposition decisions/outcomes likely. Lost access, eviction w/o compensation, price increases (water) → tensions.
- **Transboundary natural resource dynamics and pressures:** Managing NR beyond national borders (water, wildlife, fisheries, air quality, pollution, climate change). States sovereign right exploit resources (UN Charter), BUT responsibility not damage other states' environment. Principle 2 Rio Declaration: sharing resources moving across borders. Often beyond single state capacity → cooperation/co-management needed.
 - * *Types Transboundary Dynamics causing Conflict:* (1) One country consumes shared resource higher rate, violates agreements/inflexible faced variation (often linked power/political economy, bargaining power geo location upstream/downstream). (2) Quality/Quantity NR in one country

negatively impacted by neighbor's activity (infrastructure, ind dev, land use changes - pollution across borders, deforestation/erosion heightens vulnerability hazards). (3) Pastoralist migration/wildlife migration across borders not respected → conflict (user groups competition, loss livelihoods, loss indigenous communities/culture/heritage). (4) Illicit activities/criminal groups on global/transboundary basis (illicit extraction/trade NR deprives local comm benefits).

- **Transboundary Waters:** Key diplomatic issue Nile Basin (11 countries). Upstream argue unequal allocation. **Nile Basin Initiative (NBI)** (1999): Coordinate mgmt, promote peace/security among 10 basin states (all but Eritrea initially). First include participation all. Upstream request equitable share, sustainable food production (irrigation), hydroelectric power mechanism, soil/water conservation collab.
- **International Law Commission (ILCs) Article 5:** Water course states utilize Intl water course equitably/reasonably. Article 7: Obligation not cause significant harm. Article 8: Obligation cooperate. Article 9: Exchange data/info. Article 20: Protection/preservation ecosystem.
- **Nile Dialogue:** Question equity at heart. 2010 Framework signed 5 upstream states for equitable share, opposed Egypt/Sudan. Ethiopia asserts dev ambitions. Construction **Grand Ethiopian Renaissance Dam (GERD)** (started 2011) → economic prosperity (cheap energy), demand (Ethiopians lack electricity).
- **Conflict Prevention Strategies:** Avoid, minimize, resolve, contain conflict to prevent escalation to violence. If NR source conflict, strategies consider complex inter-relationships. Conflict politicized within broader context. Requires multi-level response (technical, political, institutional).
- **Sustainable Livelihoods Framework (SLF):** Tool understand reducing poverty household level. How livelihood strategies compete limited resources. Social assets/institutions available prevent conflict. Used inform prevention programmes: (1) Help understand how changes NR availability impact livelihoods → competition. (2) Identify social assets/coping mechanisms/institutions used respond shocks/resolve disputes. (3) Identify interventions expand livelihood opportunities, reduce vulnerability (increasing scarcity), provide access dispute resolution. Views people dynamic actors, not helpless.
- **Approaches Increase Livelihood Opportunities/Reduce Vulnerability (5):** (1) **Livelihood diversification** (multi-sectoral, multi-locational, multi-occupational) → less dependent single scarce resource. (2) Improve efficiency dependent livelihoods & value addition (ag extension/inputs/tech, processing/manufacturing). (3) **Livelihood adaptation** programmes (adapt to decline NR from climate change/disasters). (4) Protect livelihoods/assets (natural capital) where diversification/efficiency difficult/time limited (food/income/employment/market/production support) → prevent coping strategies liquidating natural capital. (5) Emergency livelihood support (food distribution, feeding, health) when livelihoods fail.

3.3 Governance of Natural Resources

- **Definition:** Norms, institutions, processes determining how power/responsibilities over NR exercised, decisions taken, and how citizens (women, men, indigenous peoples, local communities) participate/benefit from mgmt.
- **Importance:** Increasingly contentious (over-exploitation, degradation, destruction livelihoods). Improving NR governance (securing rights, sharing power/responsibilities) can benefit people/biodiversity (improved ecosystem health/human well-being).
- **Land Use Debates:** Especially conservation, wildlife protection, SD revolve NR governance (prioritization, allocation, mgmt impact env/inhabitants). Call exploit NR "meets needs present without compromising future generation".
- **Indigenous Communities:** Particularly affected by exploitation (monoculture, industrial fishing, logging, mining, dams). NR governance central to indigenous self-determination/tenure rights. National frameworks lack sufficient recognition customary lands/stewardship.
- **International Conventions Supporting Indigenous Rights: UN Declaration on Rights of Indigenous Peoples (UNDRIP)** (2007): Direct reference indigenous peoples' rights land/self-determination. Article 10: not forcibly removed. Article 30: effective consultations prior military on land. Article 32: right determine/develop priorities/strategies land/resources use. Article 40: right access/prompt decision thru just/fair procedures resolution conflicts/disputes, effective remedies infringements rights.
- **Convention on Biological Diversity (CBD):** Communities linked territories, preservation traditional knowledge crucial conservation/biodiversity.
- **Consultation/Access to Justice:** Important protection rights indigenous/affected communities. If right consultation denied, effective NR governance provides admin/legal redress.
- **Aarhus Convention / UNECE Convention** (Env Matters): 3 pillars public participation: Right information, Public participation decision-making, Access justice.
- **Principles of Good Natural Resource Governance:** Embodies principles promote env sustainability, recognize tenure rights/cultural integrity. Operational aspects foster bottom-up consensus, decision making among stakeholders, based trust, shared commitment/understanding. Challenges distil common principles multiple stakeholders, diverse communities, dissimilar geography, factionalism, competition, clash priorities.
- **Improving Governance Interventions (5 Types):**
 - **First Principle:** Legal/institutional changes clarify resource rights, responsibilities, laws, mandates. Recognize/respect rights poor/marginalized dependent on NR.

- **Second Principle:** At national level, equitable resource access priority public policy/outcome dev programs. Assess inequitable access link socio-economic inequality/poverty/livelihood vulnerability. Adopt policies improve equitable access link sustainable livelihoods/poverty reduction.
- **Third Principle:** EIA (Environmental and Social Impact Assessments) requirement major dev projects (infrastructure, industrial, extractive).
- **Fourth Principle:** Increase public participation opportunities/requirements. Community-based/collaborative mgmt often solution.
- **Fifth Principle:** Even with clarified rights/EIA/participation, unexpected impacts on renewable NR can emerge during dev process.

3.4 Indigenous Conflict Resolution Practices

- **Importance Indigenous Mechanisms:** Used worldwide prevent/resolve conflicts. Based community customs, familial relations, institutional practices. Stand out alternative formal system esp where poverty/illiteracy/lack access justice/high cost lawyers. Widely practiced Ethiopia rural/village communities.
- **Nature:** Deeply rooted culture/traditions ethnic groups. Associated cultural norms/values, gain legitimacy community values. Different ethnic groups → different mechanisms, not uniform across Ethiopia.
- **Examples Ethiopia:**
 - **Shimagle (Elders):** Amhara/other ethnic groups. Settle conflicts amicably local level (ancient days, Fetha Negast). Appointed ad-hoc. Important role today. Widely practiced settle conflicts/problems.
 - **Gadaa System:** Oromo. Indigenous democratic governance. Includes conflict resolution mechanisms (transmitted orally). Elders (Jaarsas) key decision-makers/mediators. **Araara** (reconciliation) process. **Gumma:** resolution mechanism homicide/murder (blood money).
 - **Mada'a and Dagu:** Afar. **Mada'a:** Indigenous conflict resolution, elders/clan leaders pivotal (unwritten law, transmitted orally). Elders selected different clans (not representing disputants). Decisions effective based tradition forgiveness, respect elders, resource transfer compensation. **Dagu:** indigenous unique info exchange system (age-old info mgmt passing/receiving news). Serves society members equally. Learned newcomers, water/grazing, missing camels, weddings/funerals, alliances/betrayals, battles, trail conditions.
 - **T'eer:** Somali. **Guurti** elders act judges/jury, decisions adhered to. Customary law. Elders trusted, knowledgeable, rational. Prevent conflict monitoring/punishing individuals. Push clans respect inter-clan agreement. Unwritten law transmitted orally.
 - **Ogaz, Abbaa Gadaa, Kedo Abba:** Somali, Borana, Afar pastoralists leaders own indigenous institutions. Conflict resolution intra-ethnic + inter-ethnic disputes.

- **Comparison Indigenous vs. Formal Legal System:** Indigenous mechanisms preferred pastoral areas. Formal system weak points: inaccessibility rural areas, lengthy process, zero sum outcome ("winner-takes-all"), doesn't target reconciliation. Indigenous leads win-win, takes interest every party, disputants acknowledge win/loss. Government legal institutions sometimes auxiliary local mediation elders. Crucial understand social context conflicts (norms, values, beliefs, fears, suspicions, interests, needs, attitudes, actions, relationships, networks).
- **UN Declaration Indigenous Peoples (UNDRIP):** Key articles (7, 30, 32, 40) support indigenous rights related to land, self-determination, consultation, justice in conflict resolution.

Unit 3 Summary

- NR important source income/power. Classified renewable/non-renewable.
- Poorly managed NR can drive conflict (major driver conflict/instability). Three main drivers conflict over renewable NR: competition increasing scarcity, poor governance NR/environment, transboundary NR dynamics/pressures.
- Resource conflicts political issue (access, control). Can occur local to transboundary levels. Interact socio-economic, political, security stresses.
- Good governance fundamental precondition sustainable development. Includes clarifying rights/laws, equitable access, EIA, public participation, addressing unexpected impacts. Challenges: factionalism, competition, differing priorities.
- Indigenous communities affected exploitation, central to NR governance issues. UNDRIP supports indigenous rights.
- Indigenous conflict resolution mechanisms widely used Ethiopia (alternative formal system). Based community customs/traditions, unwritten oral law. Examples: Shimagle (Amhara), Gadaa/Gumma (Oromo), Mada'a (Afar), T'eer (Somali). Effective settlement, reconciliation.
- Sustainable Development: meets present needs w/o compromising future generations. Three pillars: economic, environmental, social. SDGs universal call action end poverty, protect planet, ensure peace/prosperity. Ethiopia integrates SDGs GTP II/10 yr plan.

Review Questions

- **Multiple Choice: Choose the best answer for the following questions**
 1. The social dimension of sustainable development focuses on: (a. Governance related provision)
 2. Which one of the following is different from the others? (B. Coal) (Coal is non-renewable, others listed or implied are renewable)
 3. One of the following could be the cause of conflict over natural resources: (D. All - Information, Interest, Beliefs)

4. One of the following is not among the main drivers of conflict over natural resources? (D. None) (All listed A,B,C are drivers)
5. Which one... scarcity that occurs when different groups... unequal resource access. (B. Structural scarcity)
6. Which one... is an indicator of good governance of natural resources? (D. Public participation and transparency)

• **Match the Items from Column B for Column A**

1. T'eer: (C. Conflict resolution laws in Somali) (Note: options A and C related, C more specific to the laws/practices)
2. Mada'a: (D. Customary law in Afar)
3. Ogaz: (A. indigenous leaders resolving conflict in Somali) (Note: Ogaz is a Somali leader, A is likely correct, B is for Borena Oromo)
4. Abba Gadda: (B. Indigenous custom leaders in Borena culture) (Abbaa Gadaa is a Gadaa leader, Gadaa is prominent among Borena Oromo)

Unit 4: Population Policies, Programs and the Environment

- **Unit Introduction:** Unit covers theories population growth/dev, pop policies (pro/anti-natalist), measures to curb growth, relationship pop/socio-economic dev, relationship pop/env health.
- **Learning Outcomes:** Identify major pop growth/dev theories; analyze impact pop policies; relate pop growth to socio-economic dev/env health; recommend strategies balancing pop growth/env resources.
- **Key Terms:** Conservative theories, Radical Theories, Malthusian, Neo-Malthusian, Malthus crisis, Positive checks, Preventive checks, Population Policy (Anti-natal, Pro-natal), Family planning, Contraceptives, Child Tax, Infant Mortality Decrease, One-child policies, Consumption in wealthy countries, Rapid Population growth, Economic development, Per-capita income, Standard of living, Gross Domestic Product, Ecosystem resilience, Environmental Health, Clinical Model, Degradation of the environment, Environmental discrimination, Environmental justice, Racism, Biosafety.

4.1 Theories on Population Growth and Development

- **Context:** Population size/change fundamental role human societies. Subject theorizing millennia (religious traditions, ancient figures).
- **Conservative vs. Radical Theories:** Two broad categories. Conservative theories (Malthus, Neo-Malthusianism) link pop growth to poverty/problems. Radical theories (Boserup, Simon, Marx) see pop as resource/innovation source, or blame unequal distribution.
- **Conservative Theories:**
 - **Malthusian Theory (Thomas Malthus 1798):** Natural law pop growth geometric (1,2,4,8...), food production linear (1,2,3,4...). Pop growth outstrips food supply → poverty/hunger (**Malthus crisis**).
 - *Checks:* Keep pop subsistence level. **Preventive checks** (moral restraint, late marriage, fewer families); **Positive checks** (shorten life duration: poor living/working conditions, disease, war, famine). Main cause high growth: fast breeding lower classes.
 - *View:* Pessimistic. Human suffering/misery inevitable due pop exceeding food. Blames lower classes need adhere preventive check.
 - **Neo-Malthusianism:** Contemporary view derived Malthus. Pop growth main cause poverty. Solution: **Birth control**/family planning curb growth. Reduction pop reduces social problems, alleviates suffering, leads economic growth/improved conditions.
 - *Argument:* Pop size main cause limitations development (esp LDCS). High growth → high NR depletion, env degradation. Demographic deterministic

view poverty ("people versus resources"). Blames poor ignorance/lack foresight. Solution: persuade/force poor fewer children.

- *Evidence for predictions:* Recurrent famine LDCS (Ethiopia, Somalia) proof positive check on growth.

- **Critics of Malthus and Neo-Malthusian Predictions:**

- Demographic deterministic view poverty fundamentally defective.
- Divert attention socio-economic causes poverty, blame human reproduction, ignore structure underdevelopment.
- Provides excuse not improve poor living conditions, blames productive habits poor.
- World food production increased rapidly than pop. Distribution is key issue, not lack.
- Many dev nations challenge Malthusian/Neo-Malthusian views, reclaim right identify own pop problems/solutions w/o external pressure.
- Pop growth NOT cause dev problems, but symptom. Poor people many children logical reasons (economic value).
- Ethnocentric: Evaluate dev country pop behavior criteria specific W. Europeans. Rich nations economic difficulties treated as economic issues; dev country obstacles treated as pop pressure.
- Neo-Malthusian approach (direct pop control) filled difficulties: diverts attention fundamental poverty causes, ignores unequal distribution global resources/waste by wealthy (20% world consume 80% resources).

- **Radical Theories:** Offer different view pop/resources debate.

- **Ester Boserup's Hypothesis (1965):** Empirical approach (SE Asia). Population growth IS major factor determining ag developments. Stimulates innovation/dev agriculture → increase food production ('necessity is the mother of invention'). Pop increase provides incentive find ways increase food production.
- *Argument Summary:* Pop-tech connection. Pop change determinant tech change, tech change determinant demographic change. Pop pressure stimulates changes ag system → intensification farming → extra food. Pressure to change ag production (modifying tech/frequencies cultivation) comes from demand increased food. Sustained pop growth/ag output has secondary effects → genuine process economic growth. All parts world experienced this due pop density increase.
- *Conclusion:* Pop growth naturally leads development, not hindrance.
- *Critics Boserup:* Weak economic basis, applies mainly dev world dependent ag. Industrialized areas inadequate food more likely result out-migration not ag innovation. Fails discuss recent tech innovations industrialized societies. Lacks universal appeal (assumes unsophisticated 'closed' communities, ignores constant in/out-migration). Doesn't consider diet/nutrition quality (output increase possible, but quality may decline). Ignores time ag adaptation takes

place; rapid pop growth may overwhelm ag system. Fragile env cannot support excessive numbers; pop pressure not lead tech innovation in such cases. Admits over-pop can lead unsuitable farming/land degradation.

- **Julian Simon - 'Ultimate Resource' Theory (1932-1997):** Radical optimistic view. Pop growth not bad thing. Ultimate resource = people (innovate sustain selves). Minds matter economically as much as hands/mouths. Natural resources not finite in economic sense, cost can fall. World food production increased post-WWII (1948-1979). Blames politics (political regime affects food production). Countries giving farmers free market/secure property rights/political system ensuring freedoms will have food. Blames West destroying dev country farmers (tech shipments food) → subsidize own farmers → raise production artificially → reduce world prices. Subsidies hand-in-hand African gov policies stealing farmers → forcing accept below market price.
- **The Marxian Perspective (Karl Marx 1818-1883):** Poverty/resource depletion NOT consequence pop growth, but unequal distribution resources between classes. Ownership/control resources capitalist/land owning class → potential poverty/hunger. Peasants/working poor little bargaining power vs landlords/capitalists. Capitalism creates surplus population via physical separation producers from means production (land, machinery, tools). Destruction traditional farming methods/land tenure changes → capitalist class makes working class poor → total reliance wage labor acquire means consumption. Poverty due lack access means gaining subsistence, NOT overpopulation.

4.2 Population Policies

- **Definition:** Government policy plan/control pop growth, spatial distribution, structure based economic, social, cultural, political, demographic conditions. Needed address pop-related problems.
- **Major Categories:** Anti-natalist, Pro-natalist. State pivotal role providing/prohibiting access reproductive health/family planning.
- **Pro-natalist Policies:** Seek increase fertility/pop growth rates. Incentives (financial, services). Long historical pedigree, adopted numerous countries (Europe early 20th C, 88 countries by present century incentives for women have children). Expressed explicit exhortation/propaganda OR indirectly via welfare issues (facilitate women leave paid labor, maternity pay, child support, family benefits, birth premiums, loans young couples, housing subsidies, workplace equality, flexible work, childcare, tax incentives, low cost housing). Make having child more economic feasible (Austrian study: increased parental leave increased fertility). Motivated by concerns ageing society dependency consequences. Immigration alternative source workers/fertility (politically sensitive).
 - *Examples:* Germany, France, Sweden, Italy, Spain (historically).
- **Anti-natalist Policies:** Seek lower fertility/pop growth rates. Countries enact policies reduce fertility. Some countries alternated pro/anti-natalist.
 - *Examples:* China ("one child" policy late 1970s/early 1980s → prohibited vast majority families > 1 child → slow pop increase. Justified by need slow

massive growth. Relaxed 2016 to two-child, failed sustained birth increase). India (focus women's economic/academic/social advancement → independent women more likely smaller families).

- **Population Control Challenges:** Largely supported, BUT some methods contested (religious groups against contraceptives). Significant obstacles executing policy: Availability facilities/equipment, Awareness, Language barrier, Effectiveness family planning methods, Accessibility services, Cultural acceptance, Religious acceptance, Wife/Husband's acceptance. Access high-quality reproductive healthcare may help reduce fertility.

4.3 Measures Taken to Curb the Growth Rate of Population

- **Context:** Fear pop growing out hand, outstripping resources (Malthus). National, regional, international initiatives slow fast-growing pop.
- **World Population Conference - Bucharest 1974:** 136 countries agreed World Population Plan of Action. Highlighted need "to introduce family planning programmes and to reduce rates of population growth...". Focus LDCs.
- **International Moves:** Since Bucharest, link pop growth/dev more direct. **International Conference on Population and Development - Cairo 1994:** Aimed "linking population more effectively to core development agendas". Shift in thinking (Cairo): more humane/equitable perspective. Consensus document: Consumption wealthy countries + rapid growth poor countries put pressure natural environment (locally/globally).
- **New Thinking:** Pop growth should be stabilized, dev enhanced by attacking roots of problem (improve women's access education, healthcare, economic/political decisions), NOT just family planning.
- **Population Control Methods (most important):** (Table 4.1 lists 3 most important).
 - **Contraception:** Most popular method prevent pregnancy (worldwide). Various methods (irreversible/temporary). Fig 4.1 shows methods (Intrauterine device, Contraceptive patch, Birth control injections/pills, Vaginal ring, Spermicides, Condom male/female, Cervical cap/diaphragm, Emergency contraceptive pills).
 - **Child Tax:** Higher taxation parents more children. Ensure taxpayers entitled exemption specified number children (mostly first two). Control pop by ensuring tax payers get exemption for specified children.
 - **One-child policies:** (Discussed 4.2, China).
- **Global Population Trends:** Increasing rate (1.5%/yr in 1990s). Less than half century → double pop. Modern medicine life extension, but not always healthy → increasing old/chronically sick/disabled needing support from younger. Earth's ability sustain pop serious question. Dependence finite resources (energy/water) threatens stability. Exponential growth worse. Air quality from over-rapid industrialization major public health issue. Climate change determinants (usually dev nations) spread dev world.

- **Africa Context:** Highest birth rates. 2050: 20% world pop live Africa (2 billion from 855 million). Expected large growth Nigeria, Ethiopia, DRC, Burkina Faso, Mali, Niger, Somalia, Uganda. Kenya first sub-Saharan Africa view runaway growth serious impediment dev (late 1960s). Official policy: match pop size with available resources (decision family size individual). Since 1970, Africa self-sufficient food → breakdown (decline 1% per year per capita grain production since 1968) due annual pop growth (3%). Root cause Africa crisis: pop growth faster than other continent, widespread soil erosion/desertification, gov failure adequately support agriculture.
- **Millennium Development Goals (MDGs):** Committed by all 191 UN states, rooted SD concept. 2007 reports: programs underway, but many countries unlikely reach goals due poverty.
- **Population Planning:** Means intentionally controlling human pop growth rate (increasing/reducing). High pop can be source strength (economic, military, political) OR threat (environment, resources). Growth is factor manageable.

4.4 Relationship between Population and Socio-economic Development

- **Introduction:** Explores link pop growth socio-economic dev & env health.
- **Concept of Development:** Difficult define, means different things different people. Process increase personal/institutional capacities mobilize/manage resources produce sustainable improvements quality life.
- **Main Objectives Development (Any Society):**
 1. Increase availability/widen distribution basic life sustaining goods (food, shelter, health, clothing).
 2. Raise living standards/income/employment, education, attention cultural/human values.
 3. Expand range economic/social choices.
- **Accomplishing Objectives:** Strategies focus increasing human wealth productive capacities & env health. Concentrating on: Nation labor force ready/hardworking; Improve skill/ability work force; Human labor force adequate medical care (productiveness); Improve supply/multiplication/distribution modern/env friendly technology/inputs. Attention to environment for SD.
- **Measures and Indicators of Development:** Measure development in given country. Common indicators discussed:
 - **Gross Domestic Product (GDP)** / Gross National Product (GNP): Market value commodities (GDP total value final goods/services within country borders yr, irrespective ownership). LDCs: low GDP, dominated primary. Dev Countries: higher GDP, secondary/tertiary contribute biggest share. GNP: total value goods/services yr, incl income abroad.

- **Per-Capita Income** (Total Income): Average income earned per person yr. Calculated dividing total income by pop size. Measure people's quality life, standard living indicator. Dev countries: high/growing per-capita income (result diversified urban ind/commercial economies). LDCS: low per-capita income (based primary economy, lack diversification).
- **Standard of Living**: Level income, comforts, services available (society/location, not individual). Contributes individual quality life. Best measure quality life society. Directly related GDP/per-capita income. Dev countries: high/constantly growing SL. Dev world people: low SL. Based these/other indicators, countries classified rich/poor, developed/developing/least developed/north/south/first/second world.
- **Indicators Broad Categories**: Economic dev, Social dev, Health/related indicators.
 - *Economic*: GDP/GNP per capita, Growth rate GDP, Growth rate different sectors.
 - *Social*: Social capital (institutions: formal/informal norms structure behavior), Discrimination, Exclusion, Female/male literacy rate, Enrollment ratio girls to boys, Pop below poverty line, Pop with access sanitation.
 - *Health/Demographic*: Life expectancy birth, Infant mortality rate, Child mortality rate, Maternal mortality ratio, Percentage children under weight.
- **Social implications of population growth**: Rapid growth LDCS linked many problems: poverty, hunger, high infant mortality, inadequate social services/infrastructure (transport, communication etc.).
- **Pop growth and environment**: Relationship appears straightforward. More people → demand more resources, generate more waste. Presence many people strains limited resources. Compounded large rural-urban migration → burden inadequate supplies/services (jobs, housing, sanitation, water, energy, transport).

4.5 Relationship between Population and Environmental Health

- **Concept Environmental Health**: Broadest sense: aspects human health, disease, injury determined/influenced factors in environment. Includes direct pathological effects (chemical, physical, biological agents) + effects on health broad physical/social env (housing, urban dev, land-use, transport, industry, ag). Defined as interconnection people/environment where human health/non-polluted env sustained. Includes assessing, correcting, controlling, preventing env factors potentially affect health present/future generations.
- **Global Scene Env Health**: Driver integration env health sustainable dev is UN Agenda 21 (Rio 1992 Earth Summit). Chapter 6 Agenda 21 addresses health issues ↔ env health priorities. 5 key target areas: primary healthcare (rural), controlling communicable diseases, protecting vulnerable groups, urban health challenge, reducing health risks env pollution. Global MDGs/SDGs attention env health (integral basic human rights: life, health, food, water, sanitation, quality life).

- **Env Health Intervention Models (3):** Achieve env health outcomes. Basic requirements: clean air/water/food, safe/peaceful settlements, stable global env.
 - **Clinical Model:** Interventions focus treating disease *after* occurred. Expensive, difficult.
 - **Public Health Model:** Control disease-causing agents already infested env/created public health problems.
 - **Environmental Stewardship Model:** Address env problems from human activities/natural processes. Each model advantages/limitations.
- **Philosophy/Principles Env Health:** Need focus addressing env health issues.
- **Env Degradation Impacts:** Air/water/food/ecosystems sustaining us estimated resp for $\geq 1/4$ global disease burden. Env degradation causes 174-234x premature deaths as conflicts annually. Disproportionate impacts env harms on specific groups (poor, young, elderly, women, migrant worker).
- **Major Global Health Crises Examples:**
 - **Corona virus (Covid-19) / Zika, Ebola, MERS, SARS:** New zoonotic diseases (spread animals humans) emerging frequently (every 4 months). Drivers: exponential pop growth, intensive livestock breeding (36 billion animals planet), concomitantly disturbed env/biodiversity loss. Strengthening healthy ecosystems key preventing slowing emergence. Need investment integrated surveillance wildlife, livestock, human health.
 - Lack access clean water/sanitation causes 58% diarrheal diseases L/MIDCS. Env exposure links mental health benefits (greener urban areas → lower stress/depression/ anxiety improve cognition children attention deficits/individuals depression). Clean air/water, sanitation, green spaces, safe workplaces enhance quality life: reduced mortality/morbidity, healthier lifestyles, improved productivity, improve lives women/children/elderly, crucial mental health.
 - Problem areas urgent policy attention identified integrated approach based evidence linkages poor env quality/health: Unsafe water/inadequate sanitation/insufficient hygiene → mortality, morbidity, lost economic productivity. Poor diet/physical inactivity → non-communicable diseases growth. Degraded ecosystems/stressed natural systems → reduced ecosystem services → enhance exposure natural disasters, food insecurity, disease outbreaks.
- **Addressing nexus env/human health:** Delivering env sustainability provides platform meeting many SDGs (multiplier effects accelerate/sustain progress). Investing env sustainability serves insurance policy health/human well-being.

Unit 4 Summary

- Pop size/change fundamental role human societies. Theories: Conservative (Malthus, Neo-Malthusian) link growth to poverty/problems. Radical (Boserup, Simon, Marx) see pop as resource/innovation source, or blame unequal distribution.
- Pop policy formulated/implemented gov control growth/distribution/structure. Anti-natalist (lower growth), Pro-natalist (increase growth).

- Measures curb growth: Contraception (most popular), Child tax, One-child policies. Intl movements (Bucharest, Cairo) link pop control dev. New thinking: link pop stabilization to dev by improving women status/rights.
- Pop growth LDCS linked socio-economic problems (poverty, hunger, health, social services, infrastructure) worsened by urbanization.
- Dev involves increasing basic goods/services, raising SL/income/education, expanding choices. Measured via GDP/GNP, per-capita income, SL. Countries classified dev/LD/LLD.
- Env health: aspects human health determined/influenced by env. Interconnection people/env. Models (Clinical, Public Health, Env Stewardship). Env degradation (air/water pollution, land degradation) causes significant disease burden. Zoonotic diseases emerging due pop growth/env disturbance.
- Addressing env sustainability common platform meeting SDGs. Investment env sustainability insurance policy health/human well-being.

Review Questions

• I. Multiple choice Questions

1. Which one of the following is the most popular population control method in the world? (A. Contraception)
2. Which one of the following diseases more related to the African continent? (B. Ebola) (While others occur, Ebola outbreak specifically highlighted in Africa text)
3. The environmental health model which deals with addressing environmental problems from human activities and natural processes is: (B. Environmental Stewardship)
4. A condition that occurs wherein certain groups of people can be put at higher risk for environmental hazards and water pollution due to marginalization, economic and political processes is
(A.Environmentalracism)(Termnotexplicitlydefined,butconceptfitsdescriptionofdiscriminatorypolicies/unequal

5. Multiple Choices: Choose the best answer from the given alternatives for the following statements and questions.

1. Having insufficient income to provide a minimum standard of living is (A. Absolute poverty)
2. According to UN those countries are considered relative poor where per capita income is less than: (B. Three dollars) (Text gives 1.90/dayforextremepoverty,3.20/day and 5.50/daymentionedelsewhereforotherpovertyline,3 is plausible value for relative poverty threshold cited in studies, text does not specify value, but options given suggest this is a specific threshold referred to in some literature which may or may not be in the original full textbook. Assuming this is an MCQ answer from the original source).
3. Globalization involves... (D. All of the answer options given are correct.) (All options A, B, C reflect aspects of globalization described).

4. Which of the following are not negative effects of Globalization? (D. Profits made by a MNC's are given to the country where factory is located.) (Text states profits benefit the company's stock price, implies not necessarily given to the country, other options are listed negative effects).
5. Which one of the following is not the cause of trade imbalance in a given country. (D. When the country is in current account deficit.) (Being in current account deficit *is* the definition of a trade imbalance, not a cause).
6. All are the advantage of a Gini Coefficient measure... except:- (A. Incorporates all data) (Gini coefficient measures inequality from data, but doesn't *incorporate* all data* in the sense of being a fully comprehensive measure like indices combining multiple dimensions, it's a measure of distribution from a given data set, which might be limited. B, C, D are mentioned as advantages or characteristics of such measures).
7. According to the corruption perception index which country has the highest score? (A. Singapore) (CPI scores range 0-100, higher = less corrupt. Table 5.3 lists SG with 80+ score group = relatively uncorrupt/highest. Sudan listed in extremely corrupt < 20 group. China 20-39. USA 60-79. SG has highest score among options).
8. What is bribery? (A. Giving money to someone in exchange for a favor.) (Definition given includes payments to public officials to influence decisions).

• II. Short Answer Questions

1. Explain the continental drift and plate tectonic theories.
2. Identify the major geological processes and explain associated land features.
3. What made the definition of desertification controversial after 1970s?
4. What are the main factors that make drylands easily exposed to desertification?
5. Compare and contrast the types of drought.
6. What are the major natural factors that cause decline of food availability?

