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BBA	SEMESTER I	UNIVERSITY OF KERALA	COURSE CODE: UK1DSCMGT102

ENVIRONMENTAL MANAGEMENT

EXAM REVISION NOTES

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MODULE I

ENVIRONMENTAL MANAGEMENT AND NATURAL RESOURCES

Environmental Management Scope and Multidisciplinary Nature: The purposeful regulation and stewardship of human activities to ensure sustainable economic development while preserving the biosphere's structural integrity.

- **Multidisciplinary Synthesis:** Integrates Natural Sciences (biology, ecology, physics), Engineering (wastewater treatment, renewable energy), Economics (cost-benefit accounting, life-cycle analysis), Law (statutory standards, polluter liability), and Demography.
- **Imperative for Public Awareness:** Community participation, environmental education, and grassroots vigilance are essential to convert statutory laws into living reality.
- **Renewable vs Non-Renewable Resources:** Renewable replenish naturally via biological or physical cycles within human timescales (solar, wind, freshwater, forests); Non-renewable exist in finite geological reserves and cannot be replenished once depleted (fossil fuels, metallic ores).
- **Resource Depletion Paradigms:** Garrett Hardin's *Tragedy of the Commons* (unregulated shared common-pool resources inevitably suffer over-exploitation and exhaustion by rational self-interested individuals).

Forest Resources and Deforestation Dilemmas: Forests cover 31% of Earth's land, sequestering carbon, regulating microclimates, and maintaining hydrological cycles:

- **Drivers of Deforestation:** Commercial agriculture (cattle ranching, monoculture palm oil, soy), commercial logging, open-cast surface mining, and multipurpose hydroelectric dam reservoirs.
- **Ecological Consequences:** Accelerated topsoil erosion, disruption of regional rainfall patterns, severe flash floods, loss of indigenous biodiversity, and substantial greenhouse gas emissions.
- **Western Ghats Vulnerability:** The Gadgil and Kasturirangan reports documented how clearing mountain canopies for rubber and tea plantations triggered catastrophic landslides in Wayanad and Idukki.
- **Forest Conservation Initiatives:** Joint Forest Management (JFM) partnerships between state forest departments and local village communities; Social Forestry and agro-forestry programs.

Water and Mineral Resources Depletion: Finite freshwater availability and geological extraction costs:

- **Groundwater Depletion:** Over-extraction via deep submersible agricultural tube-wells causes aquifer compaction, land subsidence, coastal saltwater intrusion, and toxic fluoride/arsenic mobilization.
- **Mining Environmental Costs:** Surface strip mining strips overburden, releases toxic airborne silica dust (silicosis), and triggers Acid Mine Drainage (AMD) that acidifies downstream river catchments.
- **River Sand Depletion:** In-stream sand mining destabilizes riverbeds, lowers surrounding agricultural water tables, and destroys aquatic breeding habitats, prompting statutory promotion of M-Sand.
- **Statutory Mining Governance:** Mines and Minerals (Development and Regulation) Act (MMDR Act, 2015) mandating District Mineral Foundations (DMFs) funded by miners to remediate mining-affected local communities.

Energy Transitions and Sustainable Resource Stewardship: Shifting from fossil carbon to clean regenerative power:

- **Fossil Fuel Limits (Hubbert's Peak Oil):** Finite petroleum reserves follow a Gaussian extraction curve; high fossil combustion drives global warming and acid rain.
- **Renewable Energy Alternatives:** Solar photovoltaic systems (monocrystalline vs polycrystalline PV, MPPT controllers); Onshore/Offshore wind turbines; Run-of-the-river small hydro; Closed-cycle OTEC; Green Hydrogen produced via zero-carbon water electrolysis.
- **The 5 R Conservation Hierarchy:** Refuse single-use disposables; Reduce domestic energy and water consumption; Reuse durable goods; Recycle segregated dry wastes; Rot (compost) organic food residues.
- **Traditional Ecological Knowledge (TEK):** Sacred groves (Kavu in Kerala, Deorais in Maharashtra) preserving relict biodiversity; Traditional water systems (Surangas of Kasaragod, Johads of Rajasthan, Ahar-Pynes of Bihar).
- **Energy Conservation Standards:** Bureau of Energy Efficiency (BEE) Star Rating appliances and Energy Conservation Building Codes (ECBC) mandating thermal insulation and high-efficiency HVAC.

MODULE II

ECOSYSTEM DYNAMICS AND BIODIVERSITY CONSERVATION

Ecosystem Concept and Structural Architecture: Coined by A.G. Tansley (1935); an open, self-sustaining thermodynamic unit comprising biotic communities interacting with abiotic physical and chemical environments:

- **Abiotic Framework:** Climatic factors (solar radiation, temperature, precipitation), Edaphic factors (soil texture, pH, humus), Topographic factors, and inorganic nutrients.
- **Biotic Trophic Levels:** Producers (autotrophic green plants, phytoplankton); Consumers (primary herbivores, secondary carnivores, tertiary apex predators, omnivores); Decomposers (saprotrophic bacteria and fungi mineralizing organic matter); Detritivores (fragmenting dead organic detritus).
- **Ecological Niches:** The unique functional role, habitat space, and resource utilization profile of a biological species within an ecosystem (Fundamental vs Realized Niche).

Functional Mechanics and Energy Flow Laws: Unidirectional energy transfer versus closed-loop nutrient circulation:

- **Lindeman's 10% Efficiency Law:** Only approximately 10% of energy stored as biomass at one trophic level is transferred to the next; 90% is dissipated as metabolic respiration heat.
- **Food Chains and Webs:** Grazing Food Chain (starts with living green plants) vs Detritus Food Chain (starts with decaying organic matter, dominating forest and mangrove systems); interconnected Food Webs enhance ecosystem resilience.
- **Ecological Pyramids (Eltonian Pyramids):** Pyramid of Numbers (upright in grasslands, inverted in single-tree ecosystems); Pyramid of Biomass (upright on land, inverted in open marine waters); Pyramid of Energy (always upright without exception under the Second Law of Thermodynamics).
- **Biogeochemical Cycles:** Carbon cycle (photosynthetic fixation vs respiration/combustion); Nitrogen cycle (fixation by Rhizobium, nitrification by Nitrosomonas/Nitrobacter, assimilation, ammonification, denitrification); Phosphorus sedimentary cycle (weathering of phosphate rocks).
- **Ecological Succession:** Orderly replacement of biological communities: Primary succession (initiates on sterile rock with pioneer lichens/mosses) vs Secondary succession (initiates after disturbances on pre-existing fertile soils, reaching climax community).

Biodiversity Levels, Values, and Hotspots: Totality of genes, species, and ecosystems across the planetary biosphere:

- **Three Levels of Diversity:** Genetic diversity (variation within species, e.g., 50,000 Indian rice varieties); Species diversity (species richness and evenness); Ecosystem diversity (variety of habitats and biomes).
- **Multidimensional Values:** Consumptive use (local firewood, bushmeat); Productive use (commercial timber, marine fisheries, pharmaceuticals like Quinine, Taxol, Vincristine); Social and ethical value (sacred plants, intrinsic biocentric right to exist); Aesthetic/Ecotourism value; Option value (future medicinal/crop genes).
- **Norman Myers' Biodiversity Hotspots:** Regions containing at least 1,500 endemic vascular plant species that have lost over 70% of primary native habitat. Four Indian Hotspots: (1) Western Ghats & Sri Lanka; (2) Himalayas; (3) Indo-Burma; (4) Sundaland (including Nicobar Islands).
- **Threats and Conservation:** HIPPO drivers (Habitat destruction, Invasive species, Pollution, Population growth, Over-exploitation); In-situ conservation (National Parks, Wildlife Sanctuaries, Biosphere Reserves) vs Ex-situ conservation (Botanical Gardens, Zoos, Seed Banks, Cryopreservation).
- **Targeted Indian Conservation Missions:** Project Tiger (1973, core-buffer protected habitats); Project Elephant (1992, securing elephant migration corridors); Ramsar Convention on Wetlands (protecting Vembanad, Ashtamudi, and Sasthamkotta lakes in Kerala).
- **Keystone and Umbrella Species:** Keystone species exert disproportionate ecological control (Ficus trees, sea otters); Umbrella species protect vast multi-species habitats (Royal Bengal Tiger, Asian Elephant).

MODULE III

ENVIRONMENTAL POLLUTION AND DISASTER GOVERNANCE

Pollution Classification and Toxicology: Deleterious introduction of substances or energy into the environment causing ecological harm:

- **Pollutant Typology:** Primary (emitted directly: CO, SO2, coarse dust) vs Secondary (photochemically synthesized: Ozone, PAN, acid rain); Biodegradable vs Non-biodegradable (chlorinated plastics, heavy metals); Quantitative (CO2) vs Qualitative (synthetic pesticides).
- **Bioaccumulation and Biomagnification:** Bioaccumulation concentrates toxins in an individual over time; Biomagnification multiplies fat-soluble toxins (DDT, methylmercury) across successive trophic levels, causing disasters like Minamata disease (mercury poisoning) and Itai-Itai disease (cadmium bone fractures).

Air Pollution Chemistry and Industrial Control Hardware: Atmospheric contamination triggering acute respiratory and cardiovascular mortality:

- **Criteria Pollutants:** PM2.5 (deep alveolar penetration into bloodstream); SO2 (combustion of sulfur coal, acid rain precursor); NOx (photochemical smog precursor); CO (binds to hemoglobin forming carboxyhemoglobin, causing asphyxiation).
- **Smog Phenomena:** Photochemical Smog (hot sunny basins, vehicular NOx + VOCs + sunlight forming O3 and PAN, oxidizing) vs Classical London Smog (cold humid winters, coal soot + SO2, reducing).
- **Acid Rain:** Atmospheric SO2 and NOx oxidising into H2SO4 and HNO3; precipitation with pH < 5.6 acidifying soils, leaching aluminum, and corroding limestone monuments (Stone Leprosy on Taj Mahal).
- **Control Technologies:** Electrostatic Precipitators - ESP (high-voltage ionization collecting 99% fine particles); Fabric Baghouse Filters (reverse pulse-jet cleaning); Wet Venturi Scrubbers (acid gas absorption); Catalytic Converters (precious metals oxidizing CO/hydrocarbons and reducing NOx).
- **Atmospheric Inversions:** Radiation and subsidence inversions trapping industrial emissions and winter stubble smoke in boundary layers, creating acute Delhi NCR smog crises.

Water Quality Diagnostics and Treatment Engineering: Maintaining chemical and biological aquatic health:

- **Diagnostic Indicators:** Biochemical Oxygen Demand (BOD5 - milligrams of oxygen required by aerobic microbes over 5 days at 20°C); Chemical Oxygen Demand (COD - chemical oxidation via potassium dichromate); Dissolved Oxygen (DO - levels below 4 mg/L cause fish hypoxia).
- **Cultural Eutrophication:** Nitrate and phosphate agricultural runoff triggers explosive algal blooms, blocking light; dead algal biomass fuels massive bacterial decomposition, suffocating dissolved oxygen to create anoxic dead zones.
- **Wastewater Treatment Stages:** Preliminary (bar screens, grit chambers); Primary (gravity sedimentation clarifiers removing 50-70% TSS); Secondary (Activated Sludge Process with aeration basins and return sludge, trickling filters); Tertiary (chemical coagulation, sand/carbon filtration, UV/chlorine disinfection).
- **Bioremediation Technologies:** Microbial degradation of oil spills (TERI Oilzapper); Phytoremediation utilizing hyperaccumulator plants (Indian Mustard for lead, water hyacinths for heavy metal extraction).

Solid Waste, E-Waste, and Disaster Frameworks: Urban waste governance and risk mitigation:

- **Sanitary Landfills:** Engineered containment featuring composite clay and HDPE geomembrane bottom liners, leachate collection/treatment systems, vertical methane extraction wells, and daily soil covers.
- **Biomedical Waste Management:** Specialized segregation under Biomedical Waste Rules: Yellow bins (anatomical/clinical waste for incineration); Red bins (contaminated plastics for autoclaving); White containers (sharps/needles); Blue boxes (glassware).
- **Extended Producer Responsibility (EPR):** Mandates brand manufacturers to establish buy-back, take-back, and certified recycling systems for post-consumer e-waste and plastics.
- **Noise Standards and Decibel Limits:** Permissible day/night decibel thresholds: Industrial (75/70 dB), Commercial (65/55 dB), Residential (55/45 dB), and Silence Zones (50/40 dB).
- **Disaster Management Cycle:** Six-phase continuous governance: Prevention, Mitigation (seismic building codes, mangrove buffers), Preparedness (early warning systems, mock drills), Emergency Response (search and rescue, medical triage), Recovery, and Reconstruction (Build Back Better). Enforced in India under Disaster Management Act 2005 via NDMA, SDMA, and NDRF.

MODULE IV

SOCIAL ISSUES, HUMAN DEMOGRAPHY AND ENVIRONMENTAL ETHICS

Sustainable Development Paradigms and Global Goals: Development meeting present needs without compromising future generations (Brundtland Report 1987):

- **Foundational Principles:** Inter-generational equity; Intra-generational equity; Precautionary Principle (lack of scientific certainty cannot postpone preventive action); Polluter Pays Principle (polluter internalizes remediation costs); Carrying capacity preservation.
- **UN Sustainable Development Goals (SDGs 2030):** 17 integrated global goals balancing human poverty eradication with climate action (SDG 13), clean water (SDG 6), clean energy (SDG 7), and terrestrial life protection (SDG 15).
- **Urban Environmental Stress:** Urban Heat Island effect (concrete and asphalt elevating temperatures by 2-6°C); transportation gridlock; encroachment on natural floodplains causing severe flash floods.

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- **National Action Plan on Climate Change (NAPCC):** India's eight national missions: National Solar Mission, Mission for Enhanced Energy Efficiency, Mission on Sustainable Habitat, National Water Mission, Mission for Sustaining Himalayan Ecosystem, Green India Mission, Mission for Sustainable Agriculture, and Mission on Strategic Knowledge for Climate Change.

Water Conservation and Displacement Governance: Protecting hydrological and human capital:

- **Rainwater Harvesting:** Rooftop catchments, conveyance gutters, first-flush diverters, multi-layer sand/gravel filters, and recharge wells replenishing depleted aquifers.
- **Watershed Management:** Integrated ecological stewardship of natural drainage basins via contour bunding, gully check-dams, afforestation, and democratic community water management (Ralegan Siddhi model).
- **Displacement and Cernea's IRR Model:** Development projects displacing millions, causing landlessness, joblessness, homelessness, marginalization, food insecurity, and social disarticulation; governed under the LARR Act 2013 mandating Social Impact Assessment and fair rehabilitation.

Environmental Ethics and Planetary Climate Disruption: Moral standing of nature and atmospheric thermodynamics:

- **Ethical Philosophies:** Anthropocentrism (human-centered, nature has purely instrumental resource value); Biocentrism (all living beings possess intrinsic moral right to flourish); Ecocentrism (Aldo Leopold's Land Ethic: moral standing belongs to the entire biotic community and ecosystem).
- **Greenhouse Effect and Global Warming:** Anthropogenic emissions of CO2 (surpassing 425 ppm), Methane (GWP 28-36x CO2), and N2O (GWP 265-298x CO2) trapping infrared heat; triggering polar ice collapse, sea-level rise, ocean acidification, and severe agricultural droughts.
- **Stratospheric Ozone Depletion and Montreal Protocol:** Chlorofluorocarbons (CFCs) photolyzing in stratosphere to release free Chlorine radicals (Cl*), each catalytically destroying over 100,000 O3 molecules; successfully arrested by the universal phase-out under the 1987 Montreal Protocol.
- **Demographic Transition and IPAT Equation:** Four demographic stages; Environmental Impact I = P × A × T (Population × Affluence × Technology); Ecological Economics emphasizing Herman Daly's Steady-State Economy and Genuine Progress Indicator (GPI).
- **Loss and Damage Fund:** Historic UNFCCC COP27 breakthrough establishing dedicated international financial compensation from wealthy historic carbon emitters to climate-vulnerable developing nations.

MODULE V

ENVIRONMENTAL POLICIES, LEGISLATION AND MANAGEMENT SYSTEMS

Constitutional Mandates and Landmark Judicial Doctrines: Foundational constitutional and judicial environmental governance in India:

- **Constitutional Provisions (42nd Amendment 1976):** Article 48A directs the State to protect and improve the environment and safeguard forests and wildlife; Article 51A(g) establishes the fundamental citizen duty to protect nature and have compassion for living creatures.
- **Article 21 Judicial Expansion:** Supreme Court interpreted the fundamental Right to Life to encompass the Right to a Wholesome, Clean, and Pollution-Free Environment (Subhash Kumar v. State of Bihar).
- **Landmark Judicial Doctrines:** Doctrine of Absolute Liability (M.C. Mehta Oleum gas leak case - strict non-delegable liability with zero exceptions); Public Trust Doctrine (Kamal Nath case - natural waters and forests held in trust for public cannot be commercialized); Precautionary and Polluter Pays Principles (Vellore tanneries case).
- **Public Interest Litigation (PIL):** Relaxation of Locus Standi under Articles 32 and 226 enabling public-spirited citizens to protect environmental rights via epistolary jurisdiction.

Major Indian Environmental Statutes: Specialized statutory pollution control frameworks:

- **Water Act 1974 & Air Act 1981:** Established CPCB and State Pollution Control Boards; mandates prior Consent to Establish (CTE) and Consent to Operate (CTO) for industrial facilities; Air Act 1987 amendment incorporated noise pollution.
- **Wildlife (Protection) Act 1972:** Categorizes protected area networks (National Parks, Sanctuaries); complete statutory ban on hunting; establishes Schedule I absolute legal protection; created National Tiger Conservation Authority (NTCA).
- **Forest (Conservation) Act 1980:** Strictly prohibits state authorities from de-reserving forests or diverting forest lands for non-forest purposes without prior Central Government MoEFCC approval; mandates compensatory afforestation (CAMPA).
- **Environment (Protection) Act 1986 (Umbrella Act):** Enacted following the Bhopal Gas Tragedy; grants sweeping powers to Central Government to lay down emission standards, issue binding closure directions (Section 5), regulate hazardous substances, and promulgated specialized subordinate rules (CRZ, E-Waste, Plastic, Hazardous Waste).
- **Coastal Regulation Zone (CRZ) Rules:** Demarcates CRZ-I (ecologically sensitive, no construction), CRZ-II (urban built shoreline), CRZ-III (rural coastal zones with No Development Zones), and CRZ-IV (territorial marine waters); enforced in Supreme Court's Maradu flats demolition order.
- **Biological Diversity Act 2002:** Three-tiered architecture: National Biodiversity Authority (NBA), State Biodiversity Boards (SBB), and Panchayat-level Biodiversity Management Committees (BMCs) maintaining People's Biodiversity Registers (PBR) to combat biopiracy.
- **Forest Rights Act 2006 (FRA):** Recognizes Individual and Community Forest Rights of scheduled tribes; vests sovereign consent authority in the village Gram Sabha (reaffirmed in Niyamgiri judgment).

National Green Tribunal and International Treaties: Environmental dispute resolution and multilateral agreements:

- **National Green Tribunal (NGT Act 2010):** Specialized fast-track environmental court comprising judicial and expert scientific members; mandated to resolve disputes within 6 months guided by natural justice and sustainable development principles.
- **Multilateral Environmental Agreements:** Stockholm Conference 1972 (created UNEP); Rio Earth Summit 1992 (Rio Declaration, Agenda 21, UNFCCC, CBD, UNCCD); Kyoto Protocol 1997 (legally binding emissions reduction targets, CDM); Paris Agreement 2015 (limiting global temperature rise well below 2.0°C via NDCs).

ISO 14001, EIA Architecture, and Citizen Movements: Corporate management systems, project clearance, and grassroots activism:

- **ISO 14001 EMS:** Voluntary international standard establishing Environmental Management Systems operating through the continuous improvement Plan-Do-Check-Act (PDCA) cycle and periodic environmental audits.

- **Environmental Impact Assessment (EIA):** Proactive planning tool legally mandated under EPA 1986; sequential stages: Screening (Category A vs B1/B2), Scoping (Terms of Reference), Baseline data collection, Impact prediction, Environmental Management Plan (EMP), mandatory Public Hearing, Appraisal by EAC, and Environmental Clearance.

- **Historic Grassroots Movements:** Chipko Movement (1973, Gaura Devi and Sunderlal Bahuguna hugging trees in Uttarakhand); Silent Valley Movement (1980s Kerala, KSSP citizens halting hydroelectric dam to protect evergreen rainforest); Narmada Bachao Andolan (Medha Patkar protesting displacement from Sardar Sarovar dam); Bishnoi Movement (1730 Rajasthan, Amrita Devi sacrificing life to protect sacred Khejri trees).

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