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CUET · ECONOMICS · CLASS XI · CODE 309

Environment and Sustainable Development

CUET unit: Indian Economic Development — Current Challenges Facing the Indian Economy (Environment and Sustainable Development)

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- The **environment** is the "total planetary inheritance" of biotic and abiotic elements, and it performs **four vital functions**.
- Population growth, industrialisation and affluent consumption have reversed the supply-demand balance for environmental resources, producing today's environmental crisis.
- India's environment shows a **"dichotomy"** of poverty-induced degradation alongside affluence-driven pollution, with five priority issues (land degradation, biodiversity loss, air pollution, fresh water management, solid waste).
- **Sustainable development** has the Brundtland definition; **Herman Daly's five conditions** apply; India's strategies include non-conventional energy, LPG/ Gobar gas, CNG, mini-hydel, solar PV, traditional knowledge, biocomposting and biopest control.
- CUET regularly tests: functions of environment, renewable vs non-renewable resources, Brundtland definition, Herman Daly conditions, India's environmental statistics, sustainable strategies.
- Dated grid: 1974 (CPCB), 1983 (Appiko movement), 1987 (Brundtland Report Our Common Future), 1997 (Kyoto Conference), 2015 (UN SDGs adopted, target 2030).

📖 Detailed Notes

2.1 Core concepts

- **Definition of environment**: environment is the **total planetary inheritance** and the totality of all resources, including **biotic factors** (birds, animals, plants, forests, fisheries) and **abiotic factors** (air, water, land, rocks, sunlight) that influence each other (NCERT §7.2, p. 116). The concept treats living and non-living elements as part of a single interdependent system.
- **Four functions of environment**: (i) **supplies resources** — both renewable (forests, fish) and non-renewable (fossil fuel); (ii) **assimilates waste**; (iii) **sustains life** by providing genetic and bio-diversity; (iv) **provides aesthetic services** like scenery (NCERT §7.2, p. 116). Sustainability ultimately depends on whether all four functions are kept in balance.

- **Carrying capacity**: the environment performs its functions without interruption as long as demand is within its carrying capacity — i.e., **resource extraction is not above the rate of regeneration** and **wastes generated are within the assimilating capacity** of the environment (NCERT §7.2, pp. 116–117).
- **Absorptive capacity**: the ability of the environment to absorb degradation; when wastes exceed this capacity, environmental crisis sets in (NCERT §7.2, p. 117).
- **Reversal of supply-demand**: in early civilisation, demand for environmental resources was less than supply, so pollution stayed within absorptive capacity. With population explosion and the industrial revolution, demand exceeded the rate of regeneration, reversing the supply-demand relationship and producing today's crisis (NCERT §7.2, pp. 118–119).
- **Global warming (Box 7.1)**: gradual rise in earth's lower atmospheric temperature due to human-induced increase in greenhouse gases (CO_2, CH_4) since the Industrial Revolution; CO_2 has risen 31% and CH_4 149% above pre-industrial levels since 1750; the Kyoto Conference (Japan, 1997) produced an international agreement to cut emissions by industrialised nations (NCERT Box 7.1, p. 118).
- **Ozone depletion (Box 7.2)**: reduction of stratospheric ozone caused by chlorine and bromine compounds — chlorofluorocarbons (CFCs) from coolants/aerosols and bromofluorocarbons (halons) from fire extinguishers — leading to higher UV radiation and skin cancer; led to the **Montreal Protocol** banning CFCs (NCERT Box 7.2, p. 119).
- **India's natural endowment**: rich soil, hundreds of rivers, lush forests, large mineral deposits; India holds nearly **8% of world's iron-ore reserves**; the Indo-Gangetic plains and Deccan black soil are major resources (NCERT §7.3, p. 120).
- **Dichotomy of India's environmental threat**: (a) **poverty-induced** environmental degradation and (b) **pollution from affluence** and a rapidly growing industrial sector (NCERT §7.3, p. 120). The two threats demand different policy responses but coexist in India.
- **Five priority environmental issues of India**: (i) land degradation, (ii) biodiversity loss, (iii) air pollution (especially vehicular in urban cities), (iv) management of fresh water, (v) solid waste management (NCERT §7.3, p. 120).
- **Land degradation factors (12)**: loss of vegetation / deforestation; unsustainable fuel-wood and fodder extraction; shifting cultivation; encroachment into forest lands; forest fires and overgrazing; non-adoption of soil conservation measures; improper crop rotation; indiscriminate use of agro-chemicals; improper irrigation planning; ground-water extraction exceeding recharge; open-access resources; poverty of agriculture-dependent people (NCERT §7.3, pp. 122–123).
- **India statistics**: India supports ~**17% of world's human** and **20% of livestock population** on just **2.5% of world's geographical area**; per capita forest land is only **0.06 hectare** against the required **0.47 hectare**; excess felling of ~15 million cubic metre of forests above permissible limit; soil eroded at **5.3 billion tonnes/**

year, losing 0.8 mt nitrogen, 1.8 mt phosphorus, 26.3 mt potassium annually (NCERT §7.3, pp. 122–123).

- **Pollution Control Boards (Box 7.4)**: the **Central Pollution Control Board (CPCB)** was set up in **1974** to address water and air pollution; State Boards followed; they investigate, collect data, set standards for effluents/emissions, and monitor 125 rivers including tributaries; CPCB has identified **17 categories of significantly polluting industries** (NCERT Box 7.4, p. 123).
- **Air pollution & vehicles**: number of motor vehicles rose from ~3 lakh in 1951 to **35 crore in 2022**; two-wheelers and cars constitute about **85% of registered vehicles**, contributing significantly to total air pollution load (NCERT §7.3, p. 123).
- **Sustainable development — definition (Brundtland/UNCED)**: "**Development that meets the need of the present generation without compromising the ability of the future generation to meet their own needs**" (NCERT §7.4, p. 124).
- Our Common Future explained sustainable development as meeting the basic needs of all and extending to all the opportunity to satisfy aspirations for a better life — making it a moral issue of redistribution (NCERT §7.4, p. 124).
- **Edward Barbier's definition**: sustainable development directly increases the material standard of living of the poor at grass-root level — measured by income, education, healthcare, sanitation, water supply etc. (NCERT §7.4, pp. 124–125).
- **Herman Daly's five conditions for sustainable development**: 1. Limit human population to within the carrying capacity (the "**plimsoll line**" analogy). 2. Technological progress should be **input-efficient** not input-consuming. 3. **Renewable resources** extracted on sustainable basis (extraction ⩽ regeneration). 4. For **non-renewable resources**, the rate of depletion should not exceed the rate of creation of renewable substitutes. 5. Inefficiencies arising from pollution should be corrected (NCERT §7.4, p. 125).
- **UN Sustainable Development Goals**: 17 SDGs formulated by the UN in 2015 to be achieved by 2030 (NCERT §7.4, p. 125).
- **Strategies for sustainable development** (NCERT §7.5, pp. 125–128):
- (a) Use of **non-conventional energy** — wind and solar instead of thermal (CO_2 emitting) and hydro (forest-inundating).
- (b) **LPG and Gobar gas** in rural areas to replace wood/dung-cake (reduces deforestation and pollution).
- (c) **CNG in urban transport** (lowered Delhi's air pollution significantly).
- (d) Wind power via wind turbines.
- (e) Solar power through photovoltaic cells — India leads the **International Solar Alliance (ISA)**.
- (f) **Mini-hydel plants** in mountainous streams.

- (g) **Traditional knowledge and practices** — Ayurveda, Unani, Tibetan, folk systems; about 15,000 medicinal plant species (8,000 in regular use).
- (h) **Biocomposting** using organic wastes and earthworms (vermicompost).
- (i) **Biopest control** using neem-based pesticides, mixed cropping, and natural predators like snakes, owls, peacocks and lizards.
- **The opening anecdote**: NCERT opens with the Mahatma Gandhi quote "earth has enough for everyone's need, but not for everyone's greed" — establishing the moral frame for sustainability long before economists formalised the idea (NCERT §7.1, p. 115).
- **Environmental economics origin**: the discipline crystallised in the 1960s after **Rachel Carson's** Silent Spring **(1962)** documented the ecological cost of DDT. The economic formalisation came through **Pigou's externality** framework and later through Coase, Daly, and the Brundtland Commission (NCERT §7.2 contextual, p. 116).
- **Stockholm Conference 1972**: the United Nations Conference on the Human Environment in Stockholm produced the **Stockholm Declaration**, leading directly to India's enactment of the **Water Act 1974** (and the CPCB), the **Air Act 1981**, and the **Environment Protection Act 1986** — the legislative backbone of Indian environmental policy (NCERT §7.3 contextual, p. 120).
- **Carrying-capacity formalism**: if R = rate of regeneration of a renewable resource and E = rate of extraction, sustainability requires $E \leqslant R$. For waste, if W = rate of waste generation and A = absorptive capacity, sustainability requires $W \leqslant A$. Together these are the operational meaning of "carrying capacity" that NCERT presents narratively (NCERT §7.2, pp. 116–117).
- **Indian data — air pollution**: Delhi's PM2.5 levels routinely exceed 200 $\mu g/m^3$ in winter — over 10× the WHO guideline of 15 $\mu g/m^3$; CNG conversion (post-2002 SC order) reduced Delhi's bus-and-auto emissions but the gains were offset by the rise in private vehicles from a few lakh in 1990 to over 1.2 crore in 2020 (NCERT §7.3, p. 123).
- **Indian data — water stress**: India has 18% of world population but only 4% of world's renewable freshwater. Per capita availability has fallen from about 5177 m^3 (1951) to under 1500 m^3 (2021) — already below the "water-stress" threshold of 1700 m^3 (NCERT §7.3 contextual, p. 122).
- **Indian data — forest cover**: India's recorded forest area is about **21.7% of geographical area** (Forest Survey of India 2021), against the National Forest Policy 1988 target of **33%**. Per capita forest land of 0.06 ha is among the lowest in the world (NCERT §7.3, p. 123).
- **Indian data — soil erosion**: 5.3 billion tonnes of topsoil eroded annually carries away 0.8 mt nitrogen, 1.8 mt phosphorus and 26.3 mt potassium — equivalent to a chunk of the country's fertiliser consumption. The economic cost runs into thousands of crore rupees (NCERT §7.3, pp. 122–123).

- **Chipko movement context**: launched in 1973 at Mandal village (Chamoli, Uttarakhand) by Sundarlal Bahuguna, Chandi Prasad Bhatt and Gaura Devi — women hugged trees to stop logging contractors. NCERT positions Karnataka's Appiko (1983, Salkani forest, Sirsi district) as the southern counterpart — Pandurang Hegde led the movement (NCERT Box 7.3, pp. 121–122).
- **Brundtland Commission details**: officially the **World Commission on Environment and Development (WCED)**, chaired by Norwegian Prime Minister Gro Harlem Brundtland; published Our Common Future in **1987**. Its definition is the single most-cited sentence in environmental economics worldwide (NCERT §7.4, p. 124).
- **Three pillars of sustainability** (post-NCERT context): economic, social and environmental — sometimes called "people, planet, prosperity". Brundtland's definition contains all three implicitly, while Daly's conditions operationalise the environmental pillar (NCERT §7.4, p. 124, contextual).
- **17 SDGs at a glance**: No Poverty, Zero Hunger, Good Health, Quality Education, Gender Equality, Clean Water & Sanitation, Affordable Clean Energy, Decent Work, Industry-Innovation-Infrastructure, Reduced Inequalities, Sustainable Cities, Responsible Consumption, Climate Action, Life Below Water, Life on Land, Peace-Justice-Institutions, Partnerships. India tracks all 17 through the NITI Aayog SDG India Index (NCERT §7.4, p. 125, contextual).
- **International Solar Alliance (ISA)**: launched by India and France at COP21 Paris (2015) and headquartered at Gurugram, India; aims to mobilise USD 1 trillion of investment in solar by 2030 across 121 sun-belt countries — the cornerstone of India's solar diplomacy (NCERT §7.5, p. 127, contextual).
- **Indian solar capacity**: rose from under 10 MW in 2010 to over **70 GW by 2024**, making India the world's third-largest solar market. The National Solar Mission set 100 GW target for 2022 (later revised). Solar tariffs in India have fallen to under ₹2/kWh — among the world's cheapest (NCERT §7.5, p. 127, contextual).
- **Vermicompost detail**: prepared from organic wastes using earthworms — Eisenia foetida is the most common species; conversion ratio is roughly 100 kg waste → 25–30 kg vermicompost in 60 days. Helps reduce chemical-fertiliser dependency and addresses solid-waste management simultaneously (NCERT §7.5, pp. 127–128).
- **Neem-based biopesticides**: NCERT highlights neem (Azadirachta indica), turmeric, and pongamia oil as Indian traditional pest controls; Indian patent battles over neem (revoked European patent 2005) underscored the value of traditional knowledge protection (NCERT §7.5, p. 128, contextual).

2.2 Definitions to memorise

Term	Definition	Page
Environment	Total planetary inheritance and totality of all resources — both biotic and abiotic	116

Term	Definition	Page
Biotic elements	Living elements — birds, animals, plants, forests, fisheries	116
Abiotic elements	Non-living elements — air, water, land, rocks, sunlight	116
Renewable resources	Resources that can be used without becoming depleted (e.g., trees, fish)	116
Non-renewable resources	Resources that get exhausted with extraction (e.g., fossil fuels, iron-ore)	116
Carrying capacity	Limit within which the environment can perform its functions sustainably	116–117
Absorptive capacity	Ability of the environment to absorb degradation	117
Greenhouse gases	Gases like CO_2 and CH_4 that trap heat in the atmosphere and drive global warming	118
Global warming	Gradual rise in earth's lower atmospheric temperature due to human-induced greenhouse gases	118
Ozone depletion	Reduction of stratospheric ozone caused by CFCs and halons	119
Kyoto Protocol	1997 international agreement to cut greenhouse-gas emissions by industrialised countries	118
Montreal Protocol	International agreement that banned CFCs to protect the ozone layer	119
Land degradation	Decline in soil productivity and ecosystem function due to mismanagement and overuse	122
Biodiversity loss	Decline in the variety of plant, animal and microbial life	120
Sustainable development (Brundtland)	Development that meets the needs of the present generation without compromising future generations	124
Plimsoll line analogy	Image used by Herman Daly to represent the carrying capacity of earth	125
Input-efficient technology	Technology that uses fewer inputs per unit of output	125
CPCB	Central Pollution Control Board, set up in 1974	123
ISA	International Solar Alliance — India-led intergovernmental body for solar power	127
Gobar gas	Methane-rich gas produced from cattle dung used as rural cooking fuel	126
Mini-hydel plant	Small hydroelectric installation suited to mountainous streams	127
Vermicompost	Manure prepared from biodegradable waste using earthworms	127
Biopest control		128

Term	Definition	Page
	Use of biological agents (neem, predators) to control crop pests	
SDG	UN Sustainable Development Goals — 17 goals to be achieved by 2030	125
Open access resource	Resource not owned or regulated by any single entity, prone to overuse	122

2.3 Diagrams / processes to remember

- **Fig. 7.1 — Water bodies**: small snow-fed Himalayan streams shown as the few remaining unpolluted fresh-water sources (p. 117).
- **Fig. 7.2 — Damodar Valley**: heavily industrialised region with pollutants from heavy industries along the Damodar river — an ecological disaster (p. 119).
- **Fig. 7.3 — Deforestation**: deforestation leads to land degradation, biodiversity loss and air pollution (p. 121).
- **Fig. 7.4 — Gobar Gas Plant**: process diagram — cattle dung fed to the plant produces gas as fuel; leftover slurry is used as organic fertiliser/soil conditioner (p. 126).
- **Plimsoll line analogy**: Herman Daly's image — the carrying capacity of the environment is like a ship's plimsoll (load) line; absence of this line means human scale grows beyond what earth can carry (p. 125).
- **Box 7.3 — Chipko/Appiko**: Karnataka's "Appiko" (meaning "to hug") forest movement of **8 September 1983** in Salkani forest, Sirsi district — 160 villagers hugged trees to stop felling and saved 12,000 trees (pp. 121–122).
- **Sustainable development decision flow**: identify need → check carrying/ absorptive capacity → adopt input-efficient technology → use renewable substitutes → correct pollution externalities → monitor SDG indicators.
- **Energy transition flow (India)**: wood/coal/diesel → kerosene/LPG/gobar gas → CNG → solar/wind/mini-hydel → grid storage and electrified transport.

2.4 Common confusions / NTA trap points

- **Four functions, not five**: NCERT lists exactly four functions of environment (resources, waste assimilation, life sustenance via biodiversity, aesthetic services). Distractors may add a fifth like "providing employment".
- **Renewable vs non-renewable**: water, trees and fish are renewable; petroleum, coal and iron-ore are non-renewable. NTA may slip "water" into non-renewable to mislead.
- **CPCB year = 1974**, not 1972 (Stockholm Conference) or 1986 (Environment Protection Act).

- **Carrying capacity vs absorptive capacity**: carrying capacity is the overall limit (regeneration + assimilation); absorptive capacity is specifically the ability to absorb degradation/waste.
- **Brundtland definition**: often quoted with subtle changes — the precise phrases are "needs of present generation" and "ability of future generations to meet their own needs".
- **Herman Daly's conditions are five**, with the **plimsoll line** as the population-limit metaphor; distractors add a sixth like "free trade".
- **17% / 20% / 2.5%** — India's shares of world human population, livestock population and geographical area; figures frequently swapped in MCQs.
- **8% of world iron-ore reserves** is India's share of iron-ore, NOT a population statistic — used as a distractor.
- **Appiko movement = 1983 (Karnataka)**, distinct from Chipko (Uttarakhand, 1973).
- **Kyoto Protocol = 1997 Japan**; Montreal Protocol = 1987 (ozone) — do not interchange.
- **SDGs = 17 goals**, adopted in **2015**, target **2030**.
- **CNG reduced Delhi's air pollution** — public transport, not freight, drove the change.
- **Per capita forest land = 0.06 ha**, against required **0.47 ha** — both numbers are tested.

🎯 Practice MCQs

Q1. Which of the following is NOT one of the four vital functions performed by the environment?

A. Supply of resources

B. Assimilation of waste

C. Provision of aesthetic services

D. Generation of employment

Q2. Match List-I with List-II: | List-I | List-II | |---|---| | (a) Carrying capacity | (i) Ability of environment to absorb degradation | | (b) Absorptive capacity | (ii) Resources that get exhausted with use | | (c) Renewable resources | (iii) Limit beyond which environment cannot perform functions sustainably | | (d) Non-renewable resources | (iv) Resources whose continuous supply remains available |

A. (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

B. (a)-(i), (b)-(iii), (c)-(ii), (d)-(iv)

C. (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

D. (a)-(iv), (b)-(ii), (c)-(iii), (d)-(i)

Q3. The Brundtland definition of sustainable development is:

A. Development that maximises the present generation's standard of living

B. Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs

C. Development that is purely environmentally protective with no economic growth

D. Development that prioritises industrial growth over environmental concerns

📊 PYQ Alignment

This chapter is a high-yield CUET topic — Environment and Sustainable Development typically contributes 6–9 MCQs per year across CUET 2023–25 papers. Frequently tested patterns include: the four functions of environment, the Brundtland definition (often as a fill-in-the-blank or direct factual MCQ), Herman Daly's conditions (statement-based), India's environmental statistics (17%/20%/2.5%), CPCB year and number of polluting industries, and identification of sustainable strategies (CNG, LPG, gobar gas, biopest control, solar PV, ISA). See previous CUET PYQs on this chapter.

CUET 2024 — Actual PYQs from this chapter

Q.27 (CUET 2024) __ means resource extraction not exceeding regeneration capacity.

- A) Absorptive capacity B) Carrying capacity C) Subsistence capacity D) Exhaustive capacity Tests: Sustainable development - resource extraction and regeneration Answer: Not in extracted key