SYLLABUS
Class – B. Com/ B. Com (Hons) I Year
Subject – Indian Economy

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Unit II	**Introduction to Indian Economy** 1. Characteristics of Indian Economy 2. Natural Resource Endowments- Land, Water, Livestock, forest and Minerals 3. Infrastructure- Electricity, Transport and Communication 4. Demographic Features - Population Composition, Size
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UNIT I: ANCIENT INDIAN ECONOMY

Introduction −

The study of ancient Indian economic ideas provides a deeper insight into India's culture, tradition, and inherent national characteristics. The major sources of information about the economic ideas of Indian writers are Vedas, Arthasastra, the Ramayana and Mahabharata, Manusmriti, Sukraniti, and several other ancient Indian texts.

The peculiar features of Indian economic ideas are:

1. **Descriptive:** The economic ideas are descriptive and not analytical. Indian thinkers paid more attention to practical problems and hence are realistic in nature.

2. **Mixed with politics**: Economic ideas were mixed with politics and were influenced by political factors.

3. **Less Emphasis to Material wealth:** Indian thinkers mixed ethics and economics together and did not give much importance to material wealth and welfare. They gave importance to moral aspects of life also.

Indian economic thought is classified into − **Ancient Economic Thought And Modern Economic Thought.**

Ancient Indian Economy

Spanning from the Indus valley civilization (3300-1300 BCE) to the Mughal empire (1526-1756).

The sources of information available for the study of ancient Indian economic thought are Vedas, the Upanishads, the Epics - Ramayana and Mahabharata, Smritis and Niti Shastras particularly those of Manu and Shukra. Among these, the two most well-known ancient Indian writings are **Arthasastra and Manusmriti**. Kautilya was the important thinker, whose 'Arthasastra' has been considered the most reliable work on ancient Indian economic thought. It should be mentioned that ancient Indian thinkers had no clear conception of economics and their ideas were mixed with politics, ethics and economics.

The most common word used at that time as **Varta meaning the national economy.** The national economy consists of **agriculture, animal husbandry and trade**. Later on, money lending and artisanship were also brought under Varta. The King was expected to have a good grasp of Varta or Economics.

The term Arthasastra was wider in scope than Vartha and it was a combination of economics, political science and jurisprudence. Asthasatra is that science which describes the actions and administration of Kings in accordance with the dictates of revelation and of law as well as the means of appropriate livelihood. Arth or material prosperity was necessary for the smooth functioning of social structure, organization and institutions.

Salient Features of Ancient Indian Economy –

- **Agriculture** was regarded as the basic source of new wealth. Agriculture was the highest occupation in society.
- **Labour** was unproductive as it failed to achieve its end. Women should help men in productive activities in agriculture and trade.
- **Trade Gold or bullion** was regarded as a means of producing wealth; and trade was the source of industrialized capital. There were free trade in those days in India. Tolls, duties and customs were realized for revenue purposes. The state had framed trade regulations which show that commerce in ancient India had reached an advanced stage.
- There were no fear of large **population** as population could not grow beyond a reasonable limit because of constant wars between small states, and loss of life due to the lack of medical facilities.
- **Welfare State:** The state was to promote the welfare of people by regulating the life of people. It had to give subsidies for the development of trade, agriculture, irrigation, mines, cattle welfare, etc. Various regulations relating to financial transactions, weights and measures, essential industries, currency and exchange, public works, prevention of adulteration, usury, etc point towards the ideal of a welfare state.
- **Private Property:** Individual and family can own land and the right in land was transferable and saleable. The state dominated all forms of property and levied cesses and fines when needed.
- **Interest:** Interest in those days was part of profit. Kautilya proposed the public regulation of interest.
- **Production and Consumption:** The starting point of the ideals of consumption in ancient India was the acceptance of the doctrine of the four ends of life. They are **Dharma, Artha, Kama and Moksha**. In those days four agents of production – **land, labour, capital and organization** appear to have been recognised.
- **Functions of the State**: In the field of production, the government followed the principle of full freedom and enterprise to individuals within limits. Private individuals could also undertake the manufacture and sale of commodities monopolized by the state.
- **Public Finance:** Taxation was regarded as one of the most important source of State revenue. Ancient Indian thinkers supported tax for beneficial purposes and not to be wasted by the government. The two principles that were followed in connection with the realization of taxes were: (i) It should be levied once a year and should not prove burdensome and (ii)Taxes should be levied according to the ability to pay. Kautilya's discussion of taxation has several underlying principles - the taxing power of the state should be limited, tax should not be felt to be heavy or excessive, tax hikes should be introduced gradually, tax should be levied in the proper place, time and form, and tax level should be equitable and reasonable. Ideally, the government should collect taxes like a **honeybee that sucks just the right amount of honey from the flower so that both can survive**. Kautilya's scheme of taxation involved the elements of sacrifice by the taxpayer, direct benefit to the taxpayers, redistribution of income (the state took care of the poor), and tax incentives for desired investments. Kautilya suggested forced loans for meeting deficit budgets. Town Planning and Social Security

- **Town planning** which included there-orientation of main roads and street, and the sub-division of city areas was found in a much-developed form, particularly during the days of Mauryan Kings. The metropolitan city was established after a detailed and careful planning; and due emphasis was laid on the maintenance of sanitation and prevention of fire. Regarding social security, Kautilya emphasized that it was the prime duty of the state to protect the weak and the aged, to provide jobs to the unemployed, and to set up poor houses and charitable institutions.

Concepts of Natural Resources in Ancient India

In ancient India, natural resources were seen as economic assets under state supervision. Land, forests, water, and mines formed the foundation of agriculture, trade, and state revenue. The Arthashastra provides the clearest economic framework—classifying, taxing, and regulating resources with a strong emphasis on sustainability and wealth generation. Thus, the economic thought of ancient India reflects an early form of resource economics where natural wealth = state power + social prosperity.

1. **Resource Classification −**
   Land– agricultural base, source of state revenue.
   Forests– provider of timber, honey, ivory, medicinal plants, elephants (used in warfare and trade).
   Water Resources– irrigation, fisheries, navigation, and taxation through water use.
   Mines– metals, precious stones, salt; critical for coinage, weapons, and trade.
   Animals – livestock for dairy, agriculture, transportation, and military.
   This reflects an early economic categorization of natural resources as factors of production.

2. **Ownership and State Control**
   State as Trustee of Resources: Natural resources were largely state-owned; private ownership existed but was regulated. The ruler was seen as protector of resources for ensuring economic prosperity.

3. **Revenue and Taxation**
   The main tax, usually 1/6th of produce, variable with fertility, irrigation, and crop type.
   Land revenue was the backbone of the state economy.
   Forest Revenue: Taxation on timber, honey, ivory, and animal capture. Certain forests were reserved for the king's use (e.g., elephant forests).
   Mining and Metallurgy Revenue: Taxes on extraction of gold, silver, copper, iron, salt. Mining was often a state monopoly, ensuring strategic and financial control.
   Water Tax: Charges for irrigation canals, reservoirs, and wells constructed by the state. Thus, natural resources formed the fiscal base of kingdoms.

4. **Trade and Economic Value**

Domestic Trade: Surpluses of grains, forest produce, salt, and metals were traded in local markets. Villages specialized in resource-based production (e.g., iron in Vidisha, textiles in Varanasi).

International Trade: India's natural resources (spices, cotton, indigo, gems, elephants, teak, salt) were highly demanded in Roman, Greek, and Southeast Asian markets.

Ports like Bharuch, Tamralipti, and Kaveripattinam thrived due to resource-based exports.

This shows resources were not just for subsistence, but for wealth generation and global trade integration.

5. **Sustainability and Regulation**

Regulated Exploitation: Arthashastra prescribed sustainable use — over-extraction was penalized. Unauthorized cutting of trees, poaching, or misuse of irrigation systems attracted fines.

Community Management: Pastures, tanks, and forests were sometimes under collective village responsibility. Customary laws ensured equitable distribution and prevented monopolization.

6. **Economic Philosophy**

Dharma + Artha Balance: Dharmaśāstras stressed that wealth (Artha) must be generated without violating ecological duties (Dharma).

The idea was utilization, not exploitation.

Arthashastra considered resources as Wealth of the State or state capital—their mismanagement weakened economic and military power.

This early form of resource economics linked prosperity, stability, and power.

Indian Knowledge System regarding -

1. **AGRICUTURE**

Agriculture is the most important constituent of the economy. Three principal vocations are recognised as providing men with the means of livelihood namely, agriculture, cattle rearing and trade. In those days the state and the community were responsible for the development of agriculture for which waste land were to be cultivated. The lands which were neglected by absentee landlords were to be taken away and given to those who could cultivate them with greater advantage. With respect to taxes on agriculture, avoid extremes of either complete absence of taxes or exorbitant taxation.

- Agriculture was the main occupation with crafts, manufacturing and trade following it.
- Over 70–80% of population was engaged in agriculture.
- Economically: agriculture provided food security, state revenue (land tax), raw materials for industries (cotton, indigo, oilseeds), and surplus for trade.
- Indians cultivated wheat, barley, peas, date palms and cotton, more than 4500 years ago.
- Agriculture supplied the raw materials for textiles and crafts.
- There was high level of agricultural productivity and production; No scarcity or famine

- Agriculture generated **marketable surplus** → fed urban populations, supported craft industries, and enabled **long-distance trade**.
- Export of **cotton, spices, sugarcane, indigo, rice** contributed to India's favorable balance of trade.
- **Knowledge of Agricultural Techniques**

1. **Crop Science:** Knowledge of **seasonal crops (kharif, rabi)** and Rotation of crops to maintain fertility.
2. **Irrigation:** Construction of tank, canals, wells, dams. State officials supervised irrigation.
3. **Soil Management:** Classification of soils (black, red, alluvial). Use of organic manure (cow dung, compost).
4. **Horticulture & Forestry:** Cultivation of fruits, medicinal plants, and timber trees.
5. **Animal Husbandry Integration:** Livestock (oxen, cows, buffaloes) integrated into farm economy as draft power, dairy, and manure suppliers.

INDUSTRY

Ancient India did not have "industry" in the modern mechanized sense, but it had a **well-developed proto-industrial economy** based on **crafts, manufacturing, metallurgy, textiles, and organized guilds**. In those days four agents of production – land, labour, capital and organization appear to have been recognised. Land was regarded as the source of all wealth. In the field of production, the government followed the principle of full freedom and enterprise to individuals within limits. It is important to note that private individuals could also undertake the manufacture and sale of commodities monopolized by the state.

Country	**%age Share in World Manufacturing Output**
Europe	23.2
United States	0.1
Japan	3.8
China	32.8
India	24.5

- **Nature of Industries:** Ancient Indian industries were mainly **craft-based and resource-based**. Key sectors included:

1. **Textile Industry** – cotton (Indus Valley cotton textiles, muslin from Bengal), silk (exported to Rome and China), wool (from Gandhara). There were advanced looms for textile weaving and dyeing techniques**.**
2. **Metallurgy** – iron, copper, bronze, silver, and gold. Famous for **high-quality steel (Wootz steel)** exported to West Asia, Middle East and Europe.
3. **Mining Industry** – salt, gems, precious stones (Golconda diamonds).
4. **Handicrafts and Artisanal Production** – pottery, sculpture, jewelry, ivory carving, stonework. Harappan cities had bead-making, metallurgy, and standardized weights (proto-industrial features).

5. **Shipbuilding** – ports like Lothal, Bharuch, and Tamralipti engaged in building large vessels for trade. Large sea-going vessels described in Jatakas and Greek accounts. India was in the forefront in the field of shipbuilding.
6. **Construction Industry** – large-scale projects (stupas, temples, forts, irrigation works) employing masons, carpenters, metalworkers.

- **Organization of Industry: Guild System** function as associations of craftsmen and traders. Each guild had its own rules, acted as a **trade union + bank + cooperative**, and even issued **guild seals**. Examples: guilds of weavers, goldsmiths, potters, and oil pressers. Guilds regulated quality, fixed prices, protected members, and undertook collective contracts.
- Industries of strategic importance (metallurgy, salt, weapons, elephants) were often **state monopolies**.
- **Urbanization:** Industrial production led to thriving cities like **Pataliputra, Ujjain, Taxila, Varanasi, Madurai, Kanchipuram**—centers of trade and crafts.

Decline and Continuity

The industrial sector remained vibrant till **early medieval India**, but invasions (Turkish, later colonial) disrupted guilds and destroyed traditional industries. Colonial rule further **deindustrialized India**, turning it from exporter of finished goods to supplier of raw materials.

Ancient Indian economic thought (especially *Arthashastra*) treated industries as **strategic assets for wealth and power**, with a balance of **state control + private guild autonomy**.

TRADE

Trade was one of the strongest pillars of the ancient Indian economy, complementing agriculture and industry. Trade transformed India from a primarily agrarian society into one of the wealthiest civilizations of the ancient world, with a consistent trade surplus. Trade centres were organized hubs of exchange, specialization, and state revenue. The combination of **knowledge of monsoons, trade routes, and market networks** made India a global trade leader for over a millennium. During Mauryan and Gupta Period, trade was at the peak of prosperity. During Medieval Period, India remained a hub of Indian Ocean trade until later disruptions by colonial powers.

- **Nature of Trade**

1. **Internal Trade (Village → Town → City):**
   a) Villages supplied raw materials (grain, cotton, cattle, forest produce).
   b) Towns specialized in crafts (weaving, metalwork, pottery).
   c) Cities served as **wholesale and export hubs** (e.g., Pataliputra, Ujjain, Taxila, Varanasi, Madurai).
2. **Long-Distance Trade:**

   a) Flourished along **land routes (Uttarapatha, Dakshinapatha, Silk Road)** and **maritime routes (Indian Ocean trade)**.

b) Connected India with **Rome, Central Asia, Southeast Asia, and China**.

- **Major Trade Commodities**
  1. **Exports:** India's textiles (cotton, silk, muslin), spices (pepper, cardamom), metals, gems, ivory, pearls, steel (Wootz), elephants and handicrafts were in high demand in **Roman Empire, Central Asia, Southeast Asia, and China**.
  2. **Imports:** Horses (from Central Asia), gold and silver (from Rome), wines, luxury goods, silk (from China).
  3. **Balance of Trade:** Strongly **favorable to India.** Roman gold was drained into India in exchange for luxury goods.
- **Organization of Trade**
  a) **Guilds**

  b) **Caravan Trade:** Large caravans carried goods across land routes (Silk Road, Central Asian routes). Protected by the state against bandits.

  c) **Maritime Trade:** Ports like **Bharuch (Broach), Sopara, Tamralipti, Kaveripattinam, Arikamedu** thrived.
- Indian merchants had colonies in **Southeast Asia (Java, Sumatra, Cambodia)**.
- **Role of the State (Economic Regulation):** superintendent of trade regulated internal and external commerce. Ensured standard weights and measures, price control, and prevention of adulteration. State imposed **customs duties, road taxes, ferry charges, and octroi**.
- **Monetary System**

  a) **Coins as Medium of Trade:** Punch-marked coins (Mauryan period), Gold coins and Roman coins.

  b) **Barter System:** Co-existed in rural and village markets.
- **Economic Importance of Trade**

  a) **Urbanization:** Trade led to the rise of wealthy cities and market towns.

  b) **Wealth Accumulation:** Gold inflows from Rome and other regions enriched Indian kingdoms.

  c) **Cultural Exchange:** Trade spread not just goods but also ideas (Buddhism spread via trade routes).

  d) **Economic Diversification:** Trade created demand for handicrafts, textiles, and luxury goods, stimulating industrial growth.
- **Technological and Institutional Support**
  a) **Infrastructure:** Roads (built by Mauryas, Guptas), Riverine transport (Ganga, Godavari) and Ships capable of ocean voyages.
  b) **Market System:** Local markets (*haats*), periodic fairs (*jatras*), and urban bazaars (*mandis*).

c) **Banking & Credit:** Guilds and wealthy merchants acted as bankers. Early use of promissory notes (*hundis*).

Transportation in Ancient India

Modes of Transportation

1. **Land Routes:**
   - North Road*:* Connected Taxila → Mathura → Pataliputra → Tamralipti.
   - South Road: Connected Central India → Deccan → Kanchipuram → Southern ports.
   - Used **bullock carts, horse carriages, elephants, pack animals (camels in NW India)**.
2. **River Routes:**
   - Rivers like **Ganga, Yamuna, Godavari, Narmada** were key for bulk transport.
   - Boats and rafts reduced transport costs.
3. **Sea Routes:**
   - Indian Ocean trade connected India with **Persia, Arabia, East Africa, Rome, Southeast Asia, and China**.

Economic Role of Transportation

1. **Reduced Costs of Exchange:** Lower transaction and time costs, making long-distance trade profitable.
2. **Market Expansion:** Allowed surplus regions to connect with deficit regions, ensuring **comparative advantage**.
3. **Stimulated Urbanization:** Cities grew around trade routes and ports (e.g., Bharuch, Ujjain, Madurai).
4. **Revenue from Transit:** State levied **road tolls, ferry taxes, customs duties**, making transport routes sources of revenue.
5. **International Competitiveness:** Efficient transport (especially maritime) allowed India to dominate **luxury trade** for centuries.

UNIT II: Introduction to Indian Economy

Characteristics of the Indian Economy

From ranking 11th in 2009 to fourth by end-2025 in GDP terms, India's growth has not just been numerical, but structural, driven by domestic demand, a young and tech-adaptive workforce, and the government's policy prudence. India stands as the **fourth largest economy** in terms of nominal GDP and ranks ahead of the developed nations like Japan, Italy, France and Canada. It is predicted that India will surpass Germany by 2030. Not only this, India's GDP growth in FY25 is estimated to be 6.2% and in FY26 at 6.3%.

1. Agriculture-based Economy (but changing)

- Agriculture has been the backbone of the Indian economy since ancient times.
- About 58% of our nation's population is involved in agriculture. Too many people depend on agriculture, though its share in GDP is small (17%).
- Green Revolution a period, particularly during the 1960s and 70s, when agricultural production in many developing countries, including India, dramatically increased due to the adoption of modern farming techniques and technologies
- India is the 2nd largest producer of rice and wheat in the world.

2. Large Population

- India is the most populous country in the world (2023) with ~1.43 billion people.
- Young population: Median age ~28 years (compared to ~38 years in China, ~40+ in Europe).
- Advantage: Big labour force & market (demographic dividend).
- Challenge: Need more jobs, education, and healthcare.

3. Service Sector Dominance

- India's economy is now service-led rather than agriculture-led.
- Services contribute the largest share: ~54% of GDP (2023-24).
- India is famous as the IT hub of the world (outsourcing, software exports).

4. Low Per Capita Income

- India's GDP (Nominal, 2023): ~$3.7 trillion (5th largest in the world).
- But Per Capita Income (average income per person): only ~$2,730 (IMF, 2023). In comparison: USA: ~$80,000 and China: ~$12,700
- This shows India is a developing economy: big size but low average income.

5. High Share of Informal/Unorganized Sector

- Around 80–85% of workers are in the informal sector (no fixed wages, no job security, no social security).
- Examples: small farmers, street vendors, small shopkeepers, casual labourers.

- This keeps productivity low and reduces tax collection.

6. Uneven Growth (Regional and Social Inequality)

- Regional disparity: States like Maharashtra, Gujarat, Karnataka, Tamil Nadu are having advanced industries & services. While States like Bihar, UP, MP, Odisha are still dependent on farming, lower incomes.
- Wealth inequality: Top 10% of Indians own ~77% of national wealth (Oxfam report).
- Shows that growth is not evenly distributed across regions and people.

7. Mixed Economy

- India has both private sector (Reliance, Infosys, TCS) and public sector (Indian Railways, ONGC, SBI).
- Government controls basic sectors (defense, railways, banking), while private sector drives industries and services. This combination makes India a mixed economy.

8. High Dependence on Imports (especially energy)

- India imports ~85% of crude oil and ~50% of gas demand.
- Trade deficit (imports > exports): around $240 billion (2023-24).
- Even though India exports IT services, textiles, and gems, its oil import bill is huge.

9. Rapid but Uneven Economic Growth

- GDP Growth Rate (2023-24): ~6.5% (one of the fastest in the world).
- Challenges: Unemployment ~7% average and Inflation (especially food prices).
- India is growing fast, but job creation and price stability are problems.

10. Global Integration

- India is deeply integrated into the world economy.
- Major exporter of IT, textiles, pharma, and services.
- Major importer of oil, gold, electronics.
- Member of WTO, G20, BRICS, SCO.
- India is not an isolated economy — it is a major player in global trade and politics.

11. Industries:

The Indian industrial sector is the second pillar of the economy after services (First pillar is Agriculture). It contributes ~27% of GDP and 22% of jobs, with MSMEs playing a major role. Despite strong growth in steel, automobiles, and pharma, manufacturing's share in GDP has stagnated at ~17%, and challenges like infrastructure gaps, import dependence, and informality remain. India is the 2nd largest steel producer and a global hub for automobiles & pharmaceuticals.

Sector	% Contri in GDP	% Employment	% Growth rate	Remarks
Agriculture	17	45.8	4.4	Largest employer

Industry	27	22	6.5	Stagnant growth
Service	54	30	8.3	Largest GDP Contributor

Year/Period	Milestone	Description
1991	Economic Liberalization	India opened up to foreign investment, privatized public enterprises, and deregulated its markets.
2000s	Rise of IT and Services	The service sector, especially IT and telecom, became the engine of GDP growth and exports.
2014–2019	Infrastructure & Policy Push	Programs like Make in India, Digital India, GST reforms and expansion of highways gained momentum.
2020–2025	Digital Economy & Startups	India became a startup hub with strong government backing and digital transformation in fintech, education, and health.

Natural Resource Endowments- Land, Water, Livestock, forest and Minerals

These are the resources that are found in the environment and are developed without the intervention of humans. Common examples of natural resources include air, sunlight, water, soil, stone, plants, animals, and fossil fuels. The natural resources are naturally occurring materials that are useful to man or could be useful under conceivable technological, economic or social circumstances or supplies drawn from the earth supplies such as food, building and clothing materials, fertilizers, metals, water, and geothermal power. For a long time, natural resources were the domain of the natural sciences.

Based on the availability are two types of natural resources:

1. **Renewable:** Renewable resources are the ones that are consistently available regardless of their use. They can be fairly recovered or replaced after utilization. Examples include vegetation, water, and air. Animals can also be categorized as renewable resources because they can be reared and bred to reproduce offspring to substitute the older animals. As much as these resources are renewable, it may take tens to hundreds of years to replace them. The renewable raw materials that come from living things namely animals and trees are termed as **organic renewable resources** while those that come from non-living things such as sun, water and wind are termed as **inorganic renewable resources**.
2. **Non-Renewable**: Non-renewable resources are the ones that cannot simply be substituted or recovered once they have been utilized or destroyed. Examples of such natural resources include fossil fuels and minerals. Minerals are categorized as non-renewable because, even though they take shape naturally through the rock cycle, their formation periods take

thousands of years. Some animals mostly the endangered species are similarly regarded as non-renewable because they are at the verge of extinction. It brings about the many reasons the endangered species have to be protected by all means. The non-renewable materials that come from living things such as fossil fuels are known as organic non−renewable resources while those that come from non-living things such as rocks and soil are referred to as inorganic non-renewable resources.

TYPES OF NATURAL RESOURCES

1. LAND RESOURCES

(a) **Land as a resource**: Landforms such as hills, valleys, plains, river basins and wetlands Include different resource generating areas that the people living in them depend on. Many Traditional farming societies had ways of preserving areas from which they used resources. Eg. In the 'sacred groves' of the Western Ghats, requests to the spirit of the Grove for Permission to cut a tree, or extract a resource, were accompanied by simple rituals. The Outcome of a chance fall on one side or the other of a stone balanced on a rock gave or withheld permission. The request could not be repeated for a specified period. If land is utilized carefully it can be considered a renewable resource. The roots of trees and grasses bind the soil. If forests are depleted, or grasslands over grazed, the land becomes Unproductive and wasteland is formed. Intensive irrigation leads to water logging and salination, on which crops cannot grow. Land is also converted into a non-renewable resource when highly toxic industrial and nuclear wastes are dumped on it. Land on earth is as finite as any of our other natural resources. While mankind has learnt to adapt his lifestyle to various ecosystems world over, he cannot live comfortably for instance on polar ice caps, on under the sea, or in space in the foreseeable future. Man needs land for building homes, cultivating food, maintaining pastures for domestic animals, developing industries to provide goods, and supporting the industry by creating towns and cities. Equally importantly, man needs to protect wilderness area in forests, grasslands, wetlands, mountains, coasts, etc. to protect our vitally valuable biodiversity.

Thus a rational use of land needs careful planning. One can develop most of these Different types of land uses almost anywhere, but Protected Areas (National Park's and Wildlife Sanctuaries) can only be situated where some of the natural ecosystems are still Undisturbed. These Protected Areas are important aspects of Good land use planning.

(b) **Land use change**: The most damaging change in land use is demonstrated by the rapidity with which forests have vanished during recent times, both in India and in the rest of the world. Forests provide us with a variety of services. These include processes such as maintaining oxygen levels in the atmosphere, removal of carbon dioxide, control overwater regimes, and slowing down erosion and also produce products such as food, fuel, timber, fodder, medicinal plants, etc. In the long term, the loss of these is far greater than the short term gains produced by converting forested lands to other uses

(c) **Land degradation**: It is a process of deterioration of soil or loss of fertility. Due to increasing

population, the demands for arable land for producing food, fibre and fuel wood is also increasing. Hence there is more and more pressure on the limited land resources which are getting degraded due to over-exploitation. Nearly 56% of total geographical area of the country is suffering due to land resource degradation. Out of 17-million-hectare canal irrigated area, 3.4 million hectares is suffering from water logging and salinity.

Effects of land degradation:

1. Soil texture and soil structure are destructed.

2. Loss of soil fertility.

3. Loss of valuable nutrients.

4. increase in water logging, salinity, alkalinity and acidity problem.

5. Loss of economic social and biodiversity.

Causes of land degradation:

1. Population: More land is needed for producing food, fibre and fuel wood. So land is degraded due to over exploitation.

2. Urbanisation: Urbanisation reduces the agricultural land. Urbanisation leads to deforestation, which in turn affects millions of plants and animals.

3. Fertilizers and pesticides: It affects fertility of the soil and causes land pollution.

4. Damage of top soil: Increase in food production generally leads to damage of top soil through nutrient depletion.

5. Water logging, soil erosion, salination and contamination of the soil with industrial wastes and cause land degradation.

6. Soil erosion: The process of loss or removal of superficial layer of soil due to the action of wind,w ater and human factors. In other words, it can be defined as the movement of soil components, especially surface-litter and top soil from one place to another. It has been estimated that more than 5000 million tonnes topsoil is being eroded annually and 30% of total eroded mass is getting loosed to the sea.

2. FOREST RESOURCES

Forest is an important renewable resources. Forest vary in composition and diversity and can contribute substantially to the economic development of any country. Plants along with trees cover large areas, produce variety of products and provide food for living organisms, and also important to save the environment.

It is estimated that about 30% of world area is covered by forest whereas 26% by pastures. Among all continents, Africa has largest forested area (33%) followed by Latin America (25%), whereas in North America forest cover is only 11%. Asia and former USSR has 14% area under forest. European countries have only 3% area under forest cover. India's Forest Cover accounts for 20.6% of the total geographical area of the country as of 2005.

(1) Significance of forests

Forest can provide prosperity of human being and to the nations. Important uses of forest can be classified as under:

(i) Commercial values

Forests are main source of many commercial products such as wood, timber, pulpwood etc.

About 1.5 billion people depend upon fuel wood as an energy source.

Timber obtained from the forest can used to make plywood, board, doors and windows, furniture, and agriculture implements and sports goods. Timber is also a raw material for preparation of paper, rayon and film.

• Forest can provide food, fibre, edible oils and drugs.

• Forest lands are also used for agriculture and grazing.

• Forest is an important source of development of dams, recreation and mining.

(ii) Life and economy of tribal

Forest provide food, medicine and other products needed for tribal people and play a vital role in the life and economy of tribes living in the forest.

(iii) Ecological uses

Forests are habitat to all wild animals, plants and support millions of species. They help in reducing global warming caused by greenhouse gases and produces oxygen upon photosynthesis. Forest can act as pollution purifier by absorbing toxic gases. Forest not only helps in soil conservation but also helps to regulate the hydrological cycle.

(iv) Aesthetic values

All over the world people appreciate the beauty and tranquillity of the forest because forests have a greatest aesthetic value. Forest provides opportunity for recreation and ecosystem research.

Over exploitation of forests

Forests contribute substantially to the national economy. With increasing population increased demand of fuel wood, expansion of area under urban development and industries has led to over exploitation of forest. At present international level we are losing forest at the rate of 1.7 crore hectares annually. Over exploitation also occurs due to overgrazing and conversion of forest to pastures for domestic use.

Deforestation

Forest are burned or cut for clearing of land for agriculture, harvesting for wood and timber,

development and expansion of cities. These economic gains are short term where as long term effects of deforestation are irreversible

1. Deforestation rate is relatively low in temperate countries than in tropics if present rate of

deforestation continues we may losses 90% tropical forest in coming six decades

2. For ecological balance 33% area should be under forest cover but our nation has only 20.6% forest cover.

Causes of deforestation

Forest area in some developed area has expanded. However in developing countries area under forest is

showing declining trend particularly in tropical region. Main causes of deforestation are

a) Shifting cultivation or jhum cultivation

This practise is prevalent in tribal areas where forest lands are cleared to grow subsistence crops. It is estimated that principle cause of deforestation in tropics in Africa, Asia and tropical America is estimated to be 70, 50, and 35% respectively. Shifting cultivation which is a practice of slash and burn agriculture are process to clear more than 5 lakh hectares of land annually. In India, shifting cultivation is prevalent in northeast and to limited extent in M.P, Bihar and Andhra Pradesh and is contributing significantly to deforestation.

b) Commercial logging

It is important deforestation agent. It may not be the primary cause but definitely it acts as secondary cause, because new logging lots permits shifting cultivation and fuel wood gatherers

access to new logged areas.

c) Need for fuel wood

Increased population has lead to increasing demand for fuel wood which is also acting as an

important deforestation agent, particularly in dry forest.

d) Expansion for agribusiness

With the addition of cash crops such as oil palm, rubber, fruits and ornamental plants, there is stress to expand the area for agribusiness products which results in deforestation.

e) Development projects and growing need for food

The growing demand for electricity, irrigation, construction, mining, etc. has lead to destruction of forest. Increased population needs more food which has compelled for increasing area under agriculture crops compelling for deforestation.

f) Raw materials for industrial use

Forest provides raw material for industry and it has exerted tremendous pressure on forest.

Increasing demand for plywood for backing has exerted pressure on cutting of other species such as fir to be used as backing material for apple in J&K and tea in northeast states.

Major effects of deforestation:

Deforestation adversely and directly affects and damages the environment and living beings
Major causes of deforestation are

• Soil erosion and loss of soil fertility

• Decrease of rain fall due to affect of hydrological cycle

• Expansion of deserts

• Climate change and depletion of water table

• Loss of biodiversity, flora and fauna

• Environmental changes and disturbance in forest ecosystems

1. Jhum cultivation

Jhum Agriculture or shifting agriculture has destroyed large number of hectares of forest tracts in North-Eastern states and Orissa. Jhum agriculture is subsidence agriculture in which tract of forest land is cleared by cutting trees and it is used for cultivation. After few years, when productivity of the land decreases, cultivators abandon the land and clear next tract. As a result of this practise, combined with increasing population there is rapid deforestation as more and

more cultivators clear forest to cultivate land. Also, with increase in population, cultivators are

forced to return to previous tracts of land in relatively shorter durations, not allowing the land to

regain its productivity.

2. Chipko movement

The Chipko movement or Chipko Andolan is a social-ecological movement that practised the

Gandhian methods of satyagraha and non-violent resistance, through the act of hugging trees to

protect them from being felled. The modern Chipko movement started in the early 1970s in the

Garhwal Himalayas of Uttarakhand, with growing awareness towards rapid deforestation.

The landmark event in this struggle took place on March 26, 1974, when a group of peasant

women in Reni village, Hemwalghati, in Chamoli district, Uttarakhand, India, acted to prevent

the cutting of trees and reclaim their traditional forest rights that were threatened by the

contractor system of the state Forest Department. Their actions inspired hundreds of such

actions at the grassroots level throughout the region. By the 1980s the movement had spread

throughout India and led to formulation of people-sensitive forest policies, which put a stop to

the open felling of trees in regions as far reaching as Vindhyas and the Western Ghats.

3. Western Himalayan region.

Over the last decade, there has been widespread destruction and degradation of forest resources in Himalayas, especially western Himalayas. This has resulted in various problems such as erosion of top soil, irregular rainfall, changing weather patterns and floods.

Construction of roads on hilly slopes, have not only undermined their stability, but also damaged protective vegetation and forest cover. Tribes in these areas are increasingly facing shortage of firewood and timber, due large-scale tree cutting. Increased traffic volumes on these roads leads to increased pollution in the area.

4. Timber extraction

There has been unlimited exploitation of timber for commercial use. Due to increased industrial demand; timber extraction has significant effect on forest and tribal people.

Logging

• Poor logging results in degraded forest and may lead to soil erosion especially on slopes.

• New logging roads permit shifting cultivators and fuel wood gatherers to gain access to the logging area.

• Loss of long-term forest productivity

• Species of plants and animals may be eliminated

• Exploitation of tribal people by contractor.

5. Mining

Major effects of mining operations on forest and tribal people are:

• Mining from shallow deposits is done by surface mining while that from deep deposits is done by sub-surface mining. It leads to degradation of lands and loss of top soil. It is estimated that about eighty-thousand-hectare land is under stress of mining activities in India

• Mining leads to drying up perennial sources of water sources like spring and streams in mountainous area.

• Mining and other associated activities remove vegetation along with underlying soil mantle, which results in destruction of topography and landscape in the area. Large scale deforestation has been reported in Mussorie and Dehradun valley due to indiscriminating mining.

• The forested area has declined at an average rate of 33% and the increase in nonforest area due to mining activities has resulted in relatively unstable zones leading to landslides.

• Indiscriminate mining in forests of Goa since 1961 has destroyed more than 50000 hectare of forest land. Coal mining in Jharia, Raniganj and Singrauli areas has caused extensive deforestation in Jharkhand.

• Mining of magnetite and soapstone have destroyed 14 ha of forest in hilly slopes of Khirakot, Kosi valley and Almora.

• Mining of radioactive minerals in Kerala, Tamilnadu and Karnataka are posing similar threats of deforestation.

• The rich forests of Western Ghats are also facing the same threat due to mining projects for excavation of copper, chromites, bauxite and magnetite.

6. Effects of dams on forests and tribal people Pandit Jawaharlal Nehru referred dam and valley projects as "Temples of modern India". These big dams and rivers valley projects have multi-purpose uses. However, these dams are also responsible for the destruction of forests. They are responsible for degradation of catchment areas, loss of flora and fauna, increase of water borne diseases, disturbance in forest ecosystems, rehabilitation and resettlement of tribal peoples.

• India has more than 1550 large dams, the maximum being in the state of Maharashtra (more than 600), followed by Gujarat (more than 250) and Madhya Pradesh (130).

• The highest one is Tehri dam, on river Bhagirathi in Uttaranchal and the largest in terms of capacity is Bhakra dam on river Satluj in Himachal Pradesh. Big dams have been in sharp focus of various environmental groups all over the world, which is mainly because of several ecological problems including deforestation and socioeconomic problems related to tribal or native people associated with them.

• The Silent valley hydroelectric project was one of the first such projects situated in the tropical rain forest area of Western Ghats which attracted much concern of the people.

• The crusade against the ecological damage and deforestation caused due to Tehri dam was led by Shri. Sunder Lal Bahaguna, the leader of Chipko Movement.

• The cause of Sardar Sarovar Dam related issues have been taken up by the environmental Activitist Medha Patkar, joined by Arundhati Ray and Baba Amte. For building big dams, large scale devastation of forests takes place which breaks the natural ecological balance of the region.

• Floods, droughts and landslides become more prevalent in such areas. Forests are the repositories of invaluable gifts of nature in the form of biodiversity and by destroying them (particularly, the tropical rain forests), we are going to lose these species even before knowing them. These species could be having marvellous economic or medicinal value and deforestation results in loss of this storehouse of species which have evolved over millions of years in a single stroke.

7. Forest conservation and management

Forest is one of the most valuable resources and thus needs to be conserved. To conserve forest,

following steps should be taken.

1. Conservation of forest is a national problem; thus, it should be tackled with perfect coordination between concerned government departments.

2. People should be made aware of importance of forest and involved in forest conservation activities.

3. The cutting of trees in the forests for timber should be stopped.

4. A forestation programmes should be launched

5. Grasslands should be regenerated.

6. Forest conservation Act should be strictly implemented to check deforestation.

7. Awards should be instituted for the deserving

Water Resources

Water is an indispensable resource for life on earth. Approximately 70.8 % surface of earth is covered with water in the form of oceans. Out of this, about 97% is not fit for human consumption, about 2% is locked as a glacier and only less than 1% available as fresh water that can be used for human consumption and other uses.

Water is a very important source and essential for life because it has very unique characteristic such as

1. Water exists as liquid over a wide range of temperature 0-1000C with highest specific heat and latent heat of vaporization.

2. Water is excellent solvent and act as carrier of nutrient and helps to distribute them to the cells in the body, regulates the body temperature and support structure and can dissolve various pollutant and can act as carrier of large number of micro organisms

3. It is responsible for hydrological cycle which acts as resource of water to the earth. It is estimated that about 1.4 inch thick layer of water evaporates and majority of water returns to earth through hydrological cycle.

Water is renewable, but its overuse and pollution make it unfit for use. Sewage, industrial use, chemicals, etc. pollute water with nitrates, metals, and pesticides.

Use of Water Resources

Water resources are used for agricultural, industrial, domestic, recreational, and environmental

activities. Majority of the uses require fresh water. However, about 97 percent of water found on the earth is salt water and only three percent is fresh water. A little over two-thirds of the available fresh water is frozen in glaciers and polar ice caps. The remaining freshwater is found mainly as groundwater and a negligible portion of it is present on the ground or in the air.

Following is a brief account of how water is used in different sectors.

(i) Agricultural Use: Agriculture accounts for 69 percent of all water consumption basically in agricultural economies like India. Agriculture, therefore, is the largest consumer of the earth's freshwater.

By 2050, the global water demand of agriculture is estimated to increase by a further 19% due to irrigational needs. Expanding irrigation needs are likely to put undue pressure on water

storage. It is still inconclusive whether further expansion of irrigation, as well as additional water withdrawals from rivers and groundwater, will be possible in future.

ii) Industrial Use: Water is the life blood of the industry. It is used as a raw material coolant, a solvent, a transport agent, and as a source of energy. Manufacturing industries account for a considerable share in the total industrial water consumption. Besides, paper and allied products, chemicals and primary metals are major industrial users of water.

Worldwide, the industry accounts for 19 percent of total consumption. In industrialized countries, however, industries use more than half of the water available for human use.

(iii) Domestic Use: It includes drinking, cleaning, personal hygiene, garden care, cooking, washing of clothes, dishes, vehicles, etc. Since the end of World War II there has been a trend of people moving out of the countryside to the ever-expanding cities.

Implications on our water resources.

Government and communities have had to start building large water-supply systems to deliver water to new populations and industries. Of all water consumption in the world, domestic use accounts for about 12 percent.

(iv) Use for Hydropower Generation: Electricity produced from water is hydropower. Hydropower is the leading renewable source of electricity in the world. It accounts for about 16 percent of total electricity generation globally. There are many opportunities for hydropower development throughout the world. Today, the leading hydropower generating countries are China, the US, Brazil, Canada, India, and Russia.

(v) Use for Navigation and Recreation: Navigable water ways are defined as water courses that have been or may be used for transport of interstate or foreign commerce.

Agricultural and commercial goods are moved on water on a large scale in a number of regions in the world. Water is also used for recreational purposes such as boating, swimming, and sporting activities.

These uses affect the quality of water and pollute it. Highest priority should be given to public health and drinking water quality while permitting such activities in reservoirs, lakes, and rivers.

Over-Exploitation of Water

Water scarcity has become a burning global issue. The UN has held several conventions on water in recent decades. Continuous over utilization of surface and ground water has led to virtual water scarcity in the world today.

The depleting sources for high growth in human population over the centuries and increased man induced water pollution across the world have created unforeseen water scarcity around the globe. As a result, there has been continuous overutilization of the existing water sources due to mammoth growth in world population.

(i) Surface water

Surface water mainly comes directly from rain or snow covers. The various surface sources are natural lakes and ponds, rivers and streams, artificial reservoirs. Availability of surface water decides the economy of the country. On one side surface water availability affects the productivity, but on the other side water sources may cause floods and drought. Due to unequal distribution, water may lead to national (interstate) or international disputes. Sharing of surface water due to these disputes is affecting productivity of different agro eco-zone and creating problems for government.

(ii) Ground water

Groundwater is the major source of water in many parts of the world. However, there has been continuous depletion of this source due to its over exploitation by rising human population and the rapid rise in industrialization and urbanization in modern times. About 9.86% of the total fresh water resources are in the form of groundwater and it is about 35-50 times that of surface water supplies.

Effects of extensive and reckless groundwater usage:

1. Subsidence

2. Lowering of water table

3. Water logging

Consequences of Overutilization

Water scarcity now becomes an important topic in international diplomacy. From village to the United Nations, water scarcity is a widely-discussed topic in decision making.

Nearly three billion people in the world suffer from water scarcity. International, intrastate and regional rivalries on water are not new to world. The ongoing Jordan River conflict, Nile River conflict, and Aral Sea conflict are cases in point. The intra-state issues such as Cauvery Water dispute in South India, 2000 Cochabamba protests in Bolivia is still a simmering cauldron causing periodic tension at the national and regional levels. According to World Health Organization (WHO) sources, a combination of rising global population, economic growth and climate change means that by 2050 five billion (52%) of the world's projected 9.7 billion people will live in areas where fresh water supply is under pressure.

Researchers expect about 1 billion more people to be living in areas where water demand exceeds surface-water supply.

(i) Climate Change

Scientists, environmentalists, and biologists worldwide are now alarmed that climate change can have an impact on the drainage pattern and hydrological cycle on the earth thereby severely affecting the surface and ground water availability.

Climate change is believed to rise the global temperature at an increasing pace. Temperature increase affects the hydrological cycle by directly increasing evaporation of available surface water and vegetation transpiration.

As a result, precipitation amount, timing and intensity rates are largely affected. It impacts the flux and storage of water in surface and subsurface reservoirs.

(ii) Floods & Draughts

Floods and droughts are two well-known natural hazards in the world. The former is due to excess in water flow and the latter is due to scarcity of water.

The amount of rainfall received by an area varies from one place to another depending on the location of the place. In some places, it rains almost throughout the year whereas in other places it might rain for only few days. India records most of its rainfall in the monsoon season.

Heavy rains lead to rise in the water level of rivers, seas, and oceans. Water gets accumulated in the coastal areas, which results in floods. Floods bring in extensive damage to crops, domestic animals, property and human life. During floods, many animals get carried away by the force of water and eventually die.

On the other hand, droughts set in when a particular region goes without rain for a long period of time. In the meantime, the soil will continuously lose groundwater by the process of evaporation and transpiration. Since this water is not brought back to earth in the form of rains, the soil becomes very dry.

The level of water in the ponds and rivers goes down and in some cases water bodies get dried up completely. Ground water becomes scarce and this leads to droughts. In drought conditions, it is very difficult to get food and fodder for the survival. Life gets difficult and many animals perish in such conditions.

Frequent floods and droughts are mostly due to climate change and global warming. Various environmental organizations world over are of the view that climate change is a long-term change in weather patterns, either in average weather conditions or in the distribution of extreme weather events.

Major Water Conflicts

Some of the major water conflicts that have become thorn in relations between states and countries are

(1) Water conflict in the middle east

Countries involved are Sudan, Egypt and Turkey. It also affects countries which are water

starved viz. Saudi Arabia, Kuwait, Syria, Israel and Jordan.

(2) The Indus water treaty

This Indus water treaty dispute between India and Pakistan is lingering since long.

(3) The Cauvery water dispute

It involves two major states of India viz. Tamilnadu and Karnataka.

(4) The Satluj-Yamuna link canal dispute

The dispute is between two Northern states viz. Punjab and Haryana and UP, Rajasthan as well as Delhi has also interest in it.

In traditional water management, innovative arrangements ensure equitable distribution of water, which are democratically implemented. These disputes can be solved amicably through 'Gram Panchayats", if transparency is maintained. But disputes between countries or states sometimes attain war like situation and are difficult to solve.

Dams - Benefits and Problems

Water is a precious resource and its scarcity is increasing at global level. There is a pressure to utilise surface water resources efficiently for different purposes. Dam, structure built across a stream, a river, or an estuary to retain water. Dams are built to provide water for human consumption, for irrigating arid and semiarid lands, or for use in industrial processes.

Major benefits of dams

The major benefits of dams are:

1. Hydroelectricity generation

2. Year-round water supply to ensure higher productivity

3. Equal water distribution by transferring water from area of excess to area of deficit

4. Helps flood control and protects soil

5. Assure irrigation during dry periods

6. River valley projects provide inland water navigation, employment opportunities and can be used to develop fish hatcheries and nurseries

7. River valley projects have tremendous potential for economic upliftment and will help to raise the standard of living and can help to improve the quality of life

Disadvantages/problems

Although dams have proved very useful over the centuries but recent past big dams has created lot of human as well as environmental issues

1. Submergence of large areas may lead to loss of fertile soil and displacement of tribal people

2. Salt left behind due to evaporation increase the salinity of river water and makes it unusable when reaches down stream

3. Siltation and sedimentation of reservoirs not only makes dams use less but also is responsible for loss of valuable nutrients

4. Loss of non-forest land leads to loss of flora and fauna

5. Changes in fisheries and the spawning grounds

6. Stagnation and water logging near reservoir leads to breeding of vectors and spread of vectorborne diseases

7. Growth of aquatic weeds may lead to microclimatic changes.