

BULE HORA UNIVERSITY

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Chapter 1. Introduction

The link between population and environment

What is population? Varieties of definitions

- the total number of persons inhabiting a country, city, or any district or area,
- the number or body of inhabitants in a place belonging to a specific social, cultural, socioeconomic, ethnic, or racial subgroup: the native population; the working-class population,

Cont...

- the assemblage of a specific type of organism living in a given area. all the individuals of one species in a given area,
- A group of individuals of the same species occupying a particular geographic area,
- Populations may be relatively small and closed, as on an island or in a valley, or they may be more diffuse and without a clear boundary between them and a neighboring population of the same species,

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- For species that reproduce sexually, the members of a population interbreed either exclusively with members of their own population or, where populations intergrade, to a greater degree than with members of other populations

World population growth and environmental degradation

- The needs of this huge number of human beings cannot be supported by the Earth's natural resources, without degrading the quality of human life,

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The rapid population growth and economic development in country are degrading the environment through the uncontrolled growth of:

- urbanization and industrialization,
- expansion and intensification of agriculture, &
- destruction of natural habitats,

Cont...

- The growing population and the environmental deterioration face the challenge of sustained development without environmental damage,
- The three fundamental demographic factors of births, deaths and migration produce changes in population size; composition, distribution and these changes raise a number of important questions of cause and effect

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- As the 21st century begins, growing number of people and rising levels of consumption per capita are depleting natural resources and degrading the environment,
- The pressures on the environment intensify every day as the population grows

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- Population growth and environmental degradation are two of the great concerns of our age, as both are seen to be problems of local and global importance,
- The links between them are generally not clearly understood, though population growth is usually regarded as an underlying factor of environmental change, associated with the huge scientific and technological advances which have transformed societies, economies and politics over the last two centuries,

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major processes altered the relationships between population and environment

- ❖ **multiplication of the world population** about 5.5 times since 1800, and the diversity of demographic transition so that the dynamics of populations have never been so varied.
- ❖ **large-scale migrations** of peoples mainly of European origin into formerly less peopled continents and regions - into the Americas, Africa, Australasia and Inner Asia - altering substantially the patterns of human occupation of the earth's surface.

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- ❖ **huge expansion of the industrial and service sectors of human activity**, provoking marked concentration of population in economic core areas;
- ❖ **massive urbanization**, initially in developed countries but subsequently in the developing world, with particular concentration of population in mega-cities;
- ❖ **intensification of modern agriculture**, the decline of more extensive forms of traditional agriculture and the relative depopulation of environmentally 'negative areas' (e.g. deserts, tundra, mountains) and 'marginal areas' (e.g. moorlands, sahel, semi deserts)

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- ❖ **growing economic differentiation of populations**, oversimplistically dichotomized into developed and developing countries, but involving a very wide range of economic progress and environmental impacts;
- ❖ **growing social differentiation of populations**, increasing existing cultural contrasts through diverse levels of education, housing and social/health provision as well as the roles and status of women; and

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- ❖ **growing political fragmentation of the world**, increasing the number of independent states, which has the effect of nationalizing populations, thus influencing their distributions and dynamics as well as their impacts upon environments.

Cont...

What is environment?

- Environment is a system which provides natural surroundings for the existence of organisms (including humans) and which is a prerequisite for their further evolution,
- To summarize, it is all which surrounds us. It is noteworthy that this is essentially an anthropocentric (non-biological) definition perceiving environment as one in which a man can live,
- Abiotic components of environment (atmosphere, water, minerals, energy etc.)
- biotic components of environment (organisms – from the simplest to the most complex) are its main elements,

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Ecological Approach

- Environment is a set of all factors with which a living subject interacts, and of all surroundings which encompass it,
- Thus, it is everything that a subject influences, directly or indirectly.
- A subject can be an organism, a population, a human or whole human society,
- Usually, the notion of living environment is conceived in the sense of human environment,

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Biological Approach:

- environment' denotes the surroundings of an organism or a species, eventually the ecosystem in which an organism or a species lives,
- At the same time, it is a physical environment and other organisms with which the organism or the species enters into interacts
- The notion of biome is very similar to a living environment

Development

- development is to actually mean have passed great evolution in the last half of century and there is no consensus on how to define this notion at present
- Economic growth was regarded as central to the development endeavors up to the 1980's,
- Gradually, development came to be interpreted as multidimensional concept which should encompass material, social, environmental, political and cultural components (with all of them having a direct impact on the quality of human life)

Population and the Environment

- The link between population growth and environmental impact seems obvious at first glance:
- more people consume more resources, damage more of the earth and generate more waste,
- Humans are a force of nature. As nations develop, they increase consumption. This simple reasoning is true as far as it goes, but the larger picture is more complex.

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- A very small proportion of the population consumes the majority of the world's resources.
- The richest fifth consumes 86% of all goods and services and produces 53% of all carbon dioxide emissions, while the poorest fifth consumes 1.3% of goods and services and accounts for 3% of carbon dioxide output.

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- Human action has transformed between one-third and one-half of the entire land surface of the earth.
- We have lost more than one-quarter of the planet's birds, and two-thirds of the major marine fisheries are fully exploited, over-exploited or depleted.
- Every 20 minutes, the world adds another 3,500 human lives but loses one or more entire species of animal or plant life - at least 27,000 species per year.

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- This is a rate and scale of extinction that has not occurred in 65 million years. Spreading deserts and declining water tables in a third of the planet are contributing to famine, social unrest and migration.
- This way it was recognized that there is no single model of development appropriate and desirable for all countries,
- At the same time emerged the idea of “sustainable development”, emphasizing the questions related to demographic processes, considerate use of natural resources and mutual influences between a human and his living environment.

relationship between development and the environmental condition

- Just as development is impossible without a good condition of living environment, so quality environment cannot be maintained in inhabited or intensively exploited areas without their sustainable development,

Sustainable development

- The concept of sustainability has evolved along with our worries about the possible impact of our lifestyle on the environment,
- The strategy strives to draw people's attention to problems that development brings about as it heavily depends on intensification of industry and agriculture,
- The main reason why we should care about the issue is that for future generations it is becoming harder to meet the basic need as drinkable water, food or clear air

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- The World Commission on Environment and Development (WCED), in 1987 Brundtland Report Our Common Future defined sustainable development as “***development that meets the needs of the present generation without compromising the ability of future generation to meet their own needs***”,
- Later the concept of sustainable development has been changed from a mere concentration on environmental problems towards comprehension of three different factors: social, economic and environmental,
- Ability to meet the needs of present as well as of future generation depends on our ability to balance all three elements, so that not a single one is neglected.

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principles of sustainable development:

- Decision-making process should depend on the best available scientific information and risk analysis,
- In case of uncertainty and threat of serious risks, the precautionary principle should be involved,
- Environmental impact should be taken into account, especially in cases of nonrenewable resources or possible non-reversible effects of human activities,
- Polluters should be responsible for effects of their activities according to „polluters pay principle“ (PPP).

Chapter Two

Classification of natural resources

- Natural resources are naturally occurring substances that are considered valuable in their relatively unmodified (natural) form.
- A natural resource's value rests in the amount of the material available and the demand for it,
- The latter is determined by its usefulness to production. A commodity is generally considered a natural resource when the primary activities associated with it are extraction and purification, as opposed to creation,
- Thus, mining, petroleum extraction, fishing, hunting, and forestry are generally considered natural-resource industries, while agriculture is not,

- Natural resources which satisfy the material and spiritual needs of humans are the free gifts of the nature,
- In other words, any material which is valuable and useful for humans is called a resource,
- These resources include physical like land, water, soils and minerals; biological living like vegetation, wildlife and fisheries.
- In fact every material has some utility for human beings but its utilization is possible on the availability of appropriate technology. For example, for centuries, coal and petroleum were present below the earth's surface, but the technology for their utilization has been developed recently,
- These materials turned into resources only when they could be used. It is, therefore, human ability and need which create resource value.

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- Natural Resources (NRs) are at the core of human civilization. They are engine for economic advancement and societal wellbeing. Everything we need and everything we use, as individual or society, in processed or unprocessed form are extracts of NRs. Indeed, they are our food, shelter, energy, medicine, raw materials, etc.
- The role and importance of NRs in economic development and societal wellbeing is nowhere else appreciated than in developing countries like Ethiopia whose populations are predominantly rural in structure and directly dependent on natural resources for subsistence.

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- Today the NR bases are heavily suffering widespread improper and unwise utilization resulting in their rapid degradation. Deforestation, desertification, loss of biodiversity, soil erosion, soil fertility decline, soil acidification, salinization, environmental pollution and climate change are some of the major expressions of natural resources degradation,
- As more users place demands on the scarce environmental resources, the need for intelligent conservation and rational management of the natural assets is ever greater, the very concept of sustainable development.
- The fundamental principle of sustainable development entails that the use of natural resources by a generation should not compromise (i) their roles in maintaining natural ecological balance, (ii) their position in environmental quality and integrity, and (iii) their quantity and quality such that successive generations could also satisfy their needs.

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- Resources form the backbone of the economy of a nation. Without land, water, forest, air, mineral one cannot develop agriculture and industry.
- They constitute natural environment like air, water, forests and various life forms, which are essential for human survival and development.
- By utilizing natural resources, humans created their own world of houses, buildings, means of transport and communication, industries etc. These are also very useful along with natural resources and these human made resources are essential for development.

classification of resources

Basis for classification

- *The objective of classification would primarily decide how we put a resource under a particular category,*
- Resources can be classified in several ways: one the bases of
 - (i) origin (biotic and a biotic),
 - (ii) Renewability,
 - (iii) stage of development(utility)

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1. Based on origin (biotic and abiotic)

(a) Biotic - Biotic resources are obtained from the biosphere, such as forests and their products, animals, birds and their products, fish and other marine organisms.

- Different living organisms constitute the biotic component of an ecosystem and belong to the following categories:

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- ***(i) Producers:*** These are mainly producing food themselves e.g., Green plants produce food by photosynthesis in the presence of sunlight from raw materials like water and carbon dioxide,
- ***(ii) Consumers:*** These organisms get their food by feeding on other organisms. They are of the following types:
 - ***Herbivores***—which feed on plants e.g. rabbit, insect,
 - ***Carnivores***—which feed on herbivores as secondary carnivores (e.g., frog, small fish) or tertiary carnivores (e.g., snake, big fish), which feed on other consumers.

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- ***Omnivores***—which feed on both plants and animals e.g., humans, rats, many birds.
- ***Scavengers***—which feed on dead organisms e.g., Hyena, vulture, ants, etc.
- ***(iii) Decomposers***: These are micro-organisms which break down organic matter into inorganic compounds and in this process they derive their nutrition. They play a very important role in converting the essential nutrients from unavailable organic form to free inorganic form that is available for use by plants e.g., bacteria, fungi.

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- **(b) Abiotic** - Abiotic resources include non-living things such as land, water, air and ores such as gold, iron, copper, silver etc.
- Various physico-chemical components of the ecosystem constitute the abiotic structure:
 - (i) Physical components include sunlight, solar intensity, rainfall, temperature, wind speed and direction, water availability, soil texture etc.
 - (ii) Chemical components include major essential nutrients like C, N, P, K, H, O, S, etc. and micronutrients like Fe, Mo, Zn, Cu, etc., salts and toxic substances like pesticides.
- These physico-chemical factors of water, air and soil play an important role in ecosystem functioning.

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Every ecosystem performs the following important functions:

- (i) It has different food chains and food webs. Food chain is the sequence of eating and being eaten. e.g
- Grass → Grasshopper → Frog → Snake → Hawk
Phytoplankton (water-algae) → water fleas → small fish → large fish (Tuna)
- These are known as grazing food chain—which start with green plants and culminate with carnivores.
- Another type is detritus food chain—which starts with dead organic matter. e.g., Leaf litter in a forest → Fungi → bacteria

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- Food chains are generally found to be interlinked and inter-woven as a network and known as food web. There are several options of eating and being eaten in a food web. Hence these are more stable.
- (ii) There is uni-directional flow of energy in an ecosystem. It flows from sun and then after being captured by primary producers (green plants), flows through the food chain or food web, following the laws of thermodynamics. At every successive step in the food-chain, there is huge loss of about 90% of the energy in different processes (respiration, excretion, locomotion, etc.) and only 10% moves to next level (Ten percent law of energy flow).

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- (iii) Nutrients (Materials) in an ecosystem move in a cyclic manner. The cycling of nutrient takes place between the biotic and abiotic components, hence known as biogeochemical cycles (bio = living, geo = earth, chemical = nutrients).
- (iv) Every ecosystem functions to produce and sustain some primary production (plant biomass) and secondary production (animal biomass).
- (v) Every ecosystem regulates and maintains itself and resists any stresses or disturbances up to a certain limit. This self-regulation or control system is known as cybernetic system.

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2. Based on stage of development

- (a) Potential Resources - Potential resources are those that exist in a region and may be used in the **future**. For example, petroleum which exists in many parts of the world are formed naturally in sedimentary rocks. It is drilled out and put into use and remains a potential resource,
- (b) Actual Resources - Actual resources are those which can also be called developed resources, stock and reserves are those that have been surveyed, their quantity and quality determined and are **being used in present times**.

The development of an actual resource, such as wood processing depends upon the technology available and the cost involved. That part of the actual resource which can be developed profitably with available technology is called a reserve.

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3. Based on renewability

a) Renewable resources are generally living resources (fish, reindeer, coffee, and forests, for example), which can **restock (renew)** themselves if they are not over-harvested but used sustainably,

- Once renewable resources are consumed at a rate that exceeds their natural rate of replacement, the standing stock will diminish and eventually run out,
- The rate of sustainable use of a renewable resource is determined by the replacement rate and amount of standing stock of that particular resource,
- Non-living renewable natural resources include soil and water

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- Flow renewable resources are very much like renewable resources, only they do not need regeneration, unlike renewable resources,
- Flow renewable resources include renewable energy sources such as the following renewable power sources: solar, geothermal, biomass, landfill gas, tides and wind.

Cont.....

b) Non-renewable resources

- A non-renewable resource is a natural resource that **exists in a fixed amount that cannot be re-made, re-grown or regenerated** as fast as it is consumed and used up,
- Some non-renewable resources can be renewable but take an extremely long time to renew. Fossil fuels, for example, take millions of years to form and so are not practically considered 'renewable'.

Chapter three

Natural resources basis of Ethiopia

- Despite the presence of diversified natural resources and their invaluable benefits, some components of our resources are under ongoing pressure due to: direct causes including habitat conversion, unsustainable utilization, invasive species, replacement of local varieties and breeds, climate change, and pollution.
- Added to these direct causes, demographic changes, poverty, and lack of awareness and coordination, can become indirect causes.

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3.1.Climate

- The main physical feature of the country is the diversity in altitude and accompanying climate and ecological variation.
- The altitude ranges from 110 meters below sea level to 4620 metres above sea level. The climate in the highlands (area more than 1800 m asl) is mild and the annual precipitation ranges from 800 to 2200 mm.

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- The lowlands are hot with annual rainfall varying from less than 200 to 800 mm; of the total area, 60 % is reported suitable for agricultural purposes.
- The natural forest cover is about 2.4 percent of the total area.
- Ethiopia has diverse physical features that cause a great variety of climatic conditions.

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- The diverse latitudinal, climatic, soil and other conditions result in a multitude of agro ecological zones.
- The traditional climatic zones and their physical characteristics include Berha (hot arid, rainfall below 200 mm), Kola (warm semi-arid, rainfall 200 - 800 mm), Woina Dega (cool sub-humid, rainfall 800 - 1200 mm), Dega (cool humid, rainfall 1200 - 2200 mm) and Wurch (cold and moist, rainfall above 2200 mm).

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- Ministry of Agriculture (2000) classifies the Ethiopian climate in to different categories.
- **Agro-ecological zones**
- The multitude of agro-ecological zones (AEZs) is traditionally classified into five categories with traditional names assigned to each zone, based on altitude and temperature: Bereha, kola, weinadega, dega and wurch.
- However, the amount of rainfall and its distribution are also important in classifying common agro-ecological zones (See Table1).

Cont...

Table 1. Traditional Ethiopian Agro-ecological Zones

Zone	Altitude(m)	Mean Rainfall (mm)	Temperature (° C)
Bereha (dry-hot)	500-1,500	<900	>22
Weinadega (dry- warm)	1,500-2,500	<900	18-20
Erteb Kola (sub-moist warm)	500-1,500	900-1,000	18-24
Weinadega (sub-moist cool)	1,500-2,500	900-1,000	18-20
Erteb Weinadega (moist- cool)	1,500-2,500	>1,000	18-20
Dega (cold)	2,500-3,500	900-1,000	14-18
Erteb dega (moist cold)	2,500-3,500	>1,000	10-14
Wurch (very cold or alpine)	>3,500	>1,000	<10

Source: MoA, 2000

Note: The extreme desert (between 500 to –126 metres) area is not traditionally classified

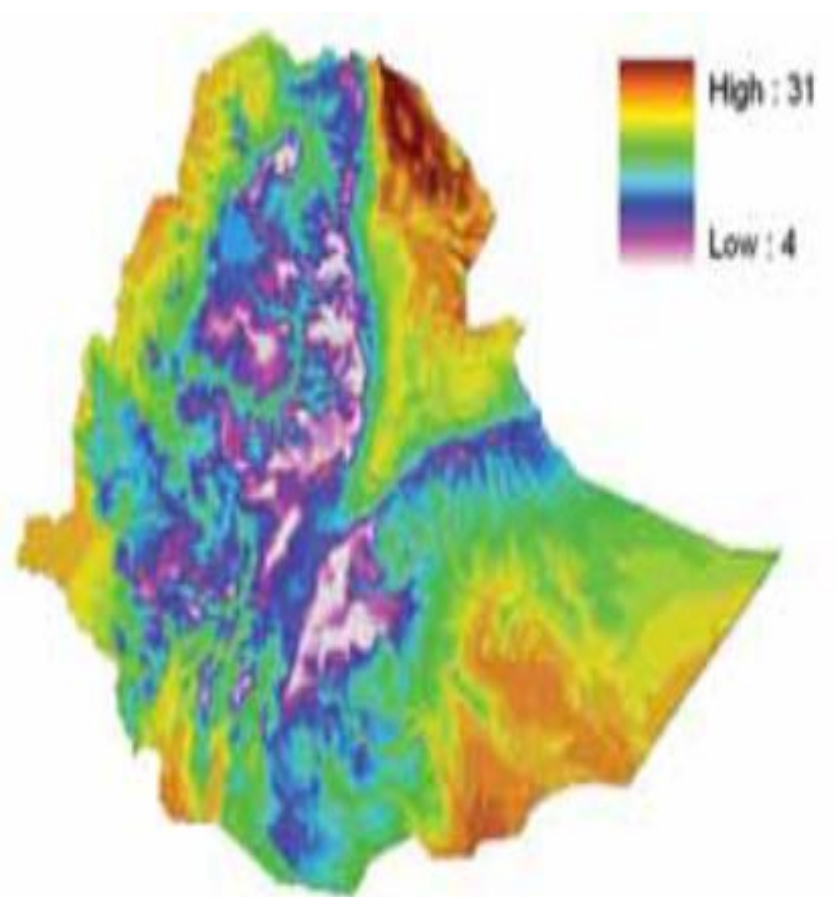
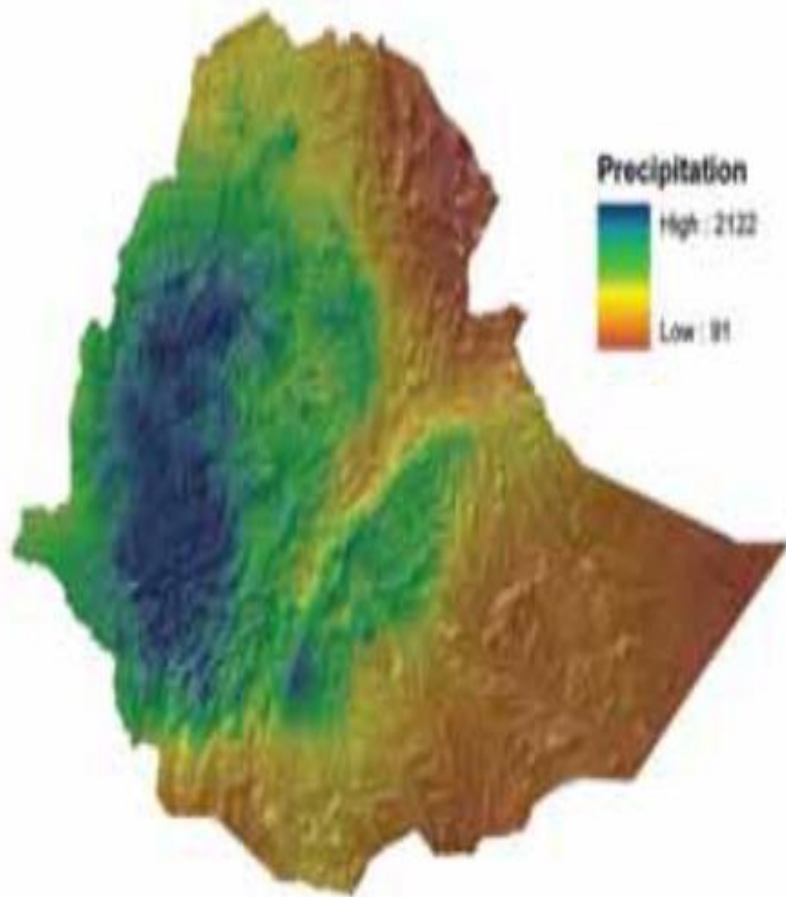
Cont...

- Based on Global Precipitation Climatology Centre (GPCC <http://gpcc.dwd.de>) data, we have derived climatological data.
- Accordingly, the mean annual rainfall is 812.4 mm, with a minimum of 91 mm and a maximum of 2,122 mm; with a highest rainfall ranging from 1,600–2,122 in the highlands of the western part of the country, and a lowest rainfall from 91-600 mm in the eastern lowlands of the country.

Cont...

- The mean annual temperature is 22.2 degrees Celsius. The lowest temperature ranges from 4-15 degrees Celsius in the highlands, and the highest mean temperature is 31 degree Celsius in the lowlands at the Denakil Depression.
- Figure 1 shows the annual average precipitation and temperature in Ethiopia (derived from globally gridded monthly precipitation-data sets for the period 1951 to 2000, based on GPCC data).

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Annual rainfall and temperature distribution in Ethiopia

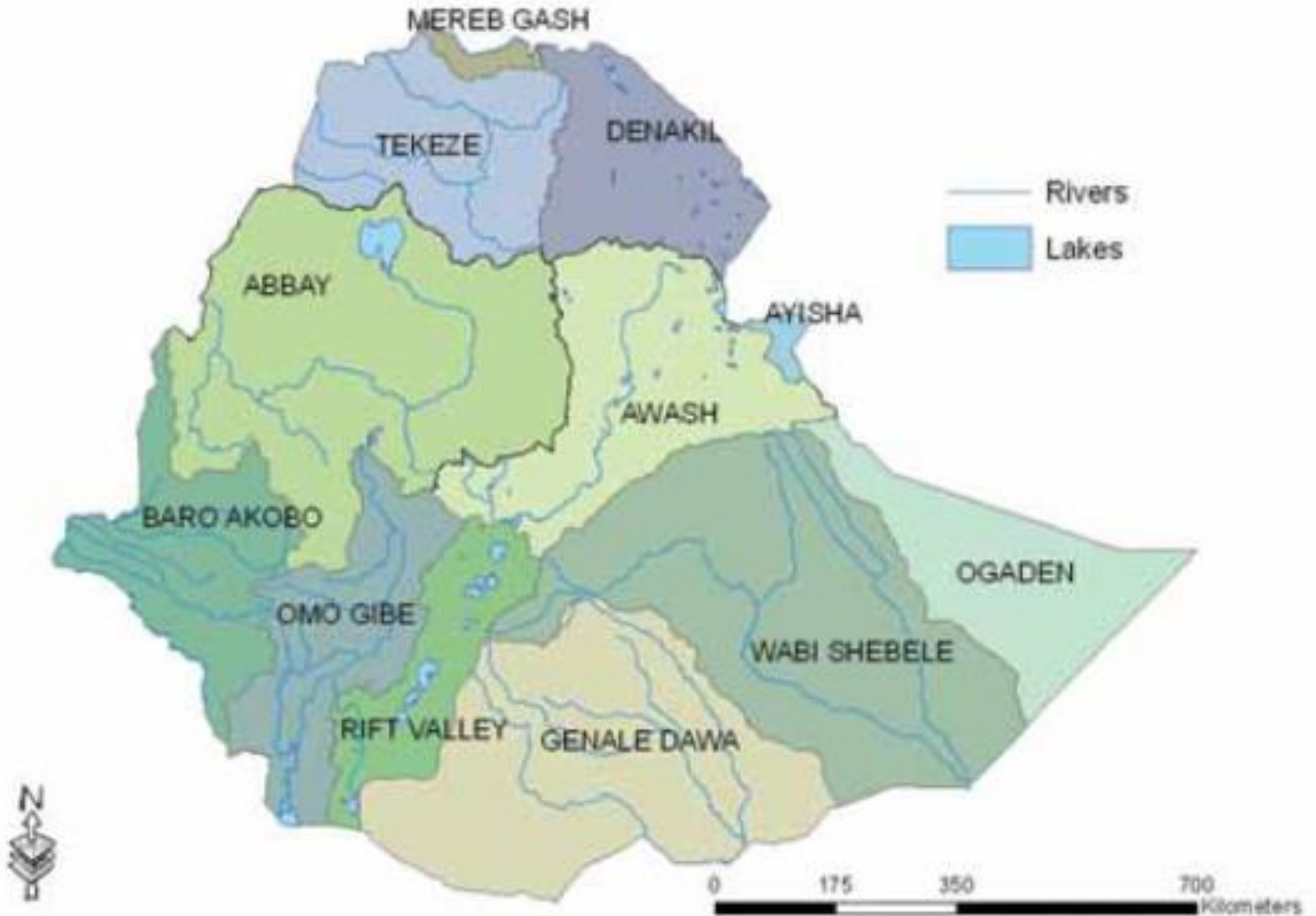
3.2 Water and drainage basin

- The idea of a river basin, despite its physical or natural attributes, is more than an engineering concept and encompasses the magnitude and dynamics of a resource that must be harnessed for the common good.

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- It has often been advocated that the most logical unit for water resources planning and optimum utilization of available water resources is the river basin.
- The country has 12 river basins. These are, Tekeze, Abbay, Baro-Akobo, Omo-Ghibe, Rift Valley, Mereb, Afar /Denakil, Awash, Aysha, Ogaden, Wabi-Shebelle*, and Genale-Dawa

Ethiopian river basins map



Irrigation and hydropower potential of river basins

River Basin	Area (Km ²)	Runoff (Bm ³)	Potential Irrigable Land (ha)	Gross Hydro- electric potential Gwh/year	Estimated ground water potential (Bm ³)
Tekeze	82,350 ***	8.2	83,368	5,980	0.20
Abbay	199,812	54.8	815,581	78,820	1.80
Baro-Akobo	75,912	23.6	1,019,523	13,765	0.28
					0.13Recharge/year
Omo-Ghibe	79,000	16.6	67,928	36,560	0.42
					(.10)Rech /yr
Rift Valley	52,739	5.6	139,300 *	800	0.10
Mereb	5,900 ***	0.65	67,560	-	0.05
Afar /Denakil	74,002 *****	0.86	158,776	-	-
Awash	112,696	4.9	134,121	4,470	0.14
Aysha	2,223 *****	-	-	-	-
Ogaden	77,121 *****	-	-	-	-
Wabi-Shebelle*	202,697 **	3.16	237,905	5,440	0.07
Genale-Dawa	171,042 **	5.88	1,074,720	9,270	0.14
Total	1,135,494	124.25	3,798,782	155,102	2.86

Source: Integrated River Basin Master Plan Studies, carried out during 1997-2007 (MoWR 1996, 1997, 1998a, 1998b) Irrigable land from the IWMI irrigation database (based on – MoWR data).

* Figures need to be updated from recent studies.

** Small-scale is not included in the database, medium and large-scale is 49,700 ha.

*** Indicates the Ethiopian part of the basin area. The total basin area is 23, 932 ha.

***** Reconnaissance study

Abbay River Basin

- Abbay river basin has a catchment area of 199,812 km², covering parts of Amhara, Oromia and Benishangul-Gumuz regional states.
- It has the major sub-basins of Anger, Beles, Dabus, Debre Markos, Didesa, Dindir/Rahid, Fincha, Guder, Jemma, Lake Tana, Mota, and Muger.
- The major river in the basin is the Blue Nile (Abbay) river, which rises in Lake Tana flowing about 1,450 km long, and merges with the White Nile to form the Nile proper.

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- The river basin has a lowest elevation of 500 m. and a highest elevation of 4261 m. The total mean annual flow from the river basin is estimated to be 54.8 BMC.
- The Abbay river basin is well known as the source of Nile, a land of dramatic gorges and mountains. Abbay is the most important river basin in Ethiopia.

Cont...

- It accounts for 20 % of Ethiopia's land area, for about 50 % of its total average annual runoff which emanates from the Ethiopian highlands, for 25 % of its population and for over 40 % of its agricultural production.
- The rivers of the Abbay basin contribute on average about 62% of Nile at Aswan; together with the contribution of Baro Akobo and Tekeze rivers, Ethiopia accounts for at least 86 % of the runoff at Aswan.

Awash River Basin

- Awash River basin has a catchment area of 112,696 km². The Awash River originates from Central West part of Ethiopia, flowing 1200 Km long, and provides a number of benefits to Ethiopia.
- Relatively, the most utilized river basin and the only river entirely in the country, Awash covers parts of the Amhara, Oromia, Afar, Somali regional states, and Dire Dawa, and Addis Ababa City administrative states of the country.
- The river basin has a lowest elevation of 210 m and a highest elevation of 4195 m.

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- The total mean annual flow from the river basins is estimated to be 4.9 BMC.
- In this river basin 37 irrigation potential sites are identified out of which 5 are small-scale, 18 are medium-scale, and 14 are large-scale. The estimated irrigation potential is 134,121 hectares.
- Out of these, a potential, 30,556 hectares are for small-scale, 24,500 hectares for medium-scale and 79,065 hectares for large-scale development.

Denakil River Basin

- Denakil river basin has an area of 74,002 km², which covers Tigray, Amhara and Afar regional states. The basin has no major river draining out of it.
- The basin has a lowest elevation of -197 m at Denakil depression, the lowest altitude of the country, and a highest elevation of 3,962 m.
- The total mean annual flow from the river basins is estimated to be 0.86 BMC.

Cont...

- Around 12 small-scale, 33 medium-scale, and 8 large-scale, and a total of 53 irrigation potential sites are identified in the basin.
- A total of 158,776 hectares of potential irrigable area is also estimated. Out of these, a potential 2,309 hectares are for small-scale, 45,656 hectares for medium-scale and 110,811 hectares for large-scale development.

Genale Dawa River Basin

- Genale Dawa river basin has an area of 171,042 Km², covering parts of Oromia, SSNRP, and Somali regions. It is the third largest river basin, after Wabi Shebelle and Abbay river basins. The river basin has a lowest elevation of 171 m and a highest elevation of 4385 m.
- The total mean annual flow from the river basins is estimated at about 5.8 BMC. The basin falls mainly in the arid and semi-arid zone and is generally drought-prone with erratic rainfall.

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- About 85 irrigation potential sites are identified in the basin, out of which, 18 are small-scale, 28 are medium-scale, and 39 are large-scale.
- The basin has an estimated total potential of 1,074,720 hectares of irrigable area.
- Out of these, a potential 1805 hectares are for small-scale, 28,415 hectares for medium-scale and 1,044,500 hectares for large-scale development.

Wabi Shebele River Basin

- Wabi Sheble river basin has an area of 202,697 Km², covering parts of the regions Oromia, Harari and Somali. This river basin has a lowest elevation of 184 m. and a highest elevation of 4182 m.
- The total mean annual flow from the river basins is estimated at about 3.16 BMC.

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- Around 41 small-scale, 77 medium-scale and 31 large-scale and a total of 149 potential irrigation sites are identified in the basin.
- It has an estimated potential of 237,905 hectares of irrigable area. Out of these, a potential 10,755 hectares are for small-scale, 55,950 hectares for medium-scale and 171,200 hectares for large-scale development.

Baro Akobo River Basin

- Baro Akobo river basin has an area of 75,912 Km², covering parts of the Benishangul- Gumz, Gambella, Oromia, and SNNPR. The basin has a lowest elevation of 390 m. and highest elevation of 3244 m.
- The total mean annual flow from the river basins is estimated to be 23.6 BMC. Twenty two large-scale potential irrigation sites are identified in the basin, with an estimated irrigable area of 1,019,523 hectares.

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- The Baro-Akobo basin is the second most important basin, next to Genale Dawa, as far as irrigation potential is concerned.
- The population is settled sparsely in the lowlands of the basin which offers a conducive environment for water resources development.
- As a consequence of regular flooding, the lowland areas are mainly used as pastures for grazing and no major water resources development has taken place to-date.

Tekeze River Basin

- Tekeze river basin has an area of 82,350 Km², covering parts of the Amhara and Tigray regional States.
- There are two main tributaries (Angereb and Goang) that contribute to Tekeze River which rises in the central highlands of Ethiopia, and joins the Atbarah River, the lower course of which is a tributary of the Nile. The river basin has a lowest elevation of 536 m and a highest elevation of 4517 m.

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- The total mean annual flow from the river basins is estimated to be 8.2 BMC. The amount of rainfall varies considerably ranging from 1300 mm in the Seimen Mountain to 600 mm in the lowland areas.
- The ground water resource is not so promising except in a few areas. The quality of surface water is suitable for irrigation. Tekeze basin has a potential for three large-scale irrigation sites with an estimated potential irrigable area of 83,368 hectares.

Omo Ghibe River Basin

- The Omo-Ghibe river basin has an area of 79,000 Km², covering parts of the SNNPR and Oromia. The total mean annual flow from the river basin is estimated at about 16.6 BMC.
- Large-scale and medium-scale irrigation potential are identified in the basin, with an estimated irrigable area of 57,900 and 10,028 hectares respectively, and a total irrigable area of 67,928 hectares (MoWR data).

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- However, this figure could be much higher given the vast land area of lower Omo. In terms of hydropower development potential it is the second largest, and it is a basin in which most of the current hydropower development is taking place.
- The basin is also endowed with a variety of wildlife; with Omo and Mago parks being located in the basin, its tourism potential will be further exploited as infrastructure develops in the area.

Rift Valley Basin

- The Rift Valley basin has an area of 52,739 Km², covering parts of the Oromia and SNNPR regions.
- The total mean annual flow from the river basins is estimated at about 5.6 BMC.
- Large-scale irrigation potential is estimated at 45,700 hectares with an estimated total irrigable area of 139,300 hectares.

Cont...

- The basin is endowed with a number of lakes of varying size with high environmental significance.
- An integrated development master plan preparation for the basin is currently in progress and more reliable data could emerge in the near future.

Other River Basins (Mereb, Aysha and Ogaden)

- Aysha and Ogaden basins are relatively considered as dry in most cases with seasonal river flows.
- Their potential in terms of irrigation development is considered not so significant and therefore, not included here.
- Mereb Basin is small in size, having about 0.65 BMC and about 65,000 hectares irrigable land area.

Cont...

- The Mereb River (or Gash River), is a river flowing out of central Eritrea. Its chief importance is defining part of the boundary between Eritrea and Ethiopia. The Mereb River is 440 kilometres (270 mi) long.
- The Ethiopian Ministry of Water Resources reports its Ethiopian catchment area as 5,700 square kilometres (2,200 sq mi), with an annual runoff of 0.26 billion cubic meters.

Surface Water Resources: Lakes and Reservoirs

- Ethiopia has 11 fresh and 9 saline lakes, 4 crater lakes and over 12 major swamps or wetlands.
- Majority of the lakes are found in the Rift Valley Basin. Table 3 provides information for 19 main natural lakes and reservoirs (MCE 2001); see also Figure 2.
- The total surface area of these natural and artificial lakes in Ethiopia is about 7,500 km².

Cont...

- The majority of Ethiopian lakes are rich in fish.
- Most of the lakes except Ziway, Tana, Langano, Abbaya and Chamo have no surface water outlets, i.e., they are endhoric. Lakes Shala and Abiyata have high concentrations of chemicals and Abiyata is currently exploited for production of soda ash.

Table 3. Basic hydrological data of lakes and reservoirs of Ethiopia

Name	Location		Elevation (m.a.s.l)	Drainage area (km ²)	Surface area (km ²)	Maximum depth (m)
	Longitude	Latitude				
Tana	37°23'	11°36'	1,788	15,319	3,000	14
Ziway	38°45'	07°54'	1,636	7,380	440	8.9
Langano	38°31'	07°32'	1,585	2,000	230	47.9
Abiyata	38°35'	07°33'	1,580	10,740	180	14.2
Shala	38°35'	07°03'	1,550	2,300	370	266
Awassa	38°27'	07°07'	1,680	1,300	92	22
Abaya ¹	37°50'	06°15'	1,169	16,342	1,140	24.2
Chamo ¹	37°38'	05°50'	1,110	18,575	317	14.2
Chew Bahir	36°56'	04°45'	500	-	308	-
Haik	39°43'	11°21'	1,900	83	22.5	88.2
Ardibo	39°46'	11°14'	2,150	53.5	14.9	64
Ashenge	39°31'	12°34'	2,440	129	20	25
Koka ²	39°10'	08°28'	1,590	11,250	236	13
Finchaa ²	37°23'	09°33'	2,219	1,391	345	7
Beseka	39°53'	08°54'	1,900	420	30	7
Turkana	36°05'	04°38'	375	-	-	-
Abhe	41°45'	11°10'	243	-	320	-
Gamari	41°40'	11°30'	339	-	63	-
Afambo	41°43'	11°24'	339	-	26	-

Source: MCE (2001)

Notes: ¹ Awulachew (2001)

² reservoirs

Groundwater Resources System

- As compared to surface water resources, Ethiopia has lower ground water potential. However, by many countries' standard the total exploitable groundwater potential is high.
- Based on the scanty knowledge available on groundwater resources, the potential is estimated to be about 2.6 BMC (Billion Metric Cube) annually rechargeable resource;

Overview of Water Usage

- Though the country possesses a substantial amount of water resources little has been developed for drinking water supply, hydropower, agriculture and other purposes.
- The water supply coverage was estimated to be 30.9 %, thus the rural water supply coverage being 23.1 % and that of urban being 74.4 % (UNESCO, 2004).

Cont...

- PASDEP envisages that the un served population will be reduced to 15.5 % by 2009/10 showing more people being served than planned by MDG (Millennium Development Goals) by year 2015.
- The goal during PASDEP is also to reduce the share of malfunctioning rural systems from 30 percent in 2005/06 to 10 percent by 2010 (MOFED, 2006). The great majority of the rural Ethiopian population community water supply relies on groundwater

Cont...

- The safe supply of water in rural areas is usually derived from shallow wells, spring development and deep wells. People who have no access to improved supply usually obtain water from rivers, unprotected springs, hand-dug wells and rainwater harvesting.
- Despite its immense relevance and importance, the groundwater sector has been given less attention until recently.

Cont...

- In order to utilize the ground water resource properly, understanding of the groundwater occurrence and distribution in space and time, proper management and efficient exploitation is necessary.
- The available studies on the groundwater resources of the country are very limited, in that, the delineation of aquifer systems, the water balance and determination of the aquifer characteristics has not been conducted.

Cont...

- Constraints of Water Resources Development in Ethiopia are numerous. They fall in one of the general categories of legal, political, social, institutional or technical.
- These require careful consideration and need to be supported by applied research if the required level of development is to be ensured.

Cont...

- Increasing the role of applied research is one of the means to alleviate the problems encountered in the water sector. Irrigation and drainage research is considered as part and parcel of water resources research. Significant research activities have not yet been undertaken on irrigated crops.
- This is because, unlike the agricultural and health sectors, institutionalized water research in Ethiopia does not exist, as it is the case in most parts of Africa and underdeveloped countries.

3.3 Forest and tree species

- Attempts to identify or classify ecosystems of Ethiopia have been very limited or non existent thus far.
- Vegetation types in the country are being considered as ecosystems.
- Owing to the extreme variations in climate, terrain, etc. and comprising most ecological systems, Ethiopia possesses one of the largest and most diverse plant genetic and wildlife resources in the world.

Cont...

- The size of the Ethiopian flora is estimated to range from 6500 to 7000 species of higher plants -flowering plants, conifers and ferns of which 12% is considered endemic.
- Historical sources indicate that, on the basis of potential climatic climax, high forests might once have covered some 35% of Ethiopia's land area. If the savanna woodland is included, two-thirds of the country was probably forest or woodland.
- The country has also over 300 tree species of which a few are used for construction and industrial purpose.

Cont...

- These diverse ecosystems have endowed Ethiopia with a diverse biological wealth of plants, animals, and microbial species.
- However, the attention given to the conservation and sustainable use of these biological resources has been inadequate. Some of the major contributory factors to accelerated decline of the biological resources are the size and pattern of the distribution of human and animal population, the level of resource consumption, market factors and policies.

Cont...

- Under-valuation of environmental resources due to low-level of awareness about the role of ecosystems and the rate at which it is being deteriorated or lost and poor regard to the conservation problems have also contributed to under-investment in biological resources management.

Utilization patterns of forest species

- The major forest products that can be derived from trees and forests include industrial wood, construction wood (pales and posts), charcoal and fuel wood.
- The minor forest products cover a wide range of products such as honey and wax from beekeeping, gums and incense, resins, and spices.

Cont...

Threats to forest genetic resources

- Especially during the last century, Ethiopia's forests and woodlands declined both in size and quality. By the early 1950's, high forests areas were reduced to 16% of the total land area. It has been estimated that by the early 1980's that the land area covered by forest has declined to 3.6%, and by 1989 to about 2.7%.

Cont...

- Although there was no record of the loss of forest genetic resource in the past, and there is very little knowledge of genetic variations between and within species, to date it is likely that some species could have been extinct.
- The challenge is to be able to conserve the remaining forest genetic resources, which have been eroded due to deforestation and changes in land use, over grazing, inappropriate harvesting practices and climate change.

Cont...

Management of forest genetic resources

- Even though not enough the country is undertaking different management system of forest genetic resources.

In situ conservation activities

- Most of the vegetation conservation work in Ethiopia has been associated with protected areas consisting of protected forests, national parks, wildlife reserves and sanctuaries, and controlled hunting areas.

Cont...

Ex situ conservation activities

- Some of the mechanism to conserve forest genetic resources from extinction can be
 - ✓ Seed banks
 - ✓ Forest plantation
 - ✓ Botanical and home gardens and etc.

Cont...

Policy and Institutional Mechanism for forest conservation

National forest policy

- Efforts toward the conservation, utilization and management of forest genetic resources reveal the absence of forest policies and strategies are one of the major constraints that need to be tackled.
- There is lack of legal status and gazettelement of the protected forest areas and human encroachment into protected area

Cont...

Laws and others rules

- The main laws and rules upon which the forest genetic resources (FGR) conservation and utilization are based are : Convention on biological diversity, Convention on CITES, National forest policy, National Forestry Law (Act), National Environment Law (act).

Cont...

Institutions involved in forest genetic resources management activities

- Responsibility for the conservation, management and utilization of forest genetic resources lies with a number of different organization within the government.
- Currently the Natural Resources Management and Regulatory Department of the Ministry of Agriculture is responsible for the formulation of forest policy and strategies and for the conservation, development and utilization of forest resources.

Cont...

- The activities are not integrated and coordinated which result to the over exploitation of the forest resources. There is also a conflict between the conservation and development objectives of the different institutions of the government some times.
- The absence of comprehensive policy guidelines on the importation, exportation and exchange activities has resulted in the movement and over exploitation of the forest resources in uncoordinated and unregulated manner

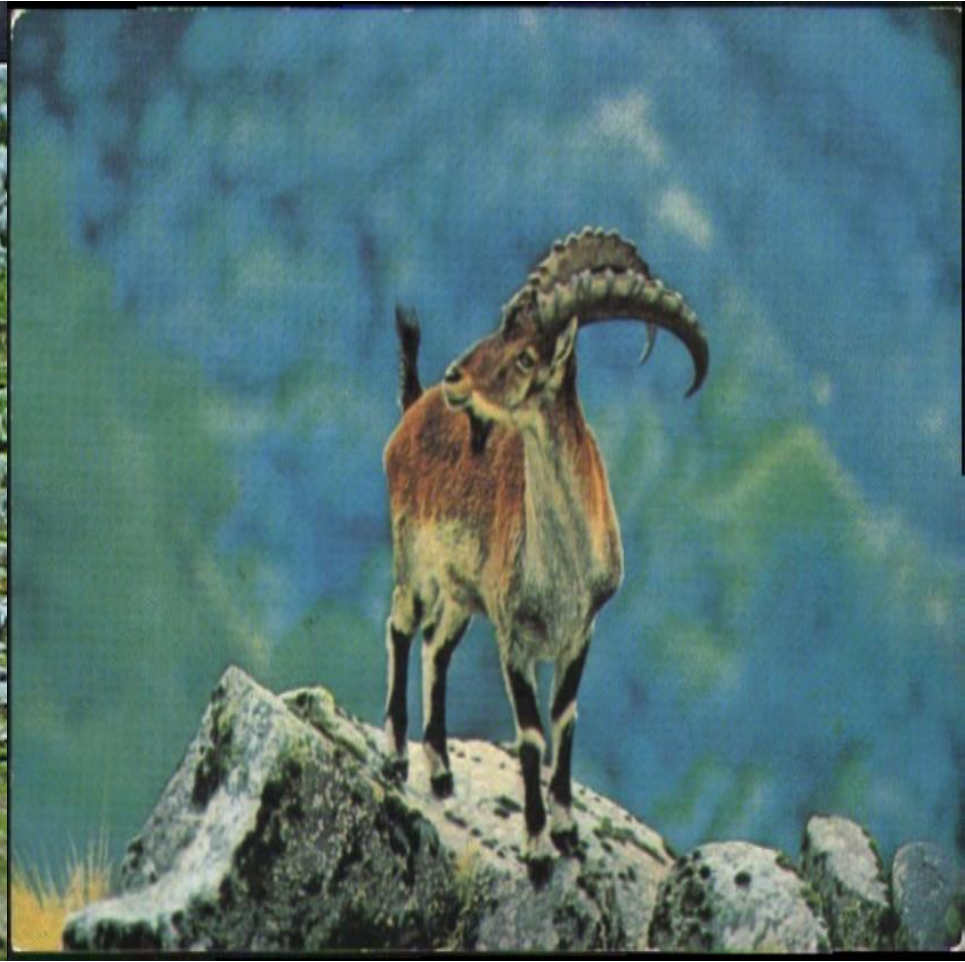
3.4 .Wildlife and parks

- Ethiopian encompasses a broad range of ecosystems with great varieties of habitats contributing for the occurrence of high faunal diversity. However, information on terrestrial fauna as a whole is limited to mammals, birds, reptiles, amphibians and a few groups of arthropods.
- The variety of species and great proportion of endemism within the groups especially in the highlands is the result of the isolation of the highland areas of the country, from other highland within and outside the country by the surrounding lowlands

Cont...



Ethiopian Wolf (*Canis simensis*) – A critically endangered species dwelling mainly in Afroalpine meadows and moorlands of few southeast, central and northern highland massifs of Ethiopia



Walia Ibex (*Capra wallie*) – An endemic ungulate with world population of less than 550, Confined only in Afro-alpine habitat of Semien Mountain National Park, Ethiopia

Cont.....



**Mountain Nyalya (*Tragelaphus buxtoni*),
a montane specialist endemic ungulate,
localized in southeast highlands of
Ethiopia**



**Swayne`s Hartbeest (Alcelaphus
buselaphus swsynei)
Amharic: Korkay**

Definitions

- National Park is Natural area of land and/or sea, designated to
 - (a) protect the ecological integrity of one or more ecosystems for present and future generations,
 - (b) exclude exploitation or occupation inimical to the purposes of designation of the area and
 - (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, core area of biosphere reserves.

Management Objectives

- protected area managed mainly for ecosystem protection (habitats & species) conservation and recreation (tourism and scientific research) all of which must be environmentally and culturally compatible.

Cont...

Guidance for selection:

- The area should contain a representative sample of major natural regions, features or scenery, where plant and animal species, habitats and geomorphological sites are of special spiritual, scientific, educational, and recreational and tourist significance.
- The area should be large enough to contain one or more entire ecosystems not materially altered by current human occupation or exploitation.

Protected Areas of Ethiopia

- Protected areas of Ethiopia are natural areas set aside to receive protection because of their recognized natural, ecological and / or cultural values.
- There are several kinds of protected areas (such as National parks, Wildlife reserves, wildlife sanctuaries, wildlife controlled hunting areas, Community conservation areas, Biosphere reserves etc...) which vary by their level of protection and management objectives.

Cont...

- Ethiopia has the following protected area with subsequently tabulated additional information below
 - ✓ 22 National parks (NP)
 - ✓ 2 Wildlife sanctuaries (WS),
 - ✓ 5 Wildlife Reserves (WR),
 - ✓ 10 Community Conservation Areas (CCA)
 - ✓ 21 Controlled Hunting areas (CHA), and
 - ✓ 4 Biosphere Reserves (BR),

Cont...

- However, only national parks and sanctuaries size, time of establishment where it is situated, flagship species & geographic settings have been described in table or pictorial form but most of them even have no defined boundary, legal status & management plan as well as well facilitated infrastructure, well trained manpower equipped with office & field facilities except Simien, Bale mountains National Parks s & others some of recently established regional government managed national parks partially facilitated.

Cont...

- Other PAs are merely listed as “Paper Park” but not well defined; conservation & management objectives.
- Most of them have no well demarcated, no decelerated legal status, written activities implementation guiding document management plan.

Cont...

- Particularly in wildlife reserves, controlled hunting areas, priority forest reserves, communal natural lands are still their establishment history ongoing management activities and ownership are not defined.
- The uses & contribution to conservation, climate change mitigation and sustainable utilization including actions & activities as well as law enforcement are not well stated.

Some of the protected areas (national parks) of the Country:

TABLE 3. SUMMARY OF THE MAJOR PROTECTED AREAS IN ETHIOPIA.

Name	Status ** = Gazetted	Size sq km	Region	Importance
Bale Mountains	NP	2040	Oromiya	Afroalpine, dry montane woodland, moist montane forest: Mt Nyala, Ethiopian wolf.
Simien Mountains	NP **	225	Amhara	Afroalpine, walia ibex, Ethiopian wolf
Gambella	NP	5061	Gambella	Swamps, Woodland, lechwe, kob
Omo	NP	4068	Southern	Wood-Scrubland, Large ungulate assemblage, Elept.
Mago	NP	2162	Southern	Wood-Scrubland, large ungulate assemblage, Elept.
Awash	NP **	156	Oromiya/Afar	Semi-Arid thorn-bush, oryx, gazelle
Abiatta - Shalla	NP	800	Oromiya	Rift Valley Lakes, avifauna
Yangudi - Rassa	NP	4731	Afar	Arid
Nech Sar	NP	514	Southern	Savannah wildlife; Swayne's Hartebeest
Total Area NP	(only 2 Gazetted)	19757		
Alatish	NP planned	2000	Amhara	Woodland Savannah
Bebille Elephant	WLS	6982	Afar	Semi-Arid Elephants
Senkelle Hartebeest	WLS	54	Southern	Swayne's Hartebeest
Yebello	WLS	2500	Oromiya	Scrub and Bush Crow
8 x Wildlife Reserve	WR			Many regions
18 x Hunting Areas	CHA			All over, many on concession
58 x Forest Priority Areas	FPA	13,863		Only those with closed forest

What is wildlife?

Various definitions of wildlife:

- Wildlife is a term that traditionally refers to non-domesticated vertebrates, but has come into more general usage to refer to all wild plants, animals and other organisms
- Wildlife is defined as “wild animals, trees, and other plants collectively”.
- Wildlife is defined as “any undomesticated organism restricted to wild animals, excluding plants”.

Cont...

- Wildlife is defined as “wild animals of all types, including birds, reptiles and fish” (Dictionary of Environment and Ecology)
- Wildlife is defined as “animals, birds, insects, etc. that are wild and live in a natural environment” (Oxford dictionary)
- Wildlife is defined as “the practical ecology of all vertebrates and their plant and animal associates”.

Cont...

- Wildlife is defined as “wild animals, usually terrestrial vertebrates whose populations are monitored and managed for exploitation or conservation”.
- As a resource wildlife contributes to the maintenance of the natural ecological process which human beings and the natural ecosystems depend upon.

Cont...

- it represents a store of genetic material that contains unrealized potential for the future, and it has a potential to contribute to the national economy.
- The direct benefits of wildlife to communities can be seen in the various forms of wildlife utilization. Examples include wildlife tourism, sport hunting, and intensive wildlife utilization schemes, such as ranching crocodiles for their skins, civet for musk, among others.

Currently Ethiopia has the following wildlife species in various protected areas

- 320 species of mammals (36 endemic),
- 862 species of Birds (18 endemic),
- 240 species of Reptiles (15 endemic),
- 71 species of Amphibians (30 endemic),
- 150 species of fish (41) endemic
- About 7000 species of plants (12-15% are endemic)

3.5 Mineral resources and soils

- The traditional artisanal production of salt, placer gold, building stones, clays and iron and the use of thermal waters and natural steam for curative and recreational purposes have a long history.
- Of these, gold and salt occupy places of importance in trade and mineral use.

Cont...

- Gold for artisanal mining is found in Benishangul, Akobo River area, Adola, Moyale (Borena) and Shire (Tigray). The level of production is not known but it is believed to be significant.
- Both production and trade have been illegal in the last two decades

Cont...

- The exploration for the assessment of the mineral and petroleum resources has been carried out both by the Ethiopian Geological Survey and private companies.
- These geological studies have come up with significant discoveries of gold, tantalum, phosphorus, iron, salt, potash, soda ash, gemstones, coal, geothermal, natural gas, other industrial and construction minerals/ rocks in different parts of the country.

Cont...

- Gold has been produced from placer deposits mainly by the artisanal miners for several thousand years. There is a large scale primary gold mining operation at Lega Dembi and Sakaro which produces about 5tons of gold per annum.
- This gold mine, which is owned by the private company, occurs in the southern part of the country hosted in the Southern Green stoneBelt

Cont...

- Nowadays significant and well defined orogenic gold and volcanogenic massive sulfide (VMS) deposits are also outlined by the private companies in the Western and Northern Greenstone Belts of the country.
- There is a small scale tantalum mining operation, called Kenticha Tantalite mining, hosted in the pegmatite rocks of the Southern Greenstone Belt.

Cont...

- Huge industrial and construction raw materials occur in various rocks varying in age from Precambrian to Recent in different parts of the country.
- The mining industry in Ethiopia is dramatically growing with major involvement of the private sector. The investment policy of Ethiopia is generally established under the principle and practices of a free market driven economy.

Cont...

- The government has enacted a very competitive legal and fiscal regime that attracted many local and foreign mining companies to involve in the mineral operations starting from exploration to mining activities. These laws have been amended so many times to make them more competitive
- The investment in the mining sector is growing from time to time and accordingly revenue generation from this sector is also increasing.

Cont...

- The government of Ethiopia is committed to manage all necessary revenues generated from the mining sector in a transparent and accountable manner.
- These incomes should be published officially and used transparently.
- Therefore, the wealth that can be generated from the mineral and petroleum resources will never be accurse rather a blessing for the development of the country.

Cont...

- Many foreign and some local companies have been granted reconnaissance, exploration and mining licenses for gold and base metals, cement and ceramic raw materials, potash, diatomite, other industrial and construction materials.
- The mineral resources of Ethiopia are yet untouched and so the country has sufficient potential to accommodate the interest of so many other investors.

Soils and topography

- Ethiopia has extremely varied topography. The complex geological history that began long ago and continues, accentuates the unevenness of the surface; a highland complex of mountains and bisected plateaux characterizes the landscape.
- Altitudes range from 126 metres below sea level in the Dalol (Afar) Depression on the northern border, to the highest mountain, Ras Dejen in the Semen Mountains north of Lake Tana rising to 4,620 metres.

Cont...

- The plateau in the northern half of the country is bisected by the East African Rift Valley, which runs more than 600 kilometres north–northeast of the Kenyan border to the Koka Dam on the Awash River south of Addis Ababa.
- The rift valley then descends to the northeast and its lateral escarpments begin to diverge from each other crossing the Afar depression toward the Red Sea coast.

Cont...

- The lowlands, the major grazing land of Ethiopia, form a wide apron surrounding the highland massif and part of the Great Rift Valley.
- This arid, hot zone, with up to 90 growing days per year, is suited mainly to extensive grazing. It includes the lowest elevation in the country at 126 metres below sea level.

Cont...

- The lowlands make up nearly 61 - 65 % of the land-mass, and are the major nomadic pastoralist and agro-pastoralist areas.
- The topographic diversity of the country has resulted in the formation of a multitude of agro-ecological zones and sub zones with varied farming systems.

Major soils of Ethiopia

- 1. Leptosols:** are soils limited in depth by continuous hard rock or highly calcareous material (45%) or a continuous cemented layer within 30cm.
 - it is located in the highlands parts of Ethiopia especially in the semiarid regions (Tigray, North Gonder)

Cont...

2. Nitosols: These are soils with a deep clay enriched B horizon. They show a yellowish or reddish colour and a gradual diffuse horizon boundaries between A and B structure. They also show a polyedric or blocky structure (nitic properties).

- They occur in many areas of the country especially in Gojjam, Sidamo, Gamogofa and have good potential for agriculture. Because the deep uniform profiles that are porous and well drained have a stable angular to sub-angular blocky structure and consequently a deep rooting volume. The clay is mainly kaolinitic.

Cont...

3. Cambisols: These are young soils compared to other tropical soils. The B-horizon of cambisols is an altered horizon with a soil structure at least moderately developed with some clay illuviation, or with a red colour or with some evidence of removal of carbonates.

- However, all these alterations in the B- horizon are not enough to qualify as an argic (clay enriched as in Nitosols), nitric (high sodium content) or toxic.

Cont...

- Many cambisols in the tropics and sub-tropics can be considered as soils in transitional stage of development between very young soils (like Leptosols or regosols) and the older more mature soils like Nitosols, Luvisols). Consequently, cambisols may occur in various regions together with many major soils of the country.

4. Regosols: are very young soils (soil from unconsolidated materials) almost without soil development. They have an A horizon without special characteristic and all other diagnostic horizons are absent; often the soil material is loose

Cont...

5. *Vertisols*: are easily recognized because of their clayey texture (30% of clay and often 50%) dark colours and special physical attributes. They develop cracks when expanding and contracting with changes in moisture content.

- They are found in large flat or gently slopping areas (mainly on volcanic plateaux of central Ethiopia, southern Sidamo, flood plains of the Wabi-shebele basins in western Ethiopia and etc.

Cont...

- Vertisols represent a vast crop production resource (teff, wheat, chickpea, lentils, linseed, noug & bread wheat are generally grown on vertisols. Workability of these soils is hampered by their stickiness when wet & hardness when dry to water logging & soil erosion

Cont...

6. Fluvisols: develop on recent fluvial marine and lacustrine sediments which receive fresh materials at regular intervals. Most soils consist of stratified layers with different textures. The mineralogical composition of the soil material is related to the types of rocks, their weathering products and alterations before transport. Examples should be valleys and deltas, river terraces and depressional areas, coastal areas, etc. these soils have a good potential for agriculture, and the major limitations are related to the flood risk.

Cont...

7. Luvisols: Luvisols are soils with a distinct clay-enriched B horizon, but with a high base saturation (50%). In general, they are showing a reddish or yellowish colour. Most luvisols are good for agriculture, except the ones on steep slopes. The clay enriched B horizon may prevent good root distribution and permeability may be low, as a consequence the erodibility can be high.

Chapter 4

Population Demography

- ***Demography***: The study of human populations, especially with reference to size and density, fertility, mortality, growth, age distribution, migration, and vital statistics and the integration of all these with social and economic conditions of a given people.

Cont...

- Demography, as understood today, is the scientific study of human population and its dynamics. It is derived from two Greek Words:
 - Demos means population
 - Graphics means to draw

Cont...

- Demography focuses its attention on three readily available human phenomena:
 - Changes in population size (growth or decline)
 - The composition of the population and
 - The distribution of population in space.

Cont...

- Demography deals with major “demographic processes” namely *fertility, mortality and migration*.
- These processes are continually at work within a population determining its size, composition and distribution.

Cont...

Sources of demographic data

- Demographic data are important in providing factual basis for decisions on matters of public policy and action concerning social and economic affairs,
- These data can be processed to indicate *present and future requirements of the population* in terms of the types and extent of social needs of the society such as health, education and employment.

Cont...

The major sources of demographic data include:

- ✓ Census
- ✓ Registration of vital events (Records)
- ✓ Sample surveys
- ✓ Ad-hoc Demographic studies

Cont...

Census

- Census is defined as an enumeration or *complete population count at a point in time within a specified geographical area*. A census provides more reliable and accurate data if properly enumerated.

Cont...

- The conducting of censuses has a long history, but modern censuses were first held in the 17th century. By the end of eighteenth and beginning of the nineteenth century many countries had held their first censuses.
- Some countries including Ethiopia have only recently held their first censuses.

Cont...

Old Censuses

Babilonia in about 3800 B.C.

China in about 3000 B.C.

Egypt in about 2500 B.C

Modern Censuses

- Quebec (Canada) in 1666 A.D.
- USA in 1790 A.D
- England and France in 1801 A.D.
- Zaire in 1984 A.D
- Ethiopia in 1984 A.D.

Techniques of Census Taking

There are two techniques of conducting census, dejure and defacto.

a. Dejure

- This technique is the counting of people according to the *permanent place of location or residence*.

Advantages

- ✓ It gives permanent picture of a community
- ✓ It provides more realistic and useful statistics

Cont...

Disadvantages

- ✓ Some persons may be omitted from the count. A household member who is temporarily away from home may be missed from being counted unless the enumerator makes sure that nobody is missing.
- ✓ Some may be counted twice.
- ✓ Information collected regarding persons away from home is often incomplete or incorrect.

Cont...

b. Defacto

- This technique of conducting census refers to *counting persons where they are present at the time of the census period.*

Advantages

- ✓ There is less chance for the omission of persons from the count.

Disadvantages

- ✓ Difficult to obtain information regarding persons in transit. These are persons who are, for example travelling and have left their area of permanent residence but haven't reached the area of destination during the census day.

Cont...

✓ Use of Census

- ✓ It provides correct picture of the population in a community.
- ✓ Vital statistics are usually distorted (in areas with high migration)

A census is useful for:

- ✓ Planning
- ✓ Calculating health indicators and vital indices.

Cont...

Registration of Vital Events (Statistics)

- It is a regular and continuous registration of vital events. Civil registration system, which records births, deaths, marriages etc.
- (vital statistics), enables rates of population growth to be calculated; but are *much less adequate than national censuses*. In developing countries where illiteracy rates are high and communications are poor, the problems of recording births and deaths are immense not only in rural populations but also in urban areas. However, efforts are being made to improve the collection of these data in many countries

Sample Surveys

- A sample survey is another source of demographic data carried out in a scientifically selected area which *covers only a section or portion (sample) of the population under consideration.*
- As countries have begun increasingly to formulate population policies as part of their development programs, especially since 1970; so they have required more data about their populations.

Cont...

- Demographic surveys have become increasingly important as a comparatively rapid method of obtaining such information.
- It was recognized that the quality of demographic data available for the developing world was poor and the need for better data both for scientific study and for policy application is also recognized.

Cont...

- For example, the first ever nationwide population census taken in 1984 in Ethiopia revealed a total population of 42,184,952. However, the population projection based on the two National sample surveys of 1964-71 put the population figure at around 34.6 *million for 1984*.
- Thus the census produced an excess population of about 7.4 million (21 % above the projected figure).

Ad-hoc Demographic studies

Reading Assignment:

❖ What is characteristic & limitation of ***ad-hoc*** method in comparison to others?

Historical perspective of population demography

- Anthropologists believe, that human species dates back at least *3 million years*. For most of our history these distant ancestors lived a precarious existence as ***hunters and gatherers***.
- This way of life kept their total numbers small, probably ***less than 10 million***. However, as agriculture was introduced, communities evolved that could support more people.

Cont...

- World population expanded to about 300 million by A.D. 1 and continued to grow at a moderate rate. But after *the start of the Industrial Revolution in the 18th century*, living standards rose and widespread famines and epidemics diminished in some regions. Population growth accelerated.
- The population climbed to about 760 million in 1750, reached 1 billion around 1800, and 6 billion by the end of the twentieth century.

Cont...

- World population accelerated *after World War II*, when the population of less developed countries began to increase dramatically.
- After millions of years of extremely slow growth, the human population indeed grew explosively, doubling again and again; a billion people were added between 1960 and 1975; another billion were added between 1975 and 1987.

Cont...

- Throughout the 20th century each additional billion has been obtained in a shorter period of time.
- July 11, 1987 was designated as the day on which world population reached 5000 million- 'a day to celebrate', 'a day to contemplate'. October 12 , 1999 was also celebrated in which the population reached 6000 million.

Cont...

- It is estimated that population numbers had grown to 1000 million around 1800, and by 1900 the total was 1,700 million.
- By the end of the 1st half of the 20th century the figure was 2500 mill, and less than 40 years later had reached 5000 million, a huge figure in the context of the history of the world population growth.

Cont...

- By 2000 the number has grown to 6,100 million. Human population entered the 20th century with 1.6 billion people and left the century with ***6.1 billion people***.
- The history of the world population growth can be divided into 2 periods. For most of the time that human beings have inhabited the planet, **population has grown very slowly indeed.**

Cont...

- The pace of growth began to increase from around the beginning of the 18th century, **accelerating to the very rapid rates characteristic of the 2nd half of the 20th century.**
- During the 1960's the rate of growth was 2 % per anum, a rate double that of the 1st half of the 20th century, which in turn was double that of the 19th century.

Demographic variables

- Demographic variables (Population dynamics) is the study of the ***changes in population size and structure over time.***

Major Factors in Population Dynamics

- Three major factors or variables determine the population of a defined area and its growth over time.

There are:

Cont...

- ◆ *Births (Fertility)*
- ◆ *Deaths (Mortality)*
- ◆ *Migration= Immigration (in migration), Emigration (out migration)*
- The balance among these three factors determines whether a population increases, remains stationary, or decreases in number.

Total population increase

- The relation between births and deaths is referred to as ***Natural Population Increase*** (Natural Population Growth).
- When the net effect of migration is added to natural increase, this is referred to as **Total Increase** (Total Growth).
- It is the rate at which a population is increasing (or decreasing) in a given year due to natural increase and net migration expressed as a percentage of the base population.

Cont...

- If we assume that the number of individuals entering a population (immigration), equals the number of leaving (emigration), population growth is the result of the increase of births over deaths.
- This relationship is summarized by a formula known as the balancing equation. It is expressed as:

Cont...

$P_2 = P_1 + (B - D) + (I + E)$ Where:-

- ✓ P_2 = Size of population for the year under consideration
- ✓ P_1 = Size of population in the preceding year
- ✓ B = Number of births between the two dates
- ✓ D = Number of deaths between the two date.
- ✓ I = Number of immigrants in the time under consideration (between P_2 and P_1)
- ✓ E = Number of emigrants in the time under consideration (between P_2 and P_1)

$$\text{Total Growth Rate} = \frac{\text{Natural increase} + \text{Net Migration} \times 100}{\text{Total Population}}$$

Net Migration: is the difference between the numbers of persons entering a geographic area (Immigrants) and those leaving the area (emigrants).

Cont...

Natural and migratory increase

a) Natural increase

- *The differences between births and deaths in a population produces the Natural Increase (or Decrease) of a population.*
- The rate of Natural Population increase is the rate at which a population is increasing (or decreasing) in a given year due to excess (or deficit) of births over deaths expressed as a percentage of the base population.

$$\begin{aligned} \text{RNI} &= \frac{\text{Births} - \text{Deaths}}{\text{Total Population}} \times 100 \\ &\text{OR} \\ &= \frac{\text{Birth Rate} - \text{Death Rate}}{10} \end{aligned}$$

b. Migratory increase

- Migration is the movement of individuals or groups from one place to another which involves permanent or semi-permanent change of usual residence.
- Migration is the most volatile of the basic demographic variables- quickly reflecting changing social, economic and political circumstances; both at the national and international level.

Cont...

- Internal and international migration are essentially geared by the same forces and the majority of migrants in the world to- day are rural dwellers moving to the towns and cities either of their own or another country.
- Most people move for economic reasons, but some migrate to escape political or religious persecution or simply to fulfill a personal dream.

Cont...

- Some people divide the reasons for migration into **Push factors and Pull factors.**
- Push factors include, widespread unemployment lack of farm land, famine or war at home. In the 1980's and 1990's hundreds of thousands of Africans were pushed out of their homelands to neighboring countries because of famine and civil war.

Cont...

- Factors that attract migrants, **pull factors**, include booming economy, favorable immigration laws, or free agricultural land in the area to which the migrant is moving.
- Both types of migration bring with them pressures for receiving areas: in the case of internal migrations, the sheer problems of rapidly growing cities whose infrastructure can barely cope; or social pressures of adjusting to cultural conflicts that can result from international migration.

International Migration

- In general, world patterns of migration are characterized by flows from the poorer, less developed countries to the richer more developed countries, but these flows have changed with the fluctuating economic and social circumstance of particular sending or receiving countries.

Cont...

- The United Nations produced a list of 63 countries for which net migration was not zero for the period 1980-85, the annual net numbers of migrants ranged from - 320,000 in Afghanistan to + 450,000 in the United states , but for 28 of these countries net annual numbers of migrants was small, ranging between + 10, 000

Cont...

- In terms of net migration rates, the traditionally most important receiving countries of the more developed world have given way to the oil rich countries of the Middle East with their booming economies and laborer shortage (the United Arab Emirates, Kuwait, Qatar, Saudi Arabia and Oman).
- Although the United States still heads the list of the most important receiving countries in terms of absolute numbers of immigrants for the period 1980- 85, Saudi Arabia received a large number of people than either Canada or Australia in that period.

Cont...

- Conflict is another potent cause of migration. The second most important receiving country in the period 1980-85 was Pakistan, while the most important sending country was Afghanistan, the country of origin of Pakistan's immigrants, as refugees were driven from their native country by civil conflict.
- The United Kingdom is the only developed country in the list of 12 most important sending countries in terms of absolute numbers for the period 1980-85.

cont...

- Compared with migration rates in the nineteenth and early twentieth century, present- day rates are small and account for a very small proportion of the total increase.
- Between 1840 and 1930's for example, approximately 52 million people left Europe for North America.
- Three types of international migration can be identified in the 1970's and 1980's: permanent migration, temporary labor migration, both legal and illegal, and refugees movements but the motivation of migrants, apart from the refugees, is higher wages.

Cont...

- In general, international migration whether permanent or labor migration has been from the developing to the richer developed countries.
- The four traditional immigration countries of the USA, Canada, Australia and Newzerland have together accepted a total of fewer than one million immigrants a year over recent years.
- Their immigration policies have become increasingly restrictive, giving preference to migrants with assets, education and specific skills

Cont...

- A new area of labor migration emerged in the 1970's as the resource- rich states of the Middle East encouraged migrant workers first from neighboring Arab States and then from Asia .
- At first the movements were relatively unrestricted. But as the receiving countries have become aware of the problems of temporary migrants staying permanently together with the problems of an excessively large foreign community, so there is now much more emphasis on the rotation of workers. Once a contract has ended they must return home.

Cont...

- As the largest importer of foreign workers, Saudi Arabia is also trying to reduce its dependence on foreign workers. Likewise Kuwait had large numbers of foreign workers (29% of the total population), and again there is pressure to reduce dependence on foreign workers.
- In the United Arab Emirates, foreign workers constitute nearly 90% of the active population. Overall, it has been estimated that there were 3 million migrant workers together with one million dependents in the countries of Middle East

Internal Migration

- Internal migration is the means by which the majority of people maximize opportunities, whether economic, social or environmental. Most movement is from areas of decline to areas of growth. Nineteenth century Europe experienced large scale rural to urban migration resulting in the highly urbanized populations of the developed world today.
- The majority of internal migration in the developing world is of rural dwellers moving to towns which as a result are growing rapidly. Urban growth rates are roughly double the national population growth rates in the developing world.

Cont...

- Migration to cities is a manifestation of more fundamental structural change in national economies which are undergoing a transformation from being agrarian to industrial based.
- People are moving from the countryside to the towns for higher income and better jobs. In many parts of Africa, seasonal labor migration is common, with men working in cities or in mines and sending, the money home to their wives and children in the rural areas, as well as within and between urban areas in response to changing economic conditions.

Population structure (composition)

- Aside from the total size, the most important demographic characteristic of a population is its population structure.
- Population structure refers to the composition of the population in terms of ***Age, sex, occupation, religion, educational status, geographical distribution, socio-economic status*** etc. The structure of a population is influenced or affected by *births, deaths and migration* and their predisposing factors.

Cont...

- The age – sex structure determines potential for future growth of specific age groups, as well as the total population. For these reasons the age structure has significant government policy implications.
- A population of young people needs a sufficient number of schools and later, enough jobs to accommodate them. Countries with a large proportion of older people must develop retirement systems and medical facilities to serve them. Therefore, as a population ages needs change from child care schools and jobs to jobs, housing, and medical care.

Population pyramids

- The age–sex structure of a country can be studied through ***population pyramids***. Population pyramids show pictorially (graphically) the effects of the three factors that influence population. ***The overall shape of the pyramid indicates the potential for future growth.***
- ***Population pyramids present the population of an area or country in terms of its composition by age and sex at a point in time.*** The series of horizontal bars in a pyramid represent the percentage contribution of each age and sex groups (often of five years age group interval) in the population.

Cont...

- A glance at a population pyramid can tell a great deal about that population. One can easily see whether a population is young or old. By convention males are shown on the left and females on the right of the pyramid. Young persons at the bottom and the elderly at the top.
- The ratio or percentage of the various age groups in a population determines the current reproductive status of the population and indicate what may be expected in the future.

Cont...

- The shape of the pyramid reflects the major influences on births and deaths, plus any change due to migration over three or four generations proceeding the date of the pyramid.
- The following four representations of population age – sex structure provide an overall example of what a pyramid for different levels of population growth would look like – rapid growth, slow growth, zero growth and negative growth.

a. A pyramid with a Broad Base

- This indicates a high percentage of young population. Rapid population growth. The low survivorship and high natality of human population in many developing countries result in a pyramidal stable age - structure, in which most of the population is young

b. A Bell shaped Polygon:-

- This indicates a moderate proportion of young to old Population. Slow population growth.

c. A Rectangular Polygon:-

- In a more developed countries high survivorship and low natality produce populations with an almost rectangular, stable age structure in which all age groups are equally abundant. Zero population growth.

Cont...

d. An Urn - shaped Figure

- This type of shape indicates a low percentage of young Population, which is characteristic of a declining Population. Negative population growth.

The Ecological Ages: The ecological age include:

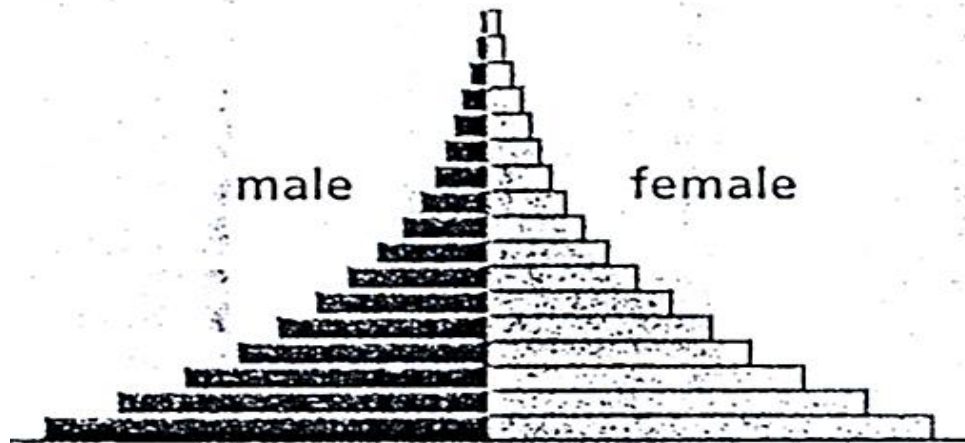
- ◆ Pre - reproductive - Population less than 15 year old
- ◆ Reproductive - Reproductive age groups (15 – 49 years)
- ◆ Post reproductive - Elderly people (> 49 years - females)

A stationary population will have a more even distribution of all age classes.

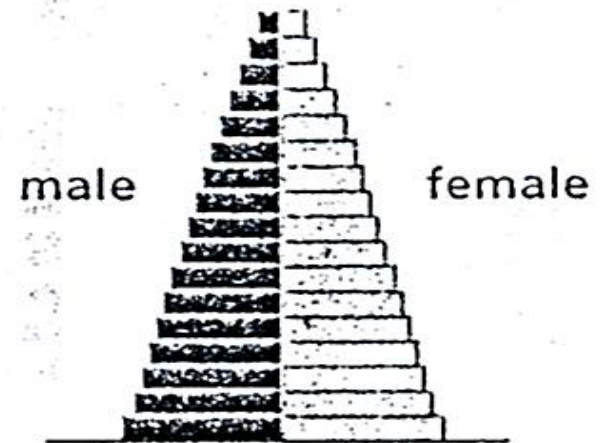
Cont...

- A rapidly expanding population will usually contain large proportion of young individuals.
- A declining population will contain a large proportion of old individuals and a small proportion of young individuals.

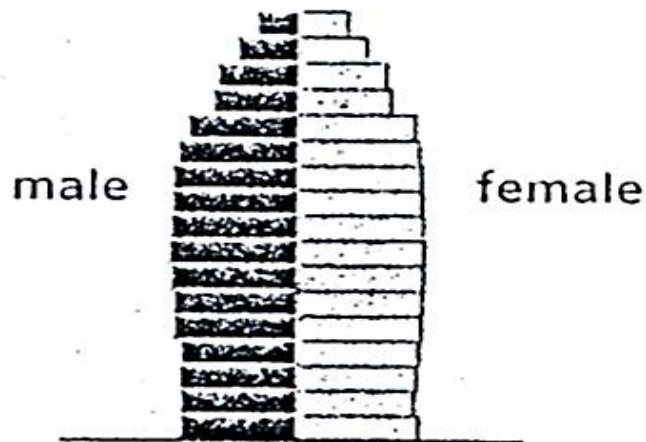
Age- Sex Structure Transition of pyramids



Rapid growth



Slow growth



Zero growth



Negative growth

Demographic transition

- Demographic transition is the historical ***shift of birth and death rates from high to low levels in a population***; a term used to describe the major demographic trends of the past centuries.
- The change in populations basically consists of a shift from an equilibrium condition of high birth and death rates, characteristic of agrarian societies to a newer equilibrium in which both birth and death rates are at much lower level.

Cont...

- The period of transition, at least in Western Europe, was initiated by a drop in death rates that was followed some years later by a fall in birth rates.
- The intermediate period was one of a rapid population growth (population explosion). The period of transition is described by four major stages.

Stage one

- Agrarian civilizations (primitive stage) are characterized by stable or **slowly growing populations** with crude birth rates greater than 45 per 1000 and crude death rates greater than 35 per 1000 births.
- Agricultural existence favours large families. However high birth rates are balanced by high death rates from diseases famine, war etc resulting in ***very low population growth.***

Stage two

- Advances in sanitation and improved availability and quality of food, water, and shelter lead to **fall in death rate and an increase in life expectancy.**
- This has usually occurred without an immediate change in birth rate; however, the improved conditions of life may favour an increase in fertility. During this period, a marked excess of births over deaths developed leading to a **rapid expansion of population.**

Stage three

- Characterized by falling growth Rates.
- After a time, birth rates tend to fall, largely as a reflection of industrialization and consequent urbanization. With industrialization people tend to migrate from rural to urban areas. Urban living not only breaks the traditional patterns but also ***creates incentives for having small families***. Living quarters are cramped, children being a financial liability rather than asset. There is a greater need for cash, since food and clothing can no longer be produced at home.

Cont...

- For these reasons husbands and wives are impelled to seek work outside the home for wages. There is a greater geographic proximity to health care service and to the availability of information and service for disease and family planning.
- These various factors increase the likelihood that contraceptive practices will be adopted. In some places abortion has been included in the measures available for the control of fertility.

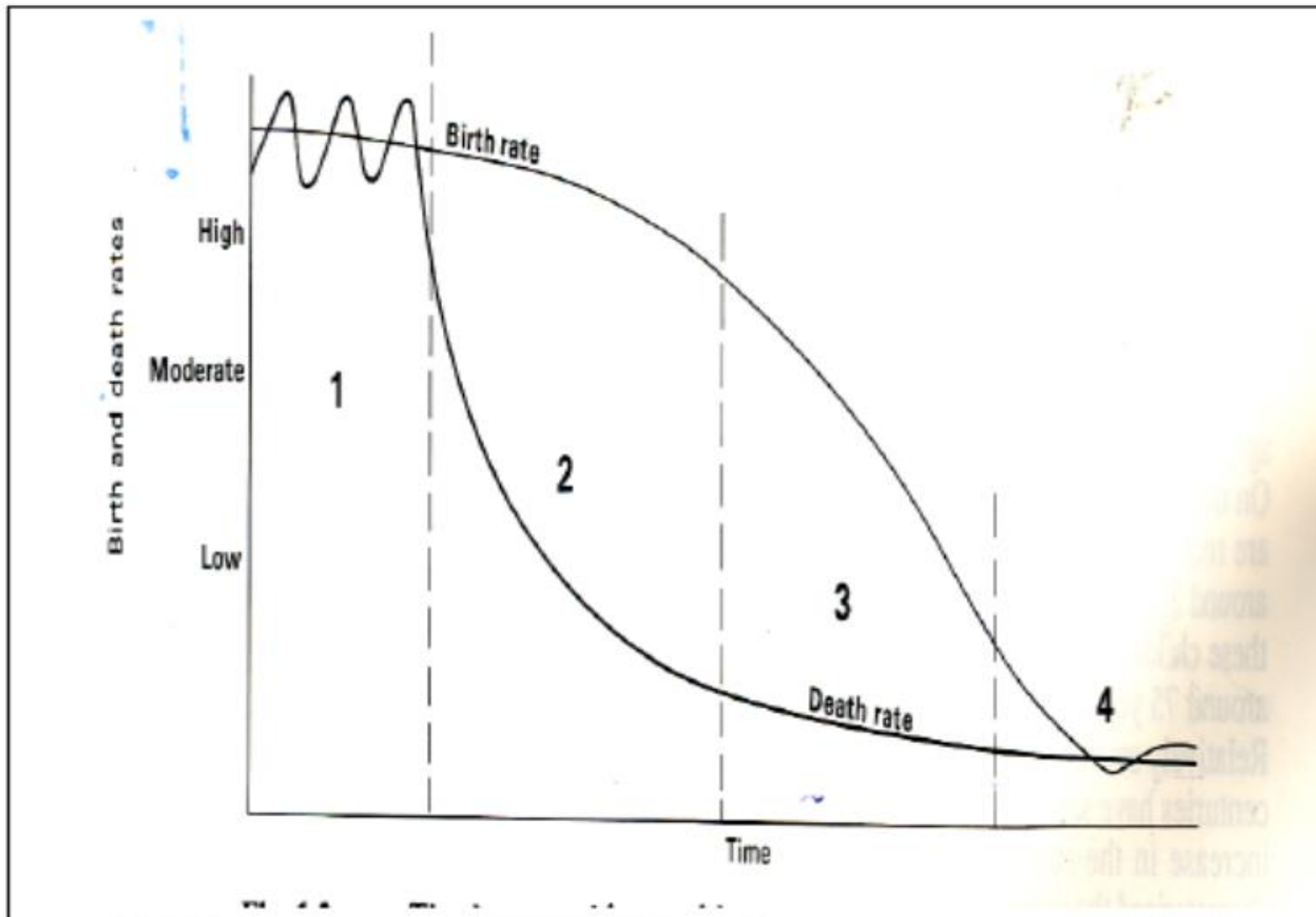
Cont...

- This stage is a situation in which birth rates and death rates are again essentially in balance, but at a lower level as compared with those of the primitive first stage, when both crude birth rate and crude death rate are in the vicinity of less than 20 per 1000 and 10 per thousand respectively

Stage four

- This stage is reached in highly developed societies when both birth and death rates are low and population growth rates are zero or even negative.

Fig: The Demographic Transition Model



Chapter 5

Theory of population growth and the environment

Outline of the topic

- Population growth as an issues
- Poverty and population growth
- Population and economic growth
- Economic development
- Basic concept of development
- Sustainable development
- Challenges to sustainable development
- Population, environment and development; the link

Population growth as an issue

- Research has shown that *changes in population growth*, age structure, and spatial distribution interact closely with the environment and development.
- *Rapid population growth* has exacerbated freshwater depletion, climate change, and biodiversity loss, depletion of fisheries and other coastal resources, and degradation of agricultural lands.

Cont...

- Fertility decline in high-fertility countries, by slowing population growth, can make many environmental problems easier to solve.
- It can also have important economic benefits by *reducing the number of children relative to the working-age population*, and creating a unique opportunity to increase investments in health, education, infrastructure, and environmental protection.

Cont...

- In high-income countries, the environmental impact of population growth and distribution must be considered jointly with *high consumption rates*.
- Even in countries where little growth is envisioned, unsustainable patterns of consumption have global implications for the environment and human well-being, and must be addressed with appropriate policies.
- After certain decades, the majority of the world's population will live in urban areas.

Cont...

- Urbanization can improve people's access to education, health, and other services.
- But it also *creates environmental health hazards, such as water and air pollution, and by increasing consumption levels, can have environmental impacts in distant rural areas as well.*

Policy Must Account for Differential Vulnerability within Populations

- Deteriorating environmental conditions and extreme events do not affect all countries populations or households in the same way.
- Even within a household, the effects may differ by age and gender. **Consideration of vulnerability** must therefore focus not only on countries but also on the most vulnerable segments of the population within countries.

Cont...

- Many factors contribute to vulnerability, including *poverty, poor health, low levels of education, gender inequality, and lack of access to resources and services, and unfavorable geographic location.*
- Populations that are socially disadvantaged or lack political voice are also at greater risk.
- Particularly vulnerable populations include the poorest, least empowered segments, especially women and children.

Cont...

- *Vulnerable populations have limited capacity to protect themselves from current and future environmental hazards, such as polluted air and water and catastrophes, and the adverse consequences of large-scale environmental change, such as land degradation, biodiversity loss, and climate change.*
- Vulnerability can be reduced by promoting empowerment, investing in human resources, and fostering participation in public affairs and decision-making.

5.2. ***Framing the debate***

5.2.1. *Malthusian theory*

- Thomas Robert Malthus (1766-1834) was the key figure to analyze the population statistics. His formulation on population was a landmark in the history of population theories.
- He generalized the relationship between population factors and social change.

Cont...

- In his Essay on the Principle of Population (1798) Malthus argued that because of the strong attraction of the two sexes, the population could increase by multiples, doubling every twenty-five years.
- He contended that the population would eventually grow so large that food production would be insufficient.
- Human capacity for **reproduction exceeded the rate at which subsistence from the land can be increased.**

Cont...

- *Malthus further wrote 'Population when unchecked increases in a geometrical ratio, Subsistence increases only in an arithmetical ratio.'*
- Malthus contended that *the world's population was growing more rapidly than the available food supply.*
- He argued that the food supply increases in an arithmetic progression (1, 2, 3, 4, and so on), whereas the population expands by a geometric progression (1, 2, 4, 8, and so on).

In brief, Malthus theory states that:

1. Population is necessarily limited by the means of subsistence.
2. Population invariably increases where means of subsistence increased, unless prevented by some very powerful and obvious checks.
3. These checks, which repress the superior power of population and keep its effects on a level with the means of subsistence, are all resolvable into moral restraint, vice and misery.

5.2.2 Boserup's theory

- Ester Boserup (May 18, 1910 – September 24, 1999), was a Danish economist. She studied economic and agricultural development, worked at the United Nations as well as other international organizations, and she wrote several books.
- Her most notable book is ***The Conditions of Agricultural Growth***: The Economics of Agrarian Change under Population Pressure.

Cont...

- This "classic ...work on agricultural intensification" presents a "dynamic analysis embracing all types of primitive agriculture."
- The work challenges the assumption dating back to Malthus's time (and still held in many quarters) that *agricultural methods determine population (via food supply)*. Instead, Boserup argued that *population determines agricultural methods*. A major point of her book is that "necessity is the mother of invention".

Cont...

- It was her great belief that humanity would always find a way and was quoted in saying "The power of ingenuity would always outmatch that of demand".
- She also influenced the debate on the women in workforce and human development, and the possibility of better opportunities of work and education for women.
- According to Malthusian theory, the size and growth of the population depends on the food supply and agricultural methods. In Boserup's theory agricultural methods depend on the size of the population.

Cont...

- In the Malthusian view, in times when food is not sufficient for everyone, the excess population will die. However, Boserup argued that in those times of pressure, people will find ways to increase the production of food by increasing workforce, machinery, fertilizers.
- Although Boserup is widely regarded as anti-Malthusian, both her insights and those of Malthus can be comfortably combined within the same general theoretical framework.

Cont...

- She argued that when population density is low enough to allow it, land tends to be used intermittently, with heavy reliance on fire to clear fields and fallowing to restore fertility (often called slash and burn farming).
- Numerous studies have shown such methods to be favorable in total workload and also efficiency (output versus input).

Cont...

- In Boserup's theory, it is only when rising population density curtails the use of fallowing (and therefore the use of fire) that fields are moved towards annual cultivation.
- Contending with insufficiently fallowed, less fertile plots, covered with grass or bushes rather than forest, mandates expanded efforts at fertilizing, field preparation, weed control, and irrigation.

Cont...

- These changes often induce agricultural innovation, but increase marginal labor cost to the farmer as well: the higher the rural population density, the more hours the farmer must work for the same amount of produce. Therefore, workloads tend to rise while efficiency drops.
- This process of raising production at the cost of more work at lower efficiency is what Boserup describes as "agricultural intensification".

5.3. Poverty and population growth

- Access to adequate food depends on one's ability to buy it or produce it. The former situation depends on income while the later depends on land availability, its fertility, climate, productive labor and tools of labor.
- When both natural and human factors are of good quality, food is produced in large quantities and food security is ensured. When both are of poor quality, little food is produced and food insecurity sets in.
- In such a situation households suffer from food poverty. Therefore both the natural resources and human resources need good care if food security is to be sustained.

5.3.1. Poverty

- Food poverty here refers to household-level hunger. Hunger is similar to undernourishment resulting from food shortage existing mainly in poor countries.
- Households in food poverty do not have enough food to meet the energy and nutrient needs of all of their members,
- Depending on patterns of intra-household distribution, at least one member of a food poor household is always hungry but, potentially, all members are,

Cont...

- World-wide around 852 million people are chronically hungry due to extreme poverty, while up to 2 billion people lack food security intermittently due to varying degrees of poverty.
- Ensuring food security presupposes elimination of vulnerability to hunger; a term which means the same as under nourishment. It is related to poverty, a phenomenon existing mainly in poor countries.

5.3.2 Poverty versus population growth

- The environment-poverty link encompasses a variety of social and political as well as economic factors that obstruct the achievement of the Millennium Development Goals(MDGs).
- The nexus is also freighted by a number of myths that implicitly discriminate against the poor and threaten environmental sustainability, one of their major resources in today's world.

Cont...

- The environment-poverty nexus is a two-way relationship. Environment affects poverty situations in three distinct dimensions:
 - ✓ *by providing sources of livelihoods to poor people,*
 - ✓ *by affecting their health and*
 - ✓ *by influencing their vulnerability to environment destruction.*

cont...

On the other hand, poverty also affects environment in various ways:

- ✓ *by forcing poor people to degrade environment,*
- ✓ *by encouraging countries to promote economic growth at the expense of environment, and*
- ✓ *by inducing societies to downgrade environmental concerns, including failing to channel resources to address such concerns.*

5.3.2. Causes of Poverty

- some households live under conditions of chronic or seasonal food poverty. Other households are pushed into food poverty because of changes in area food availability and/or in their own ability to secure entitlement to food,
- Food availability in a region is one of the key determinants of the existence and extent of food poverty.
- In food-short regions, at least some households are food poor. But widespread food poverty persists in the absence of shortage, and many households escape food poverty despite severe food shortage depending on their capacity to access food where it is available.

Cont..

➤ *Rapid population Growth and Environmental Degradation*

- It is generally agreed that population growth, environmental degradation and inequitable distribution of resources are linked to a vicious cycle that ultimately results in food shortages and human suffering.
- Where population outstrips food supplies and leads to environmental degradation that lowers the carrying capacity of the environment and agricultural systems. Food shortage culminates into food insecurity.

Cont...

➤ Declining Allocations of Public Expenditure to Agriculture

- The World Bank, 2005: 94) observes that in Africa, agriculture's share in public spending fell even when its share in economic production rose, mainly because farmers and consumers had limited political influence and because more emphasis was placed on education, health, social security and defense.

Cont...

- This bias against expenditure for agriculture in Africa, raises a major concern because that has taken place before countries had invested sufficiently in Research and Development and rural infrastructure to influence growth.
- That has affected agricultural reduction as in some instances agricultural institutions were closed, extension workers underwent redundancy, subsidies on fertilizer and pesticides were removed.

Cont...

➤ Climate Change and Natural Resource Degradation

- Widespread environmental change is altering agricultural potential worldwide. Crop failures and death of livestock due to droughts have led to famine, and human starvation to death.
- This has been more pronounced in semi-arid areas of Africa, such as Northern Uganda and Kenya, central and northern Tanzania, Northern Sudan, Ethiopia and Chad.

Cont...

➤ Changes in Food Demand

- Tony Quizon comments that one consequence of the rush of Asian countries to integrate into the global economy is a drastic reorientation of agricultural priorities as basic food crops are phased out to devote lands to higher-value export products.
- The consequences are ominous: endangered food security, a degraded environment, uprooted rural communities, and greater dependence of the poor on the market for their survival.

Cont...

➤ **Social displacement**

- People driven across international borders as a result of war or civil strife (refugees) often leave behind possessions, sources of income, and social ties. Abrupt social displacement removes most customary sources of entitlement to food and for many households, charitable distributions are the only buffers between them and starvation.
- In order to achieve sustained food security, causes of civil strife should be addressed.

Combating Food Poverty

- Eradicating hunger and poverty requires an understanding of the ways in which these two injustices interconnect. Hunger, and the malnourishment that accompanies it, prevents poor people from escaping poverty.
- This is because it diminishes their ability to learn, work, and care for themselves and their family members. Malnourishment also leads to poor health hence individuals fail to provide for their families.

Cont...

- Allocate a Big Share of Public Expenditure to the Agricultural Sector
- Promote Private Investment and Market Development
- Investments in Agricultural Research, Education and Rural Infrastructure
- Access to Land
- Employment
- Prices and Wages
- Government Safety Nets

5.4 Population and economic growth

- Economic growth typically refers to an increase in the level of goods and services produced by an economy, as estimated by measures such as Gross Domestic Product (GDP). Whilst GDP and other similar measures reflect the value of goods and services provided through the market, they exclude many others that are not provided through the market but that nevertheless contribute to overall welfare. For example, voluntary and unpaid activities or work within the home, and many services provided by the natural environment in facilitating economic activity. As a result, GDP does not reflect many of the factors that affect the society's wellbeing.

5.5 Economic development

- Human wellbeing is a complex and diverse concept, determined by a wide-range of factors including levels of income (absolute and relative), health status, educational attainment, housing conditions and environmental quality.
- It has sometimes been characterized in terms of self-reported or subjective happiness. Many studies have found that increases in GDP in high-income countries do not result in subsequent increases in levels of happiness.

Cont...

- The economic development has impact on environment in addition to economic and social issues; redevelopment has environmental impacts that affect the quality of life.
- These impacts include water quality and sewer issues, air quality and transportation issues, soil conservation and hillsides, noise pollution and the effect of barriers to protect houses from the noise, solid waste disposal, and loss of scenic resources, wildlife habitat, trees, and agricultural resources.

Cont...

- The impact of development on water, sewer and storm sewer systems is great. Clean water is essential for life, and is often taken for granted. Threatened by agricultural runoff and industrial discharges, water supply must be protected for people and wildlife.
- Worldwide, agriculture consumes 73% of off-stream fresh water, followed by industry at 21 % and residential at 6%. Development also increases the demand on the already overburdened sewer and storm sewer systems.

Cont...

- Air pollution affects the health of many residents. It comes from burning gasoline in our cars, from igniting coal and oil, from burning trash, medical and other hazardous materials, and from factories.
- Transportation is the fastest growing source of global air pollution with millions of new cars on the road each year. This is created in large part by the expansion and development in the outlying areas.

Cont...

- Some take the view that the finite resources of the Earth place limits on the extent to which economies can keep expanding in the long-term¹. Others believe that using environmental resources sustainably is consistent with continued economic growth, with the costs of inaction likely to be far greater than the cost of acting now.
- The ecosystems services framework provided by the Millennium Ecosystem Assessment (2005) suggests that the assets and services provided by the natural environment can be aggregated into four broad categories:

Cont...

- **Provisioning services** - products obtained from ecosystems, including fresh water, food, fibre¹, genetic resources, bio-chemicals, natural medicines and pharmaceuticals.
- **Regulating services** – benefits obtained from the regulation of natural processes, including air quality, climate, water/flood, erosion, water purification, disease and pest control, pollination, buffering pollution.

Cont...

- **Cultural services** – non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic enjoyment.
- **Supporting services**- that are necessary for the production of all other ecosystem services, including soil formation, photosynthesis, primary production, nutrient cycling and water cycling.
- Natural capital contributes to economic output through two main channels:
 - ✓ Directly as an input to the process of economic activity; and
 - ✓ Indirectly through its effect on the productivity of the other factors of production.

5.5.1 Basic concept of development

- Development means making a better life for everyone. In the present context of a highly uneven world, a better life for most people means, essentially, meeting basic needs: sufficient food to maintain good health; a safe, healthy place in which to live; affordable services available to everyone; and being treated with dignity and respect.

Cont...

- Beyond meeting these needs, basic to human survival, the course taken by development is subject to the material and cultural visions of different societies. The methods and purposes of development are subject to popular, democratic decision making.
- Development is a founding belief of modernity. And modernity is that time in Western history when rationality supposed it could change the world for the better.

Cont...

- In development, all the modern advances in science and technology, in democracy and social organization, in rationalized ethics and values, fuse into the single humanitarian project of deliberately and cooperatively producing a far better world for all.
- In this modernist tradition, the radical version of “development” is fundamentally different from the more conventional “economic growth.”

Cont...

- Economic growth means achieving a more massive economy producing more goods and services on the one side of the national account (Gross Domestic Product—GDP)—and a larger total income on the other (Gross National Income—GNI).

Cont...

- But economic growth can occur without touching problems like inequality or poverty when all the increase goes to a few people. Indeed, growth has occurred in most Western countries over the past 30 years at the same time that income inequality has widened.
- In this case, economic growth functions, in the most basic sense, to channel money and power to the already rich and famous. This is fine if you are rich and even better if you are famous.

Measuring 'development'

- ✓ How can development of a country be measured?
- ✓ How do we compare the development of a country with that of another?
- It is possible only on the basis of certain criteria. The indicators used for evaluating the development are called 'development indices'. When the approach to development gets changed, new indices will also be developed to measure development. The important development indices are the following:

Cont...

A) GDP and GNP

- **Gross Domestic Product (GDP)** This measures the value of all goods and services produced within a particular country. It does not matter whether the individuals or companies profiting from this production are national or foreign.
- **Gross National Product (GNP)** This measures the value of all goods and services claimed by residents of a particular country regardless of where the production took place.

Cont...

- It is, therefore, GDP plus the income accruing from abroad (such as repatriation of profits) minus the income claimed by people overseas.
- **Gross National Income (GNI)** This is an alternative name for GNP. The World Bank now refers to GNI rather than GNP in its annual World Development Report. The GNP per capita indicator is still widely used, but this has increasingly been used in conjunction with other broader indicators of 'development' which have highlights non-economic dimensions of the concept.

B) Human Development Index (HDI)

- The United Nations' Human Development Index is an annual compilation that endeavors to “capture as many aspects of human development as possible in one simple, composite index”.
- The Human Development Index is composed of four indicators in three sub-indices, **Life Expectancy**, **Education**, and **Gross Domestic Product (GDP)**, which are averaged to arrive at the Human Development Index score.

Cont...

Each indicator value is computed according to the general formula:

$$\text{Indicator value} = \frac{(\text{country value} - \text{min. value})}{(\text{max. value} - \text{min. value})}$$

Computing the Human Development Index

- The HDI is based on three indicators: **longevity**, as measured by life expectancy at birth; **educational attainment**, as measured by a combination of adult literacy (two-thirds weight) and combined primary, secondary and tertiary enrolment ratios (one-third weight); and standard of living as measured by real GDP per capita (PPP\$).

5.5.2 Sustainable development

- Human beings live in both natural and social world. Our technological development has strong impacts on the natural as well as the social components.
- When we talk of development, it cannot be perceived as Development only for a privileged few who would have a high standard of living and would derive all the benefits.

Cont...

- Development also does not mean an increase in the GNP (Gross National Product) of a few affluent nations.
- Development has to be visualized in a holistic manner, where it brings benefits to all not only for the present generation, but also for the future generations.
- Sustainable development is “Our Common Future”.

Cont...

- If you want to test whether or not a proposal will achieve the goals of sustainability just try to find out the following:
 - Does it protect our biodiversity?
 - Does it prevent soil erosion?
 - Does it slow down population growth?
 - Does it increase forest cover?
 - Does it cut off the emissions of CFC, SO₂, NO₂ and CO₂?
 - Does it reduce waste generation and does it bring benefits to all?

Aspects of sustainable development

a) Inter-generational equity:

- This emphasizes that we should minimize any adverse impacts on resources and environment for future generations i.e. we should hand over a safe, healthy and resourceful environment to our future generations.
- This can be possible only if we stop over-exploitation of resources, reduce waste discharge and emissions and maintain ecological balance.

Cont...

b) Intra-generational equity:

- This emphasizes that the development processes should seek to minimize the wealth gaps within and between nations.
- The Human Development Report of United Nations (2001) emphasizes that the benefits of technology should seek to achieve the goals of intra generational equity.

Cont...

- The technology should address the problems of the developing countries, producing drought tolerant varieties for uncertain climates, vaccines for infectious diseases, clean fuels for domestic and industrial use.
- This type of technological development will support the economic growth of the poor countries and help in narrowing the wealth gap and lead to sustainability.

Measures for Sustainable Development

- (i) Using appropriate technology:** is one which is locally adaptable, eco-friendly, resource efficient and culturally suitable. It mostly involves local resources and local Labour.
- Indigenous technologies are more useful, cost-effective and sustainable. Nature is often taken as a model, using the natural conditions of that region as its components.
 - This concept is known as design with nature. The technology should use less of resources and should produce minimum waste.

Cont...

(ii) Reduce, Reuse, and Recycle approach:

- The 3-R approach advocating minimization of resource use, using them again and again instead of passing it on to the waste stream and recycling the materials goes a long way in achieving the goals of sustainability.
- It reduces pressure on our resources as well as reduces waste generation and pollution.

Cont...

(iii) Promoting environmental education and awareness:

- Making environmental education the center of all learning process will greatly help in changing the thinking pattern and attitude of people towards our earth and the environment.
- Introducing subject right from the school stage will inculcate a feeling of belongingness to earth in small children. 'Earth thinking' will gradually get incorporated in our thinking and action which will greatly help in transforming our lifestyles to sustainable ones.

Cont...

(iv)Resource utilization as per carrying capacity:

- Any system can sustain a limited number of organisms on a long-term basis which is known as its carrying capacity.
- In case of human beings, the carrying capacity concept becomes all the more complex. It is because unlike other animals, human beings, not only need food to live, but need so many other things to maintain the quality of life.

Cont...

- Sustainability of a system depends largely upon the carrying capacity of the system. If the carrying capacity of a system is crossed (say, by over exploitation of a resource), environmental degradation starts and continues till it reaches a point of no return.

Carrying capacity has two basic components:

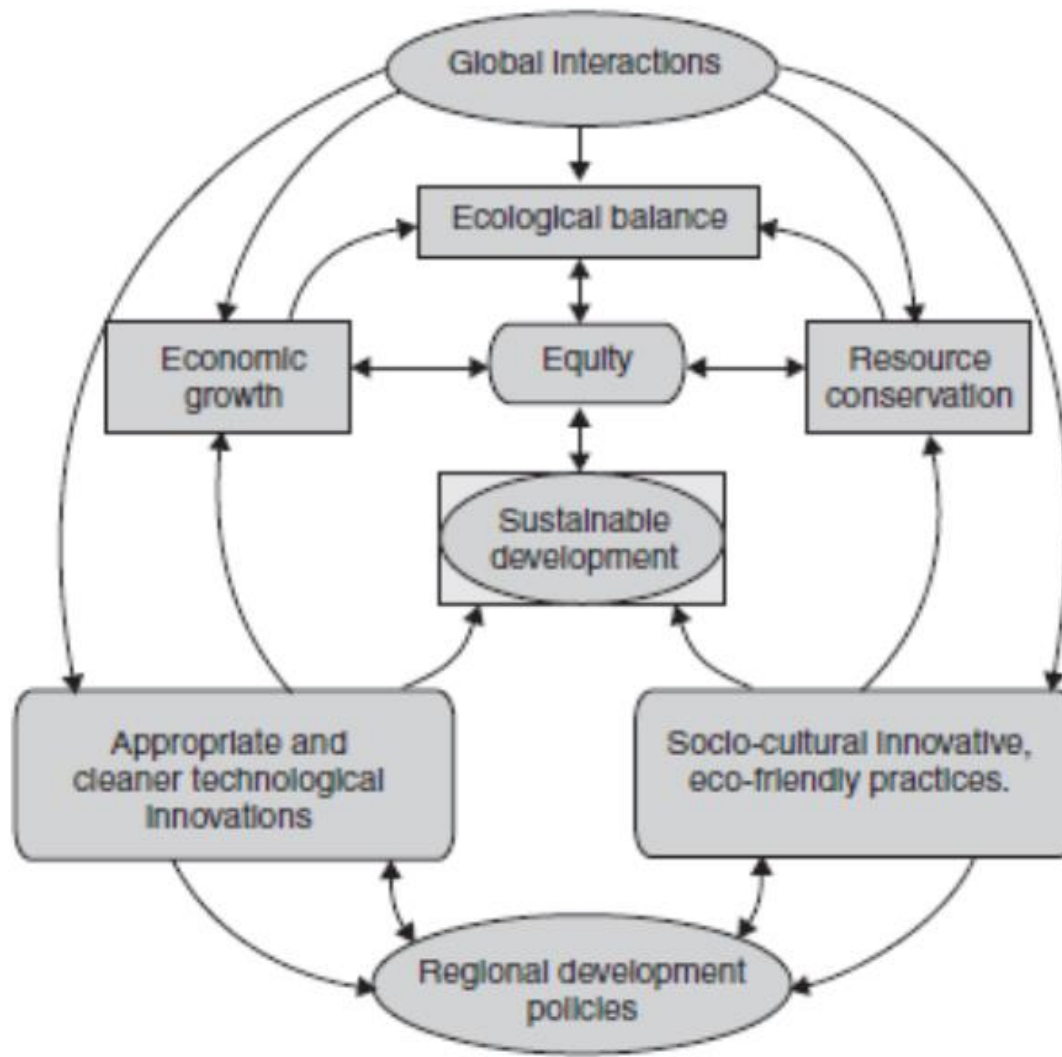
- ❑ **Supporting capacity** i.e. the capacity to regenerate
- ❑ **Assimilative capacity** i.e. the capacity to tolerate different stresses.

Cont...

(v)Improving quality of life(social, cultural and economic) dimensions:

- Development should not focus just on one section of already affluent people. Rather it should include sharing of benefits between the rich and the poor. The tribal, ethnic people and their cultural heritage should also be conserved.
- Strong community participation should be therein policy and practice. Population growth should be stabilized.

Fig 5.2 Multi- Dimensional Model for Sustainable Development



Cont...

Besides to these, sustainable development includes the following as principles

- ✓ Forest destruction cannot exceed forest regeneration
- ✓ Pollutants cannot exceed the repository capacity of the system
- ✓ Soil erosion cannot exceeds its conservation
- ✓ Life destruction cannot exceeds its evolution

5.5.3 Challenges to sustainable development

- sustainable development has emerged as a new paradigm of development, integrating economic growth, social development and environmental protection.
- But the problems challenging the sustainable development are global -- population, poverty, food shortage, freshwater, health, climate change and energy ---and no countries can confront these challenges alone.

5.5.3 .1.Environmental challenge to sustainable development

A. Climate Change: Global temperatures have risen by 0.74°C over the last century, the largest and fastest warming in the history of the Earth detected by scientists.

- The trend is accelerating and has affected all continents and most oceans. Temperatures could rise by 3°C over pre-industrial levels by the end of the century.

Cont...

- Global warming follows emissions with a long time lag. The world will experience further climate change even if emissions stopped today, albeit to a much lesser extent than otherwise.
- Adaptation to climate change in an effort to reduce its negative impacts is therefore inevitable.

Cont...

- Most impacts in the short to medium term will come from increased variability of weather and more frequent and extreme events like storms, droughts, floods and heat waves.
- Although developing countries have historically contributed least to emissions causing climate change, they stand to suffer most because many are vulnerable and least able to adapt to extreme environmental events.

Cont...

- Scientists suggest that in order to avoid dangerous, possibly irreversible and self-reinforcing climate change, atmospheric concentrations of GHG should not exceed the equivalent of 450 parts per million (ppm) CO₂.
- This would result in a warming of 2⁰C on average. Stabilization scenarios show that a 450 ppm maximum requires global emissions to peak over the next 10-20 years

Cont..

- Making economic growth and development compatible with stabilizing the climate calls for ‘low carbon economies’ worldwide.
- A reduction of emissions by half compared to trend would take cuts of the order of 60-80 per cent in industrialized countries and still need 30 per cent lower levels in developing countries
- New technologies will be needed, including carbon capture and storage, together with additional development assistance to the Least Developed Countries in particular

Cont...

B. Natural Resources Degradation

- Demand for food has grown significantly, not least through the change of consumption patterns towards more protein-rich diets as incomes rise in fast growing and large developing countries such as China and India.
- Food security is a major international concern and some countries have taken measures to try to prevent shortages

Cont...

- For a number of commodities, the best quality and lowest cost resources are already near to being fully exploited. World petroleum production for example may have already peaked. Raw material scarcity and prices are likely to trigger adjustments in production patterns and processes.
- **Recycling and reuse** can be expected to become increasingly competitive relative to primary raw materials.

Cont...

- A full examination of the implications of current natural resource constraints is beyond the scope of this note, however, they may be a harbinger of increased pressure on global natural resources and thus the need to shift to an economic model that values resource productivity much more highly.
- As with climate change, the implications for production and consumption, and thus employment, patterns are significant

5.5.3 .2.Demographic Challenges for Sustainable Development

- Human beings are at the center of concern for sustainable development. This was the view expressed in the 1992 Rio Declaration on Environment and Development, which we reaffirm.
- Therefore, consideration of the changing numbers, characteristics, and distributions of human beings on the planet must be at the core of any serious analysis of challenges and opportunities for sustainable development.

Cont...

- Any analysis of sustainable development must recognize the differences among people in terms of their impacts on the environment and their vulnerabilities to risk, which depend on their age, gender, location, and other socioeconomic characteristics

Cont...

- New evidence indicates that human capital, enhanced through education and health (including reproductive health), can make a substantial difference in people's contributions to sustainable development and their capacity to adapt to environmental change.
- Only by accounting for and addressing demographic factors will it be possible to achieve sustainable development. Investments in human capital should be emphasized alongside other measures to promote sustainable development, green economy and adaptation to environmental change.

The Current Demographic Divide

- Over the last half century, world population has more than doubled from 3 billion in 1960 to 7 billion today. Because of the young age structure in low and middle income countries to continuing population growth in the coming decades is a virtual certainty, even in the unlikely event that birth rates fall precipitously in these countries.
- Consequently, the world's population will very likely be between 8 and 11 billion by 2050, depending primarily on the speed of future fertility decline. But this population growth will not occur evenly across the globe. Indeed; traditional demographic groupings have broken down. ²⁷⁸

Cont...

- Nearly all of the world's population growth will occur in the cities and towns of today's poor countries, primarily because of **rural-to-urban migration combined with high national population growth**. Meanwhile, the populations of many low-fertility countries will be declining.
- The demographic divide between rapidly growing urban populations in poor countries and slow growth or decline in industrialized countries is historically unprecedented.

Cont...

- These demographic differences fundamentally affect people's contribution to environmental burdens, their ability to participate in sustainable development, and their adaptability to a changing environment.
- Different demographic challenges require differentiated responses. The developmental challenges are by far the most significant where population growth and poverty are the highest, education is the lowest, and vulnerabilities to environmental change are the greatest.
- Negative impacts on the environment tend to be the most significant where people's material consumption levels are at their highest.

5.6 Population, environment and development; the link

➤ 5.6.1 Down word spiral hypothesis

- The hypothesis maintains that poor people and environmental damage are often caught in a downward spiral.
- Past resource degradation deepens/expands today's poverty, while today's poverty makes it very difficult to care for or restore the agricultural base, to find alternatives to deforestation to prevent desertification, to control erosion and to replenish soil nutrients.

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- People in poverty are forced to deplete resources to survive, and this degradation of environment further impoverishes people.
- Environmental degradation can sometimes be associated with poverty, but there is not necessarily a direct causal relationship. Other factors also shape human behavior to the environment.
- The danger of the “Downward Spiral Hypothesis” is that it may often lead to policies that either reduce poverty (often in the short run) at the expense of the environment or protect the environment at the expense of poor people.

5.6.2 The Kuznets curve

- The Environmental Kuznets Curve (EKC) is often used to describe the relationship between **economic growth and environmental quality**.
- It refers to the hypothesis of an inverted U-shaped relationship between economic output per capita and some measures of environmental quality.

Cont...

- The shape of the curve can be explained as follows:

As GDP per capita rises, so does environmental degradation. However, beyond a certain point, increases in GDP per capita lead to reductions in environmental damage.

Specifically:

- ❖ At low incomes, pollution abatement is undesirable as individuals are better off using their limited income to meet their basic consumption needs;
- ❖ Once a certain level of income is achieved, individuals begin considering the trade-off between environmental quality and consumption, and environmental damage increases at a lower rate; and
- ❖ After a certain point, spending on abatement dominates as individuals prefer improvements in environmental quality over further consumption, and environmental quality begins to improve alongside economic growth.

5.6.3 Beckerman hypothesis

- The hypothesis maintains that as growth provides accumulated assets that can be used to ameliorate environmental degradation, it makes sense to degrade now and pay later to put things right.
- There are three major problems with this hypothesis: The first one is that economic growth can generate accumulated assets, but there is no guarantee that a part of such resources would be used to ameliorate environmental degradation.

Cont...

- resources, as experience has shown, might have been used for other purposes, sometimes for unproductive ones.
- Second, like the Environmental Kuznets Curve, the Beckerman Hypothesis also seems to undermine the need for conscious policy interventions.
- It indirectly implies that growth would provide accumulated assets that would take care of environmental degradation.
- Third, it takes a simplistic approach towards the intergenerational equity issue.

Cont...

- It basically says that there will be physical degradation at present, but that monetary compensation will be made in future, without answering how this would provide the same sort of opportunities as those enjoyed by the present generation or how compensation would be translated into physical natural resources or how the amount and the nature of future compensation are agreed upon.

5.6.4 Porter hypothesis

- According to the Porter hypothesis, strict environmental regulations can induce efficiency and encourage innovations that help improve commercial competitiveness. The hypothesis was formulated by the economist Michael Porter in an article in 1995.
- The hypothesis suggests that strict environmental regulation triggers the discovery and introduction of cleaner technologies and environmental improvements, the innovation effect, making production processes and products more efficient.

Cont...

- The cost savings that can be achieved are sufficient to overcompensate for both the compliance costs directly attributed to new regulations and the innovation costs.
- Porter argues that high levels of environmental protection are compatible with high levels of economic growth and may encourage innovation that supports growth.

Cont...

- The hypothesis makes two fundamental points. First, environmental protection is justified not only for pure environmental reasons, but because such protection makes economic sense as well.
- Environmental protection by ensuring minimizing waste of resources, by enhancing efficiency in resource use and by minimizing adverse environmental externalities of the production process, may contribute positively to economic growth.

Cont...

- Second, if people see the economic value of environmental protection, initiatives may be undertaken for innovations in technology, input-mix, and management to increase resource-use efficiency and also to minimize resource waste and the adverse environmental impact of production. All these enhance economic growth further

GROUP ASSIGNMENT 20%-*Already done/submitted*

Chapter six: Human activities and Environmental change

6.1 Why the environment change (*group 4*)

6.2 Impact of environmental change (*group 2*)

6.3 Consequences of human induced environmental change (*group 7*)

6.4 Land degradation and food insecurity (*group 1*)

6.5 Relationships between environment and poverty (*group5*)

6.6 Environment-poverty-environment nexus (*group 3*)

6.7 Environment-poverty myths (*group 6*)

NB

- Make group of five individuals and do the above accordingly.
- the topic should be covered/discussed well
- Maximum page: no limit
- Presenters may be selected randomly in each group
- Maximum point=20%(10% documentation+10% presentation-time based)
- Date of submission & presentation 30/07/2012, **punctuality has its own value!**