

**CLASSROOM LESSON
MATERIAL FOR THE COURSE**

**Environment and Sustainable
Development**

Course Code: GeES 3111

Targeted Groups: Third Year Geography
& Environmental
Studies Students

Compiled by: _____

Academic Year: 2020

Chapter One

Basic concepts in Environment and Development

1.1 Environment: Definition and function

The term '*environment*' is derived from the French word 'environner', which means to encircle or surround. It is the surroundings in which people, animals and plants develop and exist. All the biological and the non-biological entities surrounding us are included in environment. It also includes all the physical and biological surroundings of an organism along with their interactions. Environment is thus defined as "the sum total of water, air, and land and the inter-relationships that exist among them and with the human beings, other living things and materials.

Ecologists and environmentalists are well aware of the bad state of the environment and of the necessity of its protection. The most serious ecological problems of today are the pollution of air, water and soil, the destruction of ecosystems, disappearance of many species of animals and plants, the weather changes, acid rains, the warming up of the Earth's surface, the destruction of tropical rain forests and the breaking of the ozone layer. Most of this damage, which proceeds faster and faster has not been caused by natural catastrophes, but by the man himself. The technical progress, which enables him a more comfortable life, leads on the other hand to the degradation of the quality of the environment he lives in.

If the destruction of the environment continues, the life on this planet will be endangered. But in recent years many environmental organizations have been founded, some of them on international basis. They try to give their warnings through the mass media and public campaigns. Many of their activities have been successful and the wide public attention made the governments pass various useful laws aimed at the improvement of the environment. All over the world there are clean air acts, water pollution acts and endangered species acts. Governments of all countries have ministries or departments concerned with environmental problems.

The concern for the environment and the environmental activity should be a part of the people's lives. Therefore there is a great need for the environmental education. Children of all ages should be taught about the man's relationship to nature

1.2. Characteristics of environment

The environment has variety of characteristics; it can be renewable, and non renewable. The environment needs some time to replenish, for example to form a cm layer of soil it takes 50 years hence the regenerative time of the environment is some extent long if we use the resource in accordance with natural regeneration capacity of the environment

then there will be no question of environmental degradation. The present situation is not favorable to self regeneration of the environment i.e the excessive use of environmental resource with out considering its capacity is leading to a serious environmental degradation which altimetry affecting the self regenerative capacity of the environment.

The poor resource management is making some of the renewable resources to non renewable, wise management of soil and water resource can make them renewable otherwise they may loose their nature of renewability.

The concept of sustainable development is a great idea which came in to the scene in 1987, but to implement it in developing world will be billion dollar question. Hence at present the human intervention in to the nature by more population and more demand for the resource and extraction resources with out considering its future availability is greatly influencing the natural characteristics of nature

1.3. Global Environmental issues and challenges

The environment is a source of many challenges to the world people's .some environmental problems are the result of natural occurrences, which cannot be controlled by people. Other environmental problems are the direct result of peoples' actions. Occurrences and conditions in the environment that people cannot control are known as *environmental hazards*, or sources of danger. Environmental hazards can result in damage or loss of property, as well as loss of life.

Global Warming

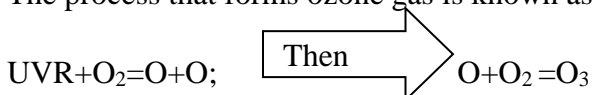
Global warming is the systematic increase of the earth's temperature that is caused mostly by greenhouse gases. Without these gases, earth would be a frozen planet with an average temperature of about -18°C instead of a comfortable 15°C. the concentration of these green house gases has a green house effects. The main natural greenhouse gases are methane and carbon dioxide. But, man-made gases like chlorofluorocarbons (CFCs), hydro fluorocarbons (HCFs) and per fluorocarbons (PFCs) also contribute to the global warming effect, increasing the temperature by holding the heat on the earth. Essentially, the gases trap the heat by absorbing energy from the sun, only allowing some of the heat energy to return to space. Global warming is one of the major issues we are being faced with. The term signifies an increase in the atmospheric temperature near the earth's Surface, which is caused by various reasons. Scientists are of the opinion that a rise in the carbon dioxide levels will further aggravate the situation. A warmer earth also causes changes in the rainfall patterns and thus affects humans, plants and animals as well.

Consequences of global warming

- Acid rain
- A rise in the sea levels that will completely inundate a number of low lying island nations and flood many coastal cities
- Extinctions of many plant and animal species
- The frequency of severe hurricanes and droughts would increase
- The severe disruption of agriculture
- e.t.c.

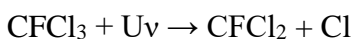
Ozone depletion

Ozone gas is formed in the stratosphere naturally by the combination of oxygen atoms and oxygen molecules. It is found in the atmosphere in the form of tri atomic oxygen. The process that forms ozone gas is known as Chapman cycle.



Ozone depletion, on the other hand, is the disappearance of ozone. The ozone layer is a dynamic protective layer above the earth; it's a layer approximately nine to 30 miles above the earth in the stratosphere (upper atmosphere). It constantly builds and destroys itself. *When the rate of destruction surpasses the rate of construction, the ozone depletes.* The ozone layers filter ultra-violet rays (UV rays). UV rays can be harmful to all life on earth in strong doses, including plant, *animals* and humans. The disappearing ozone may affect the rate of cataracts and skin cancer in humans.

CFCs are considered to be the main cause of ozone depletion. The term, ozone depletion, implies a decline of the quantity of the ozone in the Earth's stratosphere. The loss of ozone in the lower stratosphere was first recorded in Antarctica in the 1970s. As we all know, the earth's atmosphere is composed of many layers and ozone forms a layer in the stratosphere. Ozone can be destroyed by a number of *free radical* catalyts, the most important of which are the *hydroxyl radical* (OH·), the *nitric oxide* radical (NO·), atomic *chlorine* (Cl·) and *bromine* (Br·). All of these have both natural and manmade sources; at the present time, most of the OH· and NO· in the stratosphere is of natural origin, but human activity has dramatically increased the levels of chlorine and bromine. These elements are found in certain stable organic compounds, especially *chlorofluorocarbons* (CFCs), which may find their way to the *stratosphere* without being destroyed in the troposphere due to their low reactivity. Once in the stratosphere, the Cl and Br atoms are liberated from the parent compounds by the action of ultraviolet light.



The Cl and Br atoms can then destroy ozone molecules through a variety of *catalytic* cycles. In the simplest example of such a cycle, a chlorine atom reacts with an ozone molecule, taking an oxygen atom with it (forming ClO) and leaving a normal oxygen molecule. The chlorine monoxide (i.e., the ClO) can react with a second molecule of ozone (i.e., O₃) to yield another chlorine atom and two molecules of oxygen. The chemical shorthand for these gas-phase reactions is:



The process that destructs ozone gas is known as photo dissixation. The overall effect is a decrease in the amount of ozone. The amount of atmospheric ozone is measured by ‘*Dobson spectrometer*’ and is expressed in Dobson units (DU). One DU is equivalent to 0.001 mm thickness of pure ozone at the density it would posses if it were brought to ground level pressure.

Consequences of ozone depletion

- ✓ Ozone depletion in the stratosphere will result in more ultraviolet radiation reaching the earth especially the UV-B (290-320nm). The UV-B radiations affect DNA and photo synthetic chemicals. Any change in DNA can result in mutation and skin cancer.
- ✓ Easy absorbtion of UV rays by the lens and cornea of eye will result in increase in incidents of cataract.
- ✓ Melanin producing cells of the epidermis (important for human immune system) will be destroyed by UV- rays resulting in immune-suppression.
- ✓ The growth of the world’s oceanic plankton, the base of most marine food chains, would decline. Phytoplankton are sensitive to UV exposure. Ozone depletion will result in decrease in their population there by affecting the population of zooplankton, fish, marine animals, in fact the whole aquatic food chain. Plankton contains photosynthetic organisms that break down CO₂ . If plankton population decrease CO₂ increase and this in turn results an increasing in global warming.
- ✓ Yield of vital crops like corn, rice, soybean, cotton, bean, pea, sorghum, and wheat will decrease.
- ✓ Degradation of paints, plastics, and other polymer materials will result in economic loss due to effects of UV.

Acid Rain

Acid rain forms when SO₂ and NO₂ in the atmosphere are reacted with atmospheric water vapor and come back to the earth in the form of precipitation. Acid rain is caused by the numerous acidic pollutants, which have potential to damage earth's environment in a drastic way. Acid rain is caused due to the presence of chemicals like Sulfur Dioxide and Nitrogen Oxides in the atmosphere. These chemicals are introduced in the atmosphere as a result of the industrial processes. Sulfur Dioxide is emitted out of those industries that use coal as their fuel. Automobiles all around the world emit one third of the nitrogen oxide that is present in the atmosphere of earth. Natural causes like fire, volcanic eruptions and bacterial decomposition are also responsible for the increase in the amount of Nitrogen Oxide in the atmospheric air.

Consequences of Acid rain

- ✓ Acid rain chokes the pores in the plant leaves, which leads to the death of plants and a large number of plants in a short span of time.
- ✓ The brick walls and stones are also corroded and the soil composition is changed leading to the death of plants again.
- ✓ Acid rain also leads to the destruction of aquatic life.
- ✓ Disruption of the agricultural sector

Air Pollution

Air Pollution is one of the problems that seem to have no solution at all. Air carries contaminants like poisonous gases and dust particles which when inhaled lead to a number of lung disorders. The sources of air pollution includes:

- Industries
- Agriculture
- Traffic

As all of these causes consist of one or the other process of combustion they emit gases that pollute the atmospheric air. Nitrogen emissions come out mainly from agriculture mainly during the process of denitrification. The pesticides used for agricultural purposes can also be a cause of Air Pollution. Air Pollution can cause many heart and lung disorders like Bronchitis, Lung Cancer and diseases of the like.

1.4. Man-environment relation ships

There is a continuous interaction between man and environment. The objective of man's interaction with the environment is to satisfy his needs. The natural resource and human populations are inherently connected. Man can obtain his basic needs. Man's biological and cultural evolutions are tied intimately with the physical environment. The physical

environment is the sole source of his potential wealth and well being. The role of man in this interaction has been understood differently at different times.

The popular concepts those designate man-environment relationships or interaction in the late 19th and early 20th c in geography and anthropology were;

- ✓ Environmental determinism
- ✓ Environmental possibilism
- ✓ Environmental probablism
- ✓ Environmentalism

Determinism

This doctrine holds that human behavior (activities), individually or collectively is strongly affected by and even controlled or determined by the environment that prevails. Human actions are controlled by natural environment. Environment is believed to wholly determine the activities of man. Environment is considered as active/master element in the process of man –environment interaction whereas man is considered as passive/slave element in his interaction.

Possibilism

Is the view point that people not environment, are the dynamic forces of their activities. the physical environment is passive and man being the active agent is at a liberty to choose between wide ranges of environmental possibilities of opportunities. Thus the natural environment is viewed as affording opportunities rather than imposing limitations. The choices that a society makes depend on the people's requirements and technology available to them to satisfy these.

Man being active can transform, modify and change environment through science and technology.

Environmental probablism

States that though, the environment doesn't necessarily determine human action, it makes some development patterns probable and others likely under a given socio-economic conditions. Environmental probablism saved environmental factors from being discarded completely in development considerations.

Environmentalism

It is a philosophical doctrine that tries balance the role of man and the physical environment in their interactions.

1.5. The concept of Development

Development

According to Seers (1979), development is simply an action or progress made in three dimensions;

- ✚ Decrease in poverty and malnutrition
- ✚ Decline in income inequality
- ✚ Decline in unemployment

According to G. Myrdal, development means simply an upward movement of the entire social system which includes all sorts of consumption by various group of people, consumption provided collectively, education, health at all levels, distribution of power in the society economic, political and social stratification. Here we can find circular causation (when we make changes on one system or factor, it will have its effect on others. E.g. Education-health).

A. Sen also defined development as enhancement of well being of people. The nature of the life of the society is considered while we define development. As to him freedom is both the primary end and the principal means of development. He specified two functioning or elements of well being; doings (job, employment) and beings. So development is about the expansion of these functioning and happiness. Expansion of functioning means avoiding misery, increasing happiness etc. important freedoms include: freedom from famine and malnutrition, freedom from poverty, freedom from illness and freedom from unemployment.

Briefly speaking, development refers to the institutional, economic, political, social and economic change of communities of a given nation. It is the process of having a better position in all aspects of life than yesterday. It is just moving from a certain situation up to higher level. However, it is clear that all nations and even all communities may not have an evenly distributed development. This could be partly resulted from;

- ✚ Unevenness in investment
- ✚ Inadequate infrastructure and uneven natural resource endowments
- ✚ Incomplete markets (some markets are sometimes missing for some goods)
- ✚ Colonization, etc.

Economic development

Economic development refers to the widespread of income (production). In economic development income should be sustainable and widely shared (distribution). In addition, there should be structural change in which large numbers of people are employed. Structural change also includes movement from diminishing return to constant or if

possible to increasing return. Structural change in institution also refers to movement from centralized to a more decentralized and even decisions made on natural resources. Increasing return refers when output becomes greater than double E.g. manufacturing and service. Constant return means when factors of production is doubled, output is also doubled. Diminishing return also refers when output is less than double. E.g. agriculture

The aim of economic development is closing the gap between living standard and availability of income. E.g. we may have many but we may be illiterate and not well nourished.

Economic growth

It is the physical expansion or quantitative change in economy and deals only with income per capita. In economic growth environmental issues are not considered because focus is on raising income. Economic growth never tells us about the welfare of people.

Dimensions of Development

G. Myrdal's elements of dimensions of development

He used modernization ideas for development standard or for standard of perfection in general. His first element is *rationality* in policy, in application of technology, in structuring social relations and so on. Enough reason should be there and that reason should convince the society in these areas. The second element is *planning* for development-searching for coherent system. The third element is increase in production per capita and production per worker. The fourth element is improvement in the standard of living. The income generated should bring positive changes on the life of the society or should bring welfare. The fifth element is decline in social and economic inequality. The sixth element is more efficient institutions and attitudes-like diligence, orderliness, punctuality, honesty, rationality and so on. The seventh element is consolidation of national state and national integration. The eighth element is national independence. The ninth element is political democratization. The tenth element is increased social discipline. All the aforementioned elements are interdependent so that failure one element may affect the other elements.

Sen and Stiglitz elements of dimensions for development

- ✚ Material living standard (income consumption)
- ✚ Health, education, personal activities including work, to have fun and relax
- ✚ Political voice and government
- ✚ Social connections and relationships
- ✚ Environment
- ✚ Security of economic and physical nature

Measures of Development

In order to quantify the progress and look at in figures, it is possible to measure development. We have two major concepts: human resource development and human development.

Human resource development

- ✚ Is about enhancing individual productivity to bring more income or productivity. Here the ultimate goal is not to improve the health or educational standard of citizens but to raise output/productivity.
- ✚ Investment on education and health will be made when it is profitable/ economic return is greater than zero.
- ✚ Uses health and education as a means to raise output/other goal

Human development

- ✚ Is about improving health and education as well as productivity. Here the ultimate goal is better health and education for the citizens of the nation.
- ✚ Investment on education and health will be made whether it is profitable or not even when the economic return is 0 or less than 0.
- ✚ Uses health and education as ends/targets i.e. improved health and education.

Development can be calculated as;

- ✓ Human development index (HDI)
- ✓ Inequality adjusted human development index (IHDI)
- ✓ Gender inequality index (GII)
- ✓ Multi dimensional poverty index (MPI)

Human development index (HDI)

The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. was suggested by A. Sen and his colleagues in the 1990s and being modified around 2010. It includes longevity, literacy and material living standard (income). The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different human development outcomes. These contrasts can stimulate debate about government policy priorities.

The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions.

The 2010 Human Development Report introduced an Inequality-adjusted Human Development Index (IHDI).

Life expectancy refers to a year a newly born baby expected to live in that country. Mean years of schooling is years that a 25-year-old person or older has spent in schools. An expected year of schooling refers to years that a 5-year-old child will spend in education in his whole life.

Dimensions of index	Observed value	
	Maximum	Minimum
Health	83.6 (Japan, 2012)	20
Mean years of schooling	13.2 (USA, 2010)	0
Expected years of schooling	18 (capped at)	0
Combined education index	0.971 (New Zealand, 2010)	0
Percapita income	87,478 (Qatar, 2012)	100

Table.1. Goal posts for the human development index in 2013 report

The steps for calculating HDI are as follows;

Education

- ✚ Mean years of schooling = $\frac{\text{Actual value} - \text{minimum value}}{\text{Maximum value} - \text{minimum value}}$
- ✚ Expected years of schooling = $\frac{\text{Actual value} - \text{minimum value}}{\text{Maximum value} - \text{minimum value}}$
- ✓ Finally they are combined by using a geometric mean.

$$\text{Education index} = \frac{\sqrt{EYS \cdot MYS} - MIN}{CEI - MIN}$$

Health

- ✚ Life expectancy = $\frac{\text{Actual value} - \text{minimum value}}{\text{Maximum value} - \text{minimum value}}$

Income

- ✚ Income index = $\frac{\ln(\text{Actual}) - \ln(\text{minimum})}{\ln(\text{maximum}) - \ln(\text{minimum})}$

$$\text{HDI} = \sqrt[3]{I \cdot H \cdot E \cdot I}$$

Dimension index always falls between 0 and 1. A value approaching to 1 indicates a higher human development whereas a value close to 0 indicates the contrary.

Inequality-adjusted Human Development Index (IHDI)

The IHDI is the actual level of human development (accounting for inequality)" and "the HDI can be viewed as an index of 'potential' human development (or the maximum IHDI that could be achieved if there were no inequality".

The IHDI takes into account not only the average achievements of a country on health, education and income, but also how those achievements are distributed among its population by “discounting” each dimension’s average value according to its level of inequality. The IHDI is distribution-sensitive average level of HD. Two countries with different distributions of achievements can have the same average HDI value. Under perfect equality the IHDI is equal to the HDI, but falls below the HDI when inequality rises. The difference between the IHDI and HDI is the human development cost of inequality, also termed – the loss to human development due to inequality. The IHDI allows a direct link to inequalities in dimensions, it can inform policies towards inequality reduction, and leads to better understanding of inequalities across population and their contribution to the overall human development cost.

This year we have introduced the Coefficient of human inequality, a new measure of inequality in HDI, calculated as an average inequality across three dimensions. For more details on computation, see Technical notes.

The IHDI is calculated for 145 countries.

The average global loss in HDI due to inequality is about 22.9 %—ranging from 5.5% (Finland) to 44.0% (Angola). People in sub-Saharan Africa suffer the largest losses due to inequality in all three dimensions, followed by South Asia and the Arab States and Latin America and the Caribbean. Sub-Saharan Africa suffers the highest inequality in health (36.6%), while South Asia has the highest inequality in education (41.6%). The region of Arab States also has the highest inequality in education (38%), Latin America and the Caribbean suffers the largest inequality in income (36.3%).

Gender Inequality Index (GII)

Gender inequality remains a major barrier to human development. Girls and women have made major strides since 1990, but they have not yet gained gender equity. The disadvantages facing women and girls are a major source of inequality. All too often, women and girls are discriminated against in health, education, political representation, labour market, etc — with negative repercussions for development of their capabilities and their freedom of choice. The GII measures gender inequalities in three important aspects of human development—reproductive health measured by maternal mortality ratio and adolescent birth rates; empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and

older with at least some secondary education; and economic status expressed as labour market participation and measured by labour force participation rate of female and male populations aged 15 years and older. The GII sheds new light on the position of women in over 150 countries, it yields insights in gender gaps in major areas of human development. The component indicators highlight areas in need of critical policy intervention and it stimulates proactive thinking and public policy to overcome systematic disadvantages of women.

The GII is built on the same framework as the HDI and the IHDI — to better expose differences in the distribution of achievements between women and men. It measures the human development costs of gender inequality, thus the higher the GII value the more disparities between females and males. The GII values vary tremendously across countries, they range from 2.1 percent to 73.3 percent.

Countries with high gender inequality also experience more unequal distribution of human development.

Multidimensional Poverty Index (MPI)

Like development, poverty is multidimensional — but this is traditionally ignored by headline money metric measures of poverty. The Multidimensional Poverty Index (MPI), published for the first time in the 2010 Report, complements monetary measures of poverty by considering overlapping deprivations suffered by people at the same time. The index identifies deprivations across the same three dimensions as the HDI and shows the number of people who are multi-dimensionally poor (suffering deprivations in 33% of weighted indicators) and the number of deprivations with which poor households typically contend with. It can be deconstructed by region, ethnicity and other groupings as well as by dimension, making it an apt tool for policymakers. For more technical details see Technical notes.

The MPI can help the effective allocation of resources by making possible the targeting of those with the greatest intensity of poverty; it can help addressing MDGs strategically and monitoring of impacts of policy intervention.

The MPI can be adapted to the national level using indicators and weights that make sense for the region or the country, it can be adopted for national poverty eradication programs, and it can be used to study changes over time.

Almost 1.5 billion people in the 91 countries covered by the MPI—more than a third of their population — live in multidimensional poverty — that is, with at least 33 percent of the indicators reflecting acute deprivation in health, education and standard of living. This exceeds the estimated 1.2 billion people in those countries who live on \$1.25 a day or less. And close to 800 million people are vulnerable to fall into poverty if setbacks occur – financial, natural or otherwise.

Factors of Development

Economic factors

A literature from economic growth and development shows that the concepts of growth and development have been changed qualitatively and quantitatively. Historically, economic growth factors, have normally been associated with the economic circumstances in a particular period, e.g. when trade was the prevailing economic activity during the Mercantilist era, gold and trade were the main economic factors seen as leading to growth. Likewise land was the most important factor in economic progress when agriculture was the main economic activity in the Physiocrats' period.

However, the main economic factors in economic growth are traditionally land, labour, and capital. These factors have normally been mentioned in Classic and Neo-classic writings, though, sometimes, other factors such as technology and management have been added to the above factors.

The debt cycle is an economic factor highly affecting development. Many developing countries of the world are heavily indebted (owing money) to international financial institutions and foreign banks based in developed countries. The debt these countries are facing today is a result of large loans that were issued to them during the 1960s and 1970s. While these loans initially came attached with low interest rates, over time the banks which lent out the money have increased the interest rates on repayments. In most cases, interest rates have been increased to levels which are near impossible for developing countries to meet. In this way, debts continue to accumulate, and the money which could be spent by governments on such things as infrastructure and healthcare is spent on repaying debts.

The process of globalization has significantly changed the nature of how countries of the world trade their goods with one another. The free market system of international trade, while benefiting the economies of most developed countries of the world, has adversely affected the economies of many developing countries. One way in which the global free trade market has done this is through the introduction of reduced protective tariffs and increased exclusionary trading blocs. Tariffs are a form of tax placed on foreign goods that arrive in a country. When a tariff is placed on an imported product, the price of that product in the receiving country will be higher and consumers will therefore be less likely to purchase it. Sometimes countries place tariffs on goods which they produce domestically for protective reasons. Globalization has led to a rise in powerful transnational corporations, which often outsource their labor to countries where workers are exploited.

Non-economic factors

There are, therefore, numerous non-economic factors that may impact on the process of economic growth and economic development. These factors are: culture; religion; class and family; tradition; the role of individual; sociopolitical dependencies; the role of government; and existence of duality in the society.

As far as culture is concerned, the culture of a society can be a major impetus for economic development. Societies which have considerable potential for economic development, such as discipline and positive attitudes towards work, capital accumulation, production, and the quantity and quality of consumption are in a better position to become economically developed than those which are deprived of these attitudes. Although rapid progress in communication technology has affected traditional societies, traditional and peasant societies still predominate in Third World countries.

Political dependency is also another non economic factor of development. Political dependency which is one of the main characteristics of Third World countries is a fifth non-economic factor in development. After World War II, despite the end of the colonization period, dependency of weak countries on powerful countries continued but in a different way. The political environment of a country, which is often closely linked to its history, also has a significant impact on its level of development. In general, governments have the power to take actions which direct a country's social and economic development. In many developing countries with unstable political histories, however, government corruption and greed have caused problems which have hindered such progress.

In most historical cases, colonization has occurred as a result of the colonizing power's desire to exploit new lands and peoples for their own economic and political gain. Natural resources, agricultural commodities, minerals, plants and spices are some common examples of products that colonizing powers throughout history have taken from their colonies. In addition to this, the indigenous populations of colonies have often been forced to work under slave-like conditions for colonizing powers. In almost all instances, land has been taken away from indigenous peoples and divided amongst colonial settlers.

Apart from the exploitation of underdeveloped countries by developed ones, there are at least two aspects in the association between these countries that prevent Third World countries from achieving appropriate economic development.

- ✚ Developed countries, and the international organisations (IMF, World Bank, etc.) that they dominate, tend to control developing countries politically and economically in ways that serve their own economic interests. This is not

necessarily concordant with the long-term benefits of underdeveloped countries. As a result, Third World countries have often to follow projects and plans that are not normally appropriate to their social and economic potential. After some time, not only do they not progress, but their dependency has been aggravated - because of wastage of economic resources. The experience of the last forty years of economic development in Third World countries is the best evidence of this.

- ✚ Political dependency has caused instability in underdeveloped countries, which, in turn, causes capital flight from them to developed ones. Thus, even if there are enough entrepreneurs in developing countries, given that the political situation is not reliable for long-term investment, they still prefer to transfer their capital to developed countries.

Many countries lack basic infrastructure, such as roads, water and power utilities, hospitals, schools and welfare services for the disadvantaged. In most developing countries, this is because there is not enough public money (money raised by the government through taxes and national industries) to invest in the infrastructure which ensures that people's basic needs are met. A lack of government spending on promoting contraception (prevention of pregnancy) in some developing countries has also seen birth rates rise considerably. High birth rates in developing countries exacerbate problems related to poverty, as often these countries do not have the social or economic stability to support such a large population.

Social and cultural dependency can be also another non economic factor to development. Nowadays, the rapid spread of communication and transportation technologies has resulted in many social and cultural values in developed countries being transferred to underdeveloped countries.

One significant environmental factor that can contribute to a country's level of development is the availability of natural resources. Countries naturally rich in coal and oil, for example, do not need to spend money on importing these resources, which are used to produce energy. When exported, natural resources also generate wealth for countries, which means that money can then be spent on other, new industries. Countries with well-developed industries are able to provide jobs, infrastructure and services for their populations, which increase the overall quality of life of their citizens. Other natural factors that create and exacerbate global inequalities are natural disasters, such as floods, hurricanes and volcanic eruptions.

Theories of development and under development

What is theory?

Theory is a formal statement of rules, ideas, and principles, techniques that applies to a certain subject or phenomena. It is also a critique, revision and summing up of past knowledge in a form of general preposition or fusion of diverse views to explain the variation of specified phenomena.

Development theory is a conglomeration or a collective vision of theories about how desirable change in society is best achieved. Such theories draw on a variety of social science disciplines and approaches. Theories of development are the principal theoretical explanations to interpret development efforts carried out especially in the developing countries. These theoretical perspectives allow us not only to clarify concepts, to set them in economic and social perspectives, but also to identify recommendations in terms of social policies.

Orthodox Marxists and Neo-marxian theories

Orthodox Marxists tend to base their analysis on what is actually occurring in the third world, and see neo-Marxist analyses to be overly vague, even wrong. For Orthodox Marxists, development is always uneven; therefore that the third world is underdeveloped by the first is not a new problem. However, they see it as a problem to treat the world as a whole. They prefer a state-centered, class struggle – after all, the third world has many countries at different stages of development. Orthodox Marxists also argue that neo-Marxists focus on external exploitation which deflects from internal dynamics. Orthodox Marxists featured here are Laclau, Brenner (1977), Warren (1973, 1991), and Sender & Smith.

According to neo-Marxists, within a nation there is exploitation of a certain group by the other but more emphasis is given to the exploitation that exists between nations. They give more focus to international exploitation. They support class struggle to overcome domestic exploitation and delinking former colonies with their colonizers to overcome international exploitation. Therefore, neo-Marxists give elites the opportunity to use ‘underdevelopment’ and ‘dependency’ to their own advantage to serve the masses... so they say, but actually they serve their own interests. They all are criticized for their failure to consider the role of connection.

However, Marxists theorists viewed the persistent poverty as a consequence of capitalist exploitation. And a new body of thought, called the *world systems approach*, argued that the poverty was a direct consequence of the evolution of the international political economy into a fairly rigid division of labor which favored the rich and penalized the poor. In addition to its structuralist roots, dependency theory has much overlap with Neo-

Marxism and World Systems Theory, which is also reflected in the work of Immanuel Wallerstein, a famous dependency theorist. Wallerstein rejects the notion of a Third World, claiming that there is only one world which is connected by economic relations (World Systems Theory). He argues that this system inherently leads to a division of the world in core, semi-periphery and periphery. One of the results of expansion of the world-system is the commodification of things, like natural resources, labor and human relationships.

Structuralism theory

Structuralism is a development theory which focuses on structural aspects which impede the economic growth of developing countries. This theory advocates that the type of relationship that exists between economically developed and developing country doesn't support low income countries to prosper but keep them under primary activity. Therefore, as far as these two countries are connected structural change in economy (primary to industry) is impossible. The unit of analysis is the transformation of a country's economy from, mainly, subsistence agriculture to a modern, urbanized manufacturing and service economy. Policy prescriptions for structural change resulting from structuralist thinking include major government intervention in the economy to fuel the industrial sector, known as import substitution industrialization (ISI). This structural transformation of the developing country is pursued in order to create an economy which in the end enjoys self-sustaining growth. This can only be reached by ending the reliance of the underdeveloped country on exports of primary goods (agricultural and mining products), and pursuing inward-oriented development by shielding the domestic economy from that of the developed economies. Trade with advanced economies is minimized through the erection of all kinds of trade barriers and an overvaluation of the domestic exchange rate; in this way the production of domestic substitutes of formerly imported industrial products is encouraged. The logic of the strategy rests on the infant industry argument, which states that young industries initially do not have the economies of scale and experience to be able to compete with foreign competitors and thus need to be protected until they are able to compete in the free market. The Prebisch–Singer hypothesis states that over time the terms of trade for commodities deteriorate compared to those for manufactured goods, because the income elasticity of demand of manufactured goods is greater than that of primary products. If true, this would also support the ISI strategy.

Structuralists argue that the only way Third World countries can develop is through action by the state. Third world countries have to push industrialization and have to reduce their dependency on trade with the First World, and trade among themselves.

Dependency theory is essentially a follow up to structuralist thinking, and shares many of its core ideas. Whereas structuralists did not consider that development would be possible

at all unless a strategy of delinking and rigorous ISI was pursued, dependency thinking could allow development with external links with the developed parts of the globe. However, this kind of development is considered to be "dependent development", i.e., it does not have an internal domestic dynamic in the developing country and thus remains highly vulnerable to the economic vagaries of the world market.

Modernization theory

Modernization theory is used to analyze in which modernization processes in societies take place. This theory basically depends on two theories: Evolutionary and Functionalist.

Evolutionary theory suggests that other nations should follow the paths or ways in which western nations would have been followed to develop. The modernization theory is mainly based on evolutionary view.

Functionalist theory has its roots from biology and relates fields and suggests that an organism is made up of a number of organs and the well functioning of an organ determines the well functioning of a system which ultimately determines the wellbeing or life of the organism. Here, organs are treated as different institutions.

The basic premise of modernization theory is that the theory saw economic development as a universal process upon which all states would embark. As economic development advanced, political systems would move toward democratization. E.g. Rostow: The Stages of Economic Growth 1961: The major assumptions of the modernization theory of development basically are:

- ✚ Modernization is a phased process; for example Rostow has 5 phases according to his theory of economic development for a particular society,
- ✚ Modernization is a homogenizing process, in this sense, we can say that modernization produces tendencies toward convergence among societies, for example, Levy (1967, p. 207) maintains that : “as time goes on, they and we will increasingly resemble one another because the patterns of modernization are such that the more highly modernized societies become, the more they resemble one another”.
- ✚ Modernization is an Europeanization or Americanization process; in the modernization literature, there is an attitude of complacency toward Western Europe and the United States. These nations are viewed as having unmatched economic prosperity and democratic stability (Tipps: 1976, 14).
- ✚ In addition, modernization is an irreversible process, once started modernization cannot be stopped. In other words, once third world countries come into contact with the West, they will not be able to resist the impetus toward modernization.

- ✚ Modernization is a progressive process which in the long run is not only inevitable but desirable. According to Coleman, modernized political systems have a higher capacity to deal with the function of national identity, legitimacy, penetration, participation, and distribution than traditional political systems.
- ✚ Finally, modernization is a lengthy process. It is an evolutionary change, not a revolutionary one. It will take generations or even centuries to complete, and its profound impact will be felt only through time. All these assumptions are derived from European and American evolutionary theory.

There is also another set of classical assumptions based more strictly on the functionalism-structuralism theory which emphasizes the interdependence of social institutions, the importance of structural variables at the cultural level, and the built in process of change through homeostasis equilibrium. These are ideas derived especially from Parsons' sociological theories. These assumptions are as follows:

- ✚ Modernization is a systematic process. The attribute of modernity forms a consistent whole, thus appearing in a cluster rather than in isolation;
- ✚ Modernization is a transformative process; in order for a society to move into modernity its traditional structures and values must be totally replaced by a set of modern values; and
- ✚ Modernization is an imminent process due to its systematic and transformative nature, which builds change into the social system.

The strengths of modernization theory can be defined in several aspects. First, we can identify the basis of the research focus. A second feature of the modernization perspective is the analytical framework. Authors assume that Third World countries are traditional and that Western countries are modern. In order to develop, those poor nations need to adopt Western values. In third place, the methodology is based on general studies; for example the expositions regarding the value factors in the Third World, and the differentiation between unstable democracies, dictatorships and stable dictatorships.

Criticisms of the theory include the following: First, development is not necessarily unidirectional. This is an example of the ethnocentricity of Rostow's perspective. Second, the modernization perspective only shows one possible model of development. The favored example is the development pattern in the United States. Nevertheless, in contrast with this circumstance, we can see that there have been development advances in other nations, such as Taiwan and South Korea; and we must admit that their current development levels have been achieved by strong authoritarian regimes.

Rostow's stage of Economic Development

According to Rostow, Societies will inevitably move through four stages of development: traditions, preconditions, take off, drive to maturity, capitalist heaven. He argues that within a society sequential economic steps of modernization can be identified. These steps are linear and towards an evolutionary higher development. He identifies five growth stages (Figure 1):

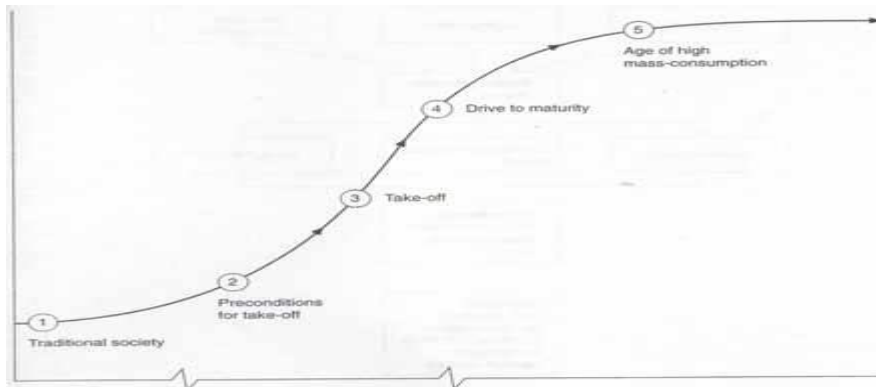


Figure 1. Rostow's five-stage model of development
(Source: Potter, Binns, Elliott & Smith 1999: 51)

1. The Traditional Society

The economic system is stationary and dominated by agriculture with traditional cultivating forms. Productivity by man-hour work is lower, compared to the following growth stages. The society characterizes a hierarchical structure and so there is low vertical as well as social mobility.

2. The Preconditions for Take-Off

During this stage the rates of investment are getting higher and they initiate a dynamic development. This kind of economical development is a result of the industrial revolution. As a consequence of this transformation, which includes development of the agriculture too, workforces of the primary sector become redundant. A prerequisite for "The Preconditions for Take-Off" is industrial revolution, which lasted for a century.

3. Take Off:

According to Rostow's model, a country needed to follow some rules of development to reach the take-off: (1) The investment rate of a country needs to be increased to at least 10% of its GDP, (2) One or two manufacturing sectors with a high rate of growth need to be established, (3) An institutional, political and social framework has to exist or be created in order to promote the expansion of those sectors.

This stage is characterized by dynamic economic growth. The main characteristic of this

economic growth is self sustained growth which requires no exogenous inputs. Like the textile industry in England, a few leading industries can support development. Generally “Take Off” lasts for two to three decades, e.g. in England it took place by the middle of the 17 C or in Germany by the end of the 17 C.

4. The Drive to Maturity

This stage is characterized by continual investments by 40 to 60 per cent. It is dominated by economic and technical progress. Here, there is a continuous employment growth, growth in national income, rise of consumer demands, and strong domestic markets. New forms of industries like neo-technical industries emerge, e.g. electrical industry, chemical industry or mechanical engineering. Neo-technical industries supplement the paleo-technical industries. As a consequence of this transformation social and economic prosperity, especially the latter, increase. Generally “The Drive to Maturity” starts about 60 years after “Take Off”. In Europe this happened by 1900.

5. The Age of high Mass Consumption

This is the final step in Rostow’s five-stage model of development. Here, most parts of society lives in prosperity and persons living in this society are offered both abundance and a multiplicity of choices. According to him the West or ‘the North’ belongs today in this category.

The Rostow model has serious flaws, of which the most serious are:

- ✚ The model assumes that development can be achieved through a basic sequence of stages which are the same for all countries, a doubtful assumption;
- ✚ The model measures development solely by means of the increase of GDP per capita;
- ✚ The model focuses on characteristics of development, but does not identify the causal factors which lead development to occur. As such, it neglects the social structures that have to be present to foster development.

Dependency Theory

Dependency can be defined as an explanation of the economic development of a state in terms of the external influences--political, economic, and cultural--on national development policies (Osvaldo 1969, p. 23). Theotonio Dos Santos emphasizes the historical dimension of the dependency relationships in his definition: [Dependency is]...an historical condition which shapes a certain structure of the world economy such that it favors some countries to the detriment of others and limits the development possibilities of the subordinate economics...a situation in which the economy of a certain

group of countries is conditioned by the development and expansion of another economy, to which their own is subjected.

The basic premise of this theory is colonialism and imperialism prevent or distort development—progression through Marx's stages—because of unequal terms by which the colony or dependent state is incorporated into the capitalist economy. Advocators of this theory believed that for capital formation developing nations on developed/former colonizers so that the root cause for their underdevelopment is this dependence. The major hypotheses with regard to development in Third World countries according to the dependency school are the following:

- ✓ First, in contrast to the development of the core nations which is self-contained, the development of nations in the Third World necessitates subordination to the core. Examples of this situation can be seen in Latin America, especially in those countries with a high degree of industrialization, such as Sao Paulo, Brazil
- ✓ Second, the peripheral nations experience their greatest economic development when their ties to the core are weakest. An example of this circumstance is the industrialization process that took root in Latin America during the 1930s, when the core nations were focusing on solving the problems that resulted from the Great Depression, and the Western powers were involved in the Second World War.
- ✓ A third hypothesis indicates that when the core recovers from its crisis and reestablishes trade and investments ties, it fully incorporates the peripheral nations once again into the system, and the growth of industrialization in these regions is stifled.
- ✓ Lastly, the fourth aspect refers to the fact that regions that are highly underdeveloped and still operate on a traditional, feudal system are those that in the past had the closest ties to core.

The foundations of the theory of dependency emerged in the 1950s of which one of the most representative authors was Raul Prebisch. The principal points of the Prebisch model are that in order to create conditions of development within a country, it is necessary:

- ✚ To control the monetary exchange rate, placing more governmental emphasis on fiscal rather than monetary policy;
- ✚ To promote a more effective governmental role in terms of national development;
- ✚ To create a platform of investments, giving a preferential role to national capitals;
- ✚ To allow the entrance of external capital following priorities already established in national plans for development;
- ✚ To promote a more effective internal demand in terms of domestic markets as a base to reinforce the industrialization process in Latin America;

- ✚ To generate a larger internal demand by increasing the wages and salaries of workers, which will in turn positively affect aggregate demand in internal markets;
- ✚ To develop a more effective coverage of social services from the government, especially to impoverished sectors in order to create conditions for those sectors to become more competitive; and
- ✚ To develop national strategies according to the model of import substitution, protecting national production by establishing quotas and tariffs on external markets.

The principal critics of the dependency theory have focused on the fact that this school does not provide exhaustive empirical evidence to support its conclusions. Furthermore, this theoretical position uses highly abstract levels of analysis. Another point of critique is that the dependency movement considers ties with transnational corporations as being only detrimental to countries, when actually these links can be used as a means of transference of technology. In this sense, it is important to remember that the United States was also a colony, and this country had the capacity to break the vicious cycle of underdevelopment.

Three issues made this policy difficult to follow. The first is that the internal markets of the poorer countries were not large enough to support the economies of scale used by the richer countries to keep their prices low. The second issue concerned the political will of the poorer countries as to whether a transformation from being primary products producers was possible or desirable. The final issue revolved around the extent to which the poorer countries actually had control of their primary products, particularly in the area of selling those products abroad. These obstacles to the import substitution policy led others to think a little more creatively and historically at the relationship between rich and poor countries.

Neo liberalism Theory

According to this theory, stagnation in structural change is due to poorly designed domestic policy and political factors. Early contributors to this theory are Adam Smith and David Ricardo. Classical economists argued - as do the neoclassical ones - in favor of the free market, and against government intervention in those markets. The 'invisible hand' of Adam Smith makes sure that free trade will ultimately benefit all of society.

One of the implications of the neoclassical development theory for developing countries were the Structural Adjustment Programmes (SAPs) which the World Bank and the

International Monetary Fund wanted them to adapt. Important aspects of those SAPs include:

- ✓ Fiscal austerity (reduction in government spending)
- ✓ Privatization (which should both raise money for governments and improve efficiency and financial performance of the firms involved)
- ✓ Trade liberalization, currency devaluation and the abolition of marketing boards (to maximize the static comparative advantage the developing country has on the global market)
- ✓ Retrenchment of the government and deregulation (in order to stimulate the free market)

Development and environment

Development has an adverse impact on the natural environment. 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.

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%. The average U.S. citizen consumes 70 times as much water as the average citizen of Ghana. Standard home toilets account for 40% of that use with showers and sinks using another 35 %. The fresh water on earth is only 5 % of the total water on the planet and does not increase despite the increase in demand by increased development and populations. Development also increases the demand on the already overburdened sewer and storm sewer systems.

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 created in large part by the expansion and development in the outlying areas.

With additional development, there is an increase in solid waste production. More landfill space is needed which results in requests for landfill expansions and permits for new landfills. Options that have been suggested include sending to other places waste to landfills is greatly reducing the amount of waste we create through pollution prevention.

Chapter Two

2. Issues related with the Environment

2.1. Economic growth and Environment

The natural environment and the economy

The natural environment plays an important role in supporting economic activity. It contributes:

- ✚ Directly, by providing resources and raw materials such as water, timber and minerals that are required as inputs for the production of goods and services; and
- ✚ Indirectly, through services provided by ecosystems including carbon sequestration, water purification, managing flood risks, and nutrient cycling.

Natural resources are, therefore, vital for securing economic growth and development, not just today but for future generations.

Economic and environmental performance must go hand in hand. The natural environment is central to economic activity and growth, providing the resources we need to produce goods and services, and absorbing and processing unwanted by-products in the form of pollution and waste.

The relationship between economic growth and the environment is complex. Several different drivers come into play, including the scale and composition of the economy – particularly the share of services in GDP as opposed to primary industries and manufacturing – and changes in technology that have the potential to reduce the environmental impacts of production and consumption decisions whilst also driving economic growth. With many key natural resources and ecosystems services scarce or under pressure, achieving sustained economic growth will require absolute decoupling of the production of goods and services from their environmental impacts. This means consuming environmental resources in a sustainable manner – whether by improving the efficiency of resource consumption or by adopting new production techniques and product designs. It also means avoiding breaches in critical thresholds beyond which natural assets cannot be replaced and can no longer support the desired level of economic activity. Existing commitments to avoid dangerous climate change exemplify the need for absolute decoupling, requiring a reduction in greenhouse gas emissions, even in the face of an expanding global economy.

The economic impact of environmental policy will depend on the context within which it is applied – the nature and severity of the environmental impact being addressed, the policy design chosen, and the sectors it affects. Policies that improve the efficiency with which businesses use resources, such as energy, water and materials, produce not just environmental benefits but also financial savings for businesses.

The debate over economic growth and the environment

While economic growth has produced many benefits – raising standards of living and improving quality of life across the world – it has also resulted in the depletion of natural resources and the degradation of ecosystems. There has been much debate over whether or not it is possible to achieve economic growth without unsustainably degrading the environment, and a growing realization that economic growth at the current rate of depletion and degradation of environmental assets cannot continue indefinitely. In the context of environmental resources more generally, the Millennium Ecosystem Assessment (2003) found that 15 out of the 24 ecosystems services it examined were being degraded or used unsustainably, and the use and consumption of natural resources such as minerals and metals continues at an increasing pace.

For some social and physical scientists, growing economic activity (production and consumption) requires larger inputs of energy and material, and generates larger quantities of waste by-products. Increased extraction of natural resources, accumulation of waste and concentration of pollutants will therefore overwhelm the carrying capacity of the biosphere and result in the degradation of environmental quality and a decline in human welfare, despite rising incomes (H. Daly, 1977). Furthermore, it is argued that degradation of the resource base will eventually put economic activity itself at risk. To save the environment and even economic activity from itself, economic growth must cease and the world must make a transition to a steady-state economy.

At the other extreme, are those who argue that the fastest road to environmental improvement is along the path of economic growth: with higher incomes comes increased demand for goods and services that are less material intensive, as well as demand for improved environmental quality that leads to the adoption of environmental protection measures. As Beckerman puts it, “The strong correlation between incomes, and the extent to which environmental protection measures are adopted, demonstrates that in the longer run, the surest way to improve your environment is to become rich” (W. Beckerman, 1998).

Some went as far as claiming that environmental regulation, by reducing economic growth, may actually reduce environmental quality.

Environmental Kuznets Curve

The implied inverted-U relationship between environmental degradation and economic growth came to be known as the “environmental Kuznets curve,” by analogy with the income inequality relationship postulated by Kuznets.

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 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; at low levels of development, both the quantity and the intensity of environmental degradation are limited to the impacts of subsistence economic activity on the resource base and to limited quantities of biodegradable wastes. As agriculture and resource extraction intensifies and industrialization takes off, both resource depletion and waste generation accelerate.
- ✚ 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. At higher levels of development, structural change towards information-based industries and services, more efficient technologies, and increased demand for environmental quality result in levelling-off and a steady decline of environmental degradation as given in fig 1 below.

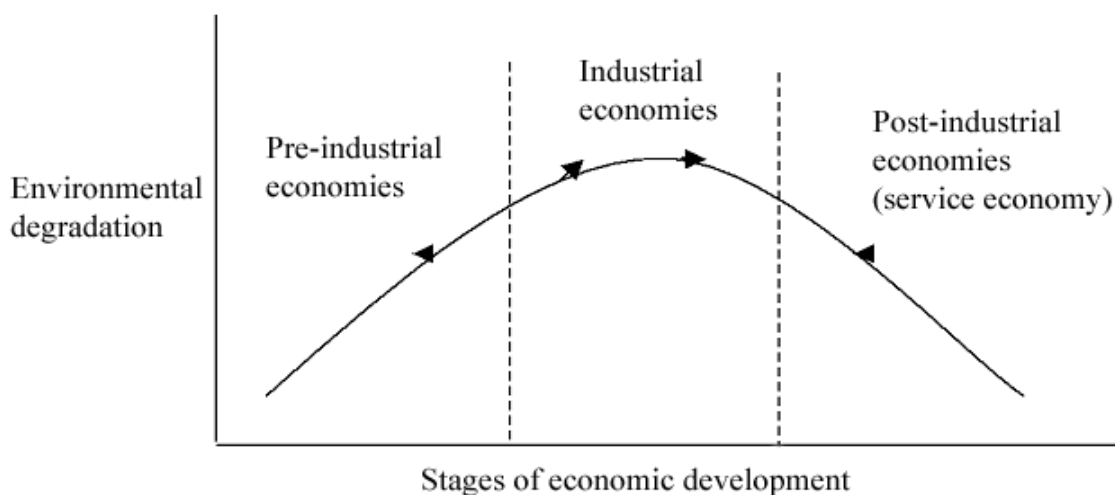


Figure 1: The environmental Kuznets curve: a development-environment relationship

Other possible explanations for the shape of the EKC include:

- ✓ **Technological progress:** firms initially concentrate on expanding production as quickly as possible, but as technology evolves production processes become cleaner and more resource efficient;
- ✓ **Behavior Change:** society is at first interested in higher levels of consumption, regardless of the means by which it is achieved, but after a certain point greater consideration is given to other factors affecting quality of life, including the environment;
- ✓ **Lewis growth model:** the development pattern of any economy is characterized by the changing patterns of economic activity. Stage 1: society concentrates resources in the primary sector (i.e. extraction, agriculture) to satisfy necessary consumption; Stage 2: resources are switched to the secondary sector (i.e. manufacturing) as basic needs are satisfied and further consumption is concentrated on consumption goods; and Stage 3: society moves from the secondary to the tertiary sector (i.e. services) characterized by much lower levels of pollution. However, this model is less applicable in an increasingly globalised world where the move from stage 1 to 3 may happen as the result of a shift rather than a reduction in the levels of pollution.

However, there are several reasons to question the relevance of the EKC hypothesis to policy-making.

- ✚ First, the definitions of environmental quality normally used in EKC analyses are based on a *limited set of pollutants*. As such, the conclusions reached by these analyses are not applicable to all types of environmental damage. For example, there was no evidence of an EKC relationship in the Ecological Footprint – an aggregate measure of the pressure human beings place on the environment – unless energy use was removed from the measure (Caviglia-Harris *et al*, 2009). The Environmental Kuznets relationship appears strongest for *pollutants with significant local impacts*. For carbon and other greenhouse gases, on the other hand, where the impacts are global and diffuse, emissions have continued to rise with increases in income per capita – even in the richest countries.
- ✚ Second, the econometric evidence put forward in support of the EKC has been found to be *less reliable and robust* than previously thought. For example, the choice of model used to describe the relationship between income and pollution has a significant impact on the results of the analysis.
- ✚ Third, the existence of *hysteresis* may reduce the relevance of EKC to environmental policy. Specifically, the costs of repairing damage and improving environmental quality once the economy is past its turning point may be drastically higher than the cost of preventing the damage or undertaking mitigation earlier; for

example, cleaning up a polluted waterway, where the cost of avoiding the pollution in the first place is lower than the subsequent cost of the cleanup.

- ✚ Fourth, it has been shown that countries with similar levels of wealth perform differently, *without any clear or systematic signs of convergence*. Furthermore, it is been suggested that the decreasing part of the EKC exists only for economies with less inequality and a relatively uniform distribution of wealth.

Therefore, while there is some evidence of an EKC relationship existing for certain countries and for certain local pollutants, it *cannot be generalised to all types of environmental damage and across all countries and income levels*. Moreover, it has limited use as a predictor of environmental performance as countries develop.

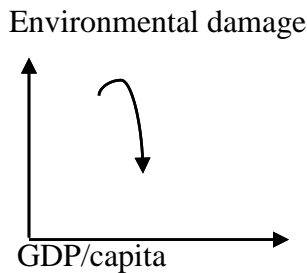
Alternative views on the economy-environment relationship

There are other alternate theories describing the relationship between economic growth and environmental quality.

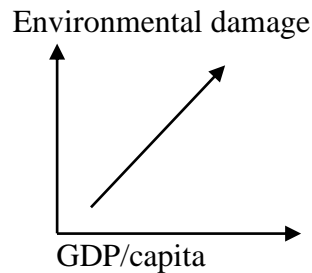
The *limits theory* considers the possibility of breaching environmental thresholds before the economy reaches the EKC turning point. Commentators, such as Arrow *et al.*, (1996), suggest that the risk of small changes causing catastrophic damage means that solely focusing on economic growth to deliver environmental outcomes could be counter-productive. For example, in the context of biodiversity, increased spending on maintaining species diversity will not be able to recreate extinct species. The limits theory defines the economy-environment relationship in terms of environmental damage hitting a threshold beyond which production is so badly affected that the economy shrinks.

Another theory questions the existence of turning points, and considers the possibility that environmental damage continues to increase as economies grow (see figure below). This is similar to the *new toxics view*, where emissions of existing pollutants are decreasing with further economic growth, but the new pollutants substituting for them increase.

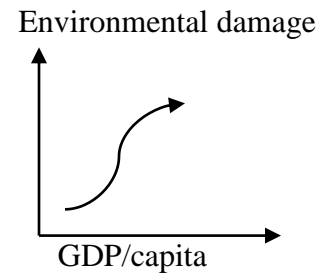
Stern (2004) discusses a further possible relationship between economic growth and the environment in the context of international competition. International competition initially leads to increasing environmental damage, up to the point when developed countries start reducing their environmental impact but also outsource polluting activities to poorer countries. The net effect is, in the best case scenario, a non-improving situation (see figure below). This model is known as ‘race to the bottom’.



I. Limits theory



II. New Toxics & Davidson



III. Race to the Bottom

Drivers of the economy-environment relationship

What these various theories demonstrate is that the relationship between economic growth and the environment is complex and multi-dimensional. While there may be no conclusive evidence on the shape of the economy-environment relationship, these theories provide a useful starting point for thinking about the factors that drive this relationship. These can broadly be divided into three effects:

- **The scale effect** – economic growth has a negative effect on the environment, where increased production and consumption causes increased environmental damage;
- **The composition effect** – the composition of production changes along the growth path: initially economic growth leads to industrialization (and as the goods balance shifts from agriculture to manufactured products, environmental damage increases); but the balance then shifts from producing manufactured goods to producing services, due to both demand- and supply-side changes, reducing the level of domestic environmental damage;
- **The technical effect** – technological developments lead to a change in the environmental impacts of production. Whilst this often means reductions in environmental intensity, for example improvements in energy efficiency, it could also represent technological advances that lead to greater environmental damage (such as through increased energy use). Changes in the preferences of society may also drive changes in environmental damage, for example through encouraging changes in the stringency of environmental regulation of industry. The relative size of these effects determines the relationship between economic growth and the environment.

Decoupling production from environmental damage

The development of cleaner technologies and more efficient use of natural resources is key to reducing the environment impacts of production, and of economic activity more generally. *Decoupling* refers to a breaking of the link between GDP and environmental damage, and can be classified as:

- ✚ **Relative**, a decrease in environmental damage *relative* to GDP; or
- ✚ **Absolute**, a decrease in environmental damage even as GDP is rising.

Ekins (2000) compares GDP growth with the growth in emissions of CO₂, SO₂, and NO_x in seven developed countries between 1970 and 1993, and finds that while GDP rose by between 50% and 150% across the seven countries, emissions rose by less than GDP in the majority of countries (relative decoupling) and fell in the others (absolute decoupling). Updated analysis using OECD data up to 2005 indicates greater evidence of absolute decoupling in recent years; for example, UK, Germany, and France report absolute decoupling for all indicators.

Decoupling in the international context

The globalised nature of the world economy means that decoupling needs to be discussed in the international context, rather than in terms of individual countries. For example, shifting manufacturing activities from advanced to developing countries without a significant change in patterns of domestic consumption simply results in environmental damage being exported from advanced to developing countries and, for global impacts, does not necessarily imply a reduction in overall levels of environmental damage – in some cases it has even led to an increase in environmental damage.

2.2. Poverty and Environmental Issues

Both environmental degradation and poverty alleviation are urgent global issues that have a lot in common, but are often treated separately. Consider the following:

- ✦ Human activities are resulting in mass species extinction rates higher than ever before, currently approaching 1000 times the normal rate;
- ✦ Human-induced climate change is threatening an even bleaker future;
- ✦ At the same time, the inequality of human societies is extreme:
 - The United Nations Human Development Report reveals that, “Globally, the 20% of the world’s people in the highest-income countries account for 86% of total private consumption expenditures—the poorest 20% a minuscule 1.3%”
 - To highlight this inequality further, consider that approximately 1 billion people suffer from hunger and some 2 to 3.5 billion people have a deficiency of vitamins and minerals
 - Yet, some 1.2 billion suffer from obesity
 - One billion people live on less than a dollar a day,
 - However, half the world- nearly 3 billion people- live on less than 2 dollars a day.
 - Yet, just a few hundred millionaires now own as much wealth as the world’s poorest 2.5 billion people.

Issues about environment, economics and politics are inter-related through the way humans interact with their surroundings and with each other.

Biological diversity allows a variety of species to all work together to help maintain the environment without costly human intervention. We benefit because the environment sustains us with the variety of resources produced.

However, there is often a mainstream belief that for poor countries to develop, environmental concerns have to be sacrificed, or is a luxury to address once poverty is alleviated.

Therefore, the approaches to such issues require rethinking. The overloaded phrase “sustainable development” must recognize the interconnectedness between human beings and the environment if true environmental and social justice is to be obtained.

As Delhi-based environment organization, the Centre for Science and Environment, points out, if the poor world were to develop and consume in the same manner as the West to achieve the same living standards, “we would need two additional planet Earths to produce resources and absorb wastes ... and good planets are hard to find!”

Impact of Poverty on the Environment

Poverty and third world debt has been shown to result in resource stripping just to survive or pay off debts.

For example, Nepal and Bangladesh have suffered from various environmental problems such as increasingly devastating floods, often believed to be resulting from large-scale deforestation.

Forests around the world face increased pressures from timber companies, agricultural businesses, and local populations that use forest resources.

Some environmentalists, from rich nations especially, also raise concerns about increasing populations placing excessive burdens on the world’s resources as the current major source of environmental problems.

This makes for a worrying situation for third world development and poverty alleviation. However, an environment-only approach risks “blaming the victims.” While humans are largely responsible for many problems of the planet today, not all humans have the same impact on the environment. It is important to consider, for example, that the consumption of just the world’s wealthiest fifth of humanity is so much more than the rest of the world, as highlighted at the beginning.

Thus, putting emphasis on population growth in this way is perhaps over-simplistic. However, this does not mean we can be complacent about future population burdens.

Sustainability is critical for the world's majority to develop without following the environmentally damaging processes of the world's currently industrialized nations.

Also adding to the complexity is that resource usage is not necessarily fixed. That is, while there may be a finite amount of say oil in the ground, we may have not discovered it all, and further, overtime the use of those resources may increase in efficiency (or inefficiency). This means a planet could sustain a high population (probably within some limits) but it is a combination of things like how we use resources, for what purpose, how many, how the use of those resources change over time, etc, that defines whether they are used inefficiently or not and whether we will run out of them or not.

Impact of Richer Nations on the Environment

Economic growth—meaning a sustained expansion in the resources available to meet society's needs—provides the best setting for meeting environmental challenges. Typically, the greatest obstacle in overcoming familiar environmental problems such as air and water pollution is simply a lack of resources. However, growth alone is not enough, since some patterns of economic growth are environmentally damaging, especially when polluters do not have to bear the full costs of their activities. The proper response in such cases is to improve the pattern of growth, not to abandon growth as an objective.

Poverty can both aggravate and be aggravated by environmental problems. For example, poverty may combine with population pressures to cause forests and other natural resources to be exploited inefficiently and unsustainably. Equally, many environmental problems bear heavily on the poor. Because they tend to live in less favored locations, poor people may be the greatest sufferers from air and water pollution and the effects of natural disasters.

Ideally, the environment benefits from virtuous circles in which sustainable economic growth reduces poverty, increases resources available to improve the environment, and is itself reinforced by these trends.

The relationship between the rich and poor, and the impacts on the environment go deep. Economics is meant to be about efficient allocation of resources to meet everyone's needs. However, international power politics and ideologies have continued to influence policies in such a way that decision-making remains concentrated in the hands of a few narrow interests. The result is that the world's resources are allocated to meet a few people's wants, not everyone's needs.

Indian activist and scientist, Vandana Shiva, shows in her work that many people have been forced into poverty due to politics and economics such as concentrated land rights, pressure from industry to exploit the environment in ways that destroy diversity and affect local populations, etc. Shiva also highlights that the poor often have a lot of knowledge about their environment and are often sustainers and efficient users of it, as they recognize their link to it for their survival.

Mainstream economists and politicians have long been criticized for concentrating on economic growth in ways that ignores humanity and the environmental costs. Perhaps one of the harshest ironies is how food and farm products flow from areas of hunger and need, to areas where money and demand is concentrated. Farm workers, and women especially, are amongst the world's most hungry.

For years, rich countries have been migrating some polluting industries to poor countries, but still producing primarily for rich countries. This has been possible insofar as it is cheaper than to pay for costly environmentally clean technologies that people demand.

Environment and Poverty are Related Issues

The above just scratches the surface, but highlights the interconnectedness of humanity, the environment and all other forms of life. We cannot take the environment for granted. Humanity has a responsibility not only to each other, but to the environment as well, as the environment has long sustained us and can only continue to do so if we do not destroy it.

Technological solutions, such as more environmentally friendly technologies, while extremely important, do not address underlying political, social and economic causes. Just as doctors highlight the need to prevent illnesses in the first place, and resort to cures when needed, so too do we need to understand these deeper issues in a more holistic manner. The interconnectedness needs more recognition if environmental degradation, poverty and other global problems can begin to be addressed.

Concentrating on one dimension without others is similar to those blind men looking at just a part of the elephant. A form of environmentalism that ignores humanity as an integral part of the solution, of economic dogma that forgets about our basic needs, and of forms of development that ignore environmental concerns all add up to numerous problems for the world's people and fragile ecosystems. Some of these problems are so big we do not even see them even when we think our eyes are open.

2.3. Population and Environmental Issues

Population dynamics, poverty and environmental change are linked in many ways and through multiple social and economic mechanisms, at various geographic levels. But not all those linkages have relevance for policy formulation in one of the three domains thus interconnected. We try to identify policy issues among the array of conceivable linkages, placing emphasis on environmental policy. It considers both the environmental issues regarding the management of natural resources and those regarding the pollution of humankind's living quarters. These groups, which broadly correspond to the respective concerns of the rural and the urban environment - the "green" and "brown" agendas - differ in nature, and population dynamics plays different roles in them.

Population-resource-environmental linkages

Our global human population of about 6.5 billion in 2005 is likely to increase to 7 billion in a few years from now. By 2015, it is likely to be 7.27 billion if population growth is controlled. By 2015, it is likely to be 7.92 billion if it is not controlled. The needs of such increasing huge number of human population cannot be supported by earth's natural resource without degrading some resource and their quality.

The increasing population will need more land to live, thereby reducing forests, will have more cattle to graze needing conversion of forest land in to pasture land, will need more goods, which will increase industrialization and commercialization, will need more fuels and energy to meet a modern life style. All such activities are likely to cause severe adverse environmental impacts. As a result of increasing population number, the following consequences will be occurred.

- It will become impossible to met the demand for food without degrading the environmental resources
- More lands may needed to be under cultivation which result expansion of desertification
- More water may needed for drinking and irrigation, thereby creating water famines
- More land may be needed for urbanization which in turn causes some environmental pollutions
- Pasture land will be over grazed which increases frequency of flood
- Energy resources may be exhausted and oil wells may also become dry
- Increased industrialization and commercialization will create greater problem due to the pollution of water ,air ,and soil
- Larger ozone holes may be developed due to the discharge of industrial chemicals in to the atmosphere.

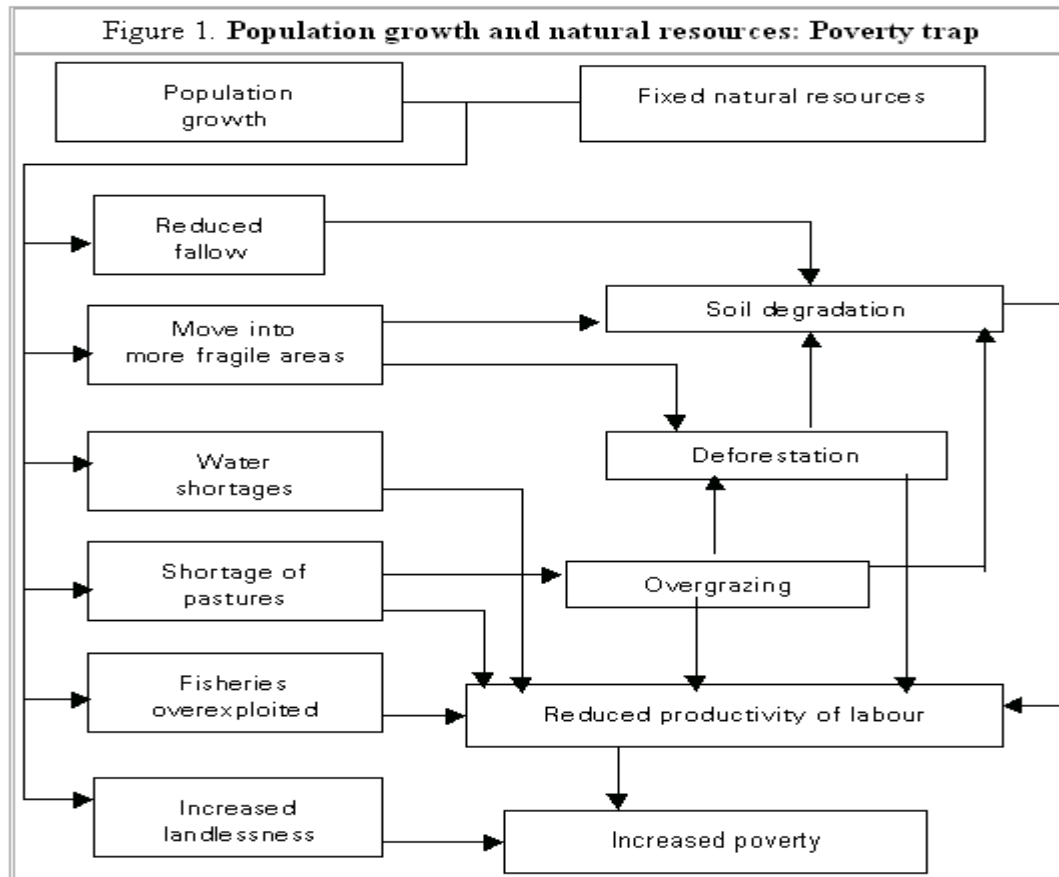
Ways of minimizing the adverse effect of population growth on the environment

- Creating a mass environmental awareness movement that may encourage the people to change their way of life.
- Designing an appropriate population policy that can reduce high population growth
- More storages of water should be developed
- Industry will adopt environmentally good models and technologies to minimize resource consumption, pollution and generation of wastage
- Designing appropriate environmental policy that gives priority for conservation along with reducing energy demands of the population, environmental protection by recycling and recovery

Alternative views on population-environment linkages.

Most theories of population and environment are expounded primarily in relation to agricultural resource usage, but they can be applied *mutandis mutatis* to all types of natural resources.

For the *natural science* perspective humankind is one of the many species competing for the resources of the biosphere. As the resources of any ecosystem are finite, so is the latter's carrying capacity; hence, beyond a point, each additional inhabitant has a negative impact on the productivity of resources; this in turn depresses labour productivity and incomes (see Figure 1). Policy-wise, this perspective leads to advocate population stabilization. At first sight, it thus seems redundant with policy prescriptions that emphasize the need to slow down population growth for the sake of enabling more productive investment and a higher rate of economic growth.



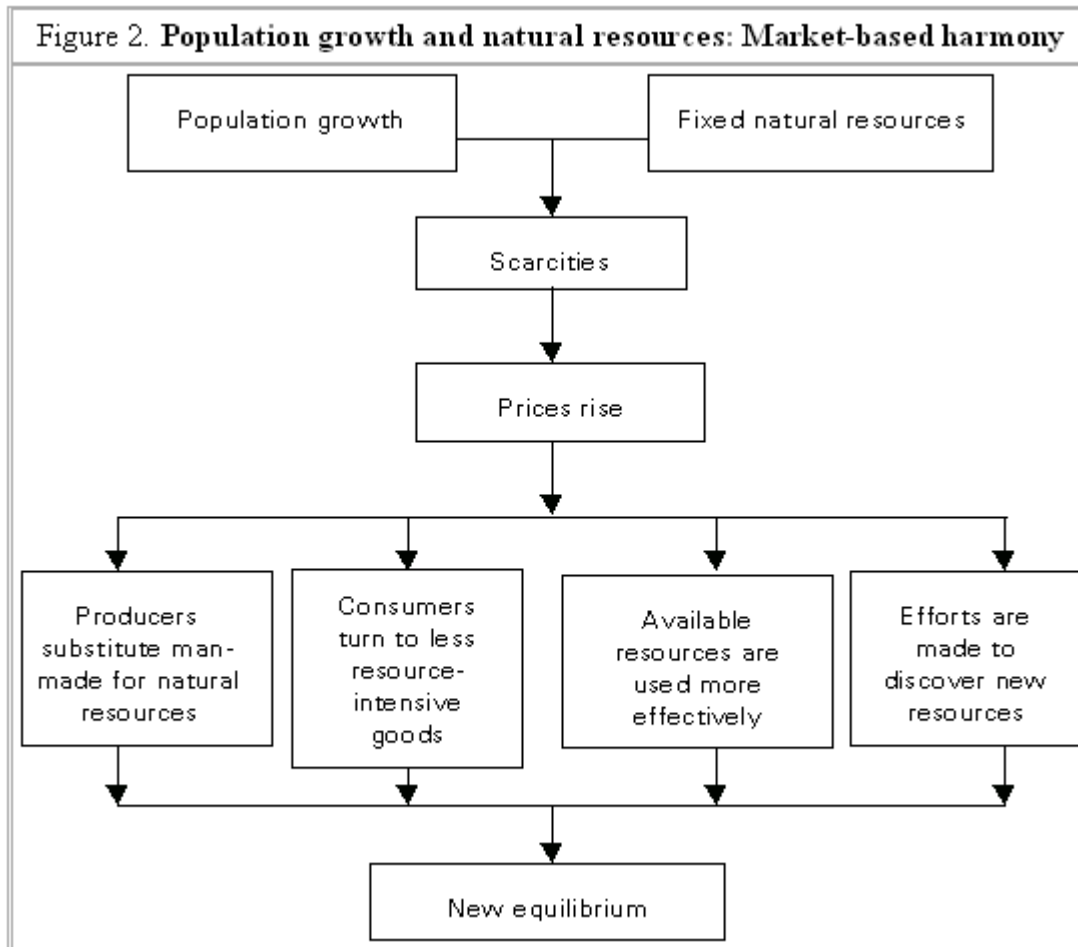
That, however, is not exactly the case. This perspective proposes that population growth must be stopped as soon as possible: this drastic goal is a logical consequence of explicitly raising the issue of the scale of human interaction with the environment (and therefore of limits to economic growth). Such a goal is not much on national agendas yet. The largely accepted policy merely seeks a slowdown; in fact, many of its proponents concede that slow population growth helps stimulate the economy, and they avoid addressing the long-term view and the difficult question of an eventual upper limit to population size. The fate of natural resources and the environment is absent from this perspective, but the concept of sustainable development now imposes a re-examination of the problem.

In fact, the two ideas (stabilizing population to protect the environment versus slowing population growth to foster more rapid economic growth) are at sharp variance. The problem is that economic growth, even coupled with slower population growth or even population stabilization, other things being equal, brings about greater environmental damage. It is frequently said that "sustained economic growth in the context of sustainable development", but the two concepts are mutually contradictory. In

conclusion, this perspective does add a dimension to the "population slowdown" doctrine, but it is a thorny dimension that does not necessarily facilitate advocacy work.

This view also recommends a balanced population distribution, i.e. a more even pressure on natural resources. It is difficult to make much of that policy-wise. First of all, the population of a given territory can exert very different degrees of pressure on land, water, biomass, and other resources, because those may be present in different quantities and qualities. Some concepts may be of help here, for instance the "potential population-supporting capacity" (PPSC). But human pressure also depends on resource-specific patterns of use, which also vary across space, cultures etc. Equalizing degrees of resources exploitation depends on much more than population distribution, because non-resident populations participate in that exploitation (e.g. urban dwellers require agricultural products or water - in greater quantities than rural people - so they too exert a pressure on rural resources). In sum, this policy recommendation is potentially very relevant, but it requires conceptual deepening and the development of appropriate methods of analysis.

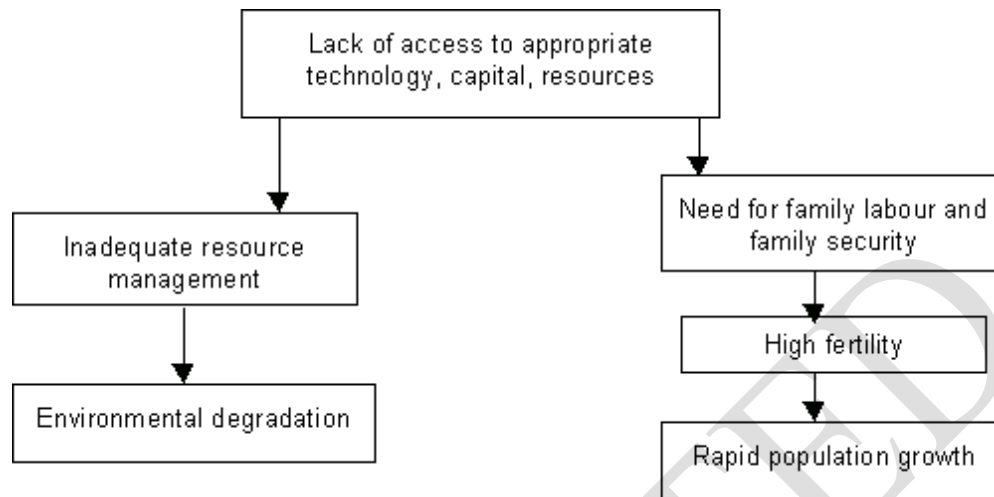
A major source of criticism to the natural science view is based on neo-classical economics and market-based adjustment mechanisms (see Figure 2). In this framework natural resources degradation is not necessarily a problem, since resources can be depleted at an acceptable rate, i.e. one that allows the market to replace those resources by alternative ones for the future ("efficient depletion"). Excessive degradation also may happen, either as a temporary consequence of population growth while adaptations take place, or as a structural problem where markets do not work efficiently (because some resources are not privately held and because prices do not reflect the scarcities and "sustainable values").



The policy prescription deriving from the neo-classical perspective is to give full efficiency to the market, meaning: define and price the use of common property resources; do not subsidize the exploitation of natural resources; and let the market, not the government, allocate resources. In this view population policy may "buy time", but it is not a "proper solution". This perspective leaves no role for population policies and programmes (else, of course, than their health value).

A third perspective (sometimes labelled *political ecology*) argues that environmental degradation and rapid population growth are both consequences of poverty (see Figure 3). In this framework, resource degradation is the result of poor farmers eking out a living in marginal areas, with few resources and an inappropriate technology. Distortions in social structures, particularly unequal land distribution, inequitable relationships between landowner and tenants, limited access to credit, and biases in technology against small peasants, are designated as culprits.

Figure 3. **Population growth and natural resources: Dual effect of poverty**



Policy-wise, this line of thought sees usefulness neither in population policy nor in mere technical interventions (such as terracing to fight land degradation), that it regards as inefficient as long as the "real" factors of degradation are not addressed. Therefore, it advocates poverty alleviation, through a more equitable distribution of resources and the redressing of distorted relations both within developing societies and between countries. This policy conclusion is entirely redundant, since the objective of poverty alleviation imposes itself on mere grounds of human rights, without any need to assume that it is the single most effective manner of tackling environmental problems.

Unlike natural resource degradation issues, there has been little analysis of the role of population dynamics in pollution. Soil, air and water pollution is mostly urbanization- and industry-related: rural pollution by agricultural chemicals (or local mining or industrial activities) is limited if compared to industrial wastes from urban areas ^[4]; domestic wastes are a much more serious problem in urban areas than in rural ones because they are emitted in much higher quantities on a per caput basis; and population concentration plays a specific role in that it physically makes the dispersion of pollutants in the air or water much more difficult.

These problems cannot be much alleviated by population policies. They have to do mostly with [a] economic and technological models that favor mass production and place paramount value on GDP and income considerations, downplaying quality of life (including health) and the importance of a clean and pleasant environment; and [b] careless individual and household behavior. Population composition has been shown to play a small part, in that household structure affects greenhouse gas emissions, but it is not likely to be a policy variable for emission reduction policies ^[5]. As for population

concentration, it is the very substance of urbanization; of course, one may seek to keep population and housing densities within ecologically (and socially) acceptable limits.

Some policies have attempted to reduce the rate of growth of urban agglomerations, but clearly the margins for intervention are limited in this domain. It is sensible to aim to harmonize urban population growth rates with the rates of growth of productive employment in cities, just like national policies aim to moderate overall population growth in order to enable tackling investment and equipment needs in a more progressive and orderly way. But this should be done by reducing the "push" factors in rural areas, especially when this leads to redressing unjustifiable inequities.

Finally, population has been viewed as an *intermediate variable*: technical, economic or social variables (e.g. poverty, defective markets, polluting technologies, distortionary policies etc.) would work "through" population growth, which merely "exacerbates" the effects of these processes. Of course the broad policy conclusion then is that measures are needed to attack the "root causes". However, population policy in this framework is accepted, as it "buys time". Further, the population variable is viewed by some as more tractable than some other factors, especially those more politically charged such as the urban bias, land mismanagement or distortionary fiscal and price policies ^[6]. Accordingly, it has been for instance recommended to focus population policies on the more ecologically problematic areas, or to focus family planning efforts on landless families (thus also contributing to improve human capital).

3.2 Environmental issues: relevance of population dynamics

How do we enter the debate between the conflicting theoretical and policy perspectives when it comes to providing advice on their application at the country level? I think we have a duty to say that population dynamics do matter, and to show why and how.

- ✚ Opponents of the natural science perspective stress the static character of the model. In reality, this perspective does not ignore the role of technological change in enabling adaptations, and therefore in accommodating more population. But in this view technology merely "buys time": it is a temporary remedy, with increasing costs, and an ultimately limited capacity to solve problems. Critics reply that this underrates the adaptive capacities of humankind, and point for instance to the record of technological successes of the last century. But, in turn, the natural science perspective asks: must we mobilize ever more technological ingenuity and resources simply to crowd up the ecosystem with human beings?

- ✚ The neo-classical perspective underrates the importance of population growth, whose place in the theory is flawed in two manners: (a) population growth is not a one-time event, but a continuous process: therefore, the necessary adaptations must

be continuous also and their failures cannot be regarded as a temporary inconvenience; and (b) "true prices" reflecting expected future values would be affected by the rate of population growth, as the latter increases competition for resources - hence discount rates - and raises amortization costs. Conversely, this perspective overrates the capacity of markets to generate a sustainable use of resources. If anything, markets have been shown not to adequately take into account the long-term view. Intergenerational equity can only be entrusted to a collective entity, also because decisions based on private utility functions usually ignore the ecological and social functions of the environment (e.g. aquifer recharge, flood control, health protection). Indeed, private property does not guarantee that resources will be managed with a concern for long-term sustainability.

- ✚ The "political ecology" analysis does provide an explanation for situations in which the outcome contradicts expectations based on the mere population-resources ratio, but it also has limitations. One of those is the rejection of a territory's carrying capacity as a significant factor in ecological outcomes - a view contradicted by empirical data, since population/PPSC ratios are rather well correlated with the incidence of land degradation . Another is the simplification of the poverty-fertility linkage (there is high fertility in a number of high-income populations, while in certain institutional and cultural contexts poverty may trigger a fertility transition) . Yet another is the neglect of the influence of population dynamics on poverty. Access to natural resources is affected, among others, by population density: population pressure "is an important and reinforcing link in reducing that access to sectors of an agrarian population" so that, while not causing inevitably land degradation, it "may almost inevitably lead to extreme poverty when it occurs in underdeveloped, mainly rural, countries". And inequality reduction is insufficient as a remedy when that pressure is strong .

Besides, the idea of a causal linkage between poverty and environmental degradation is questionable. Poverty has been seen as contributing much to resource overuse in developing countries: "poor households are often virtually forced to overuse natural resources for daily subsistence. Thus, landless farmers colonize tropical forests, or [cultivate] highly erodible hillsides. Rural households in fuelwood-deficit countries strip foliage and burn crop and animal residues for fuel rather than using them for fertilizer and this contributes to desertification. Underemployed men in coastal villages overexploit already depleted inshore fisheries". But this view seems to be an illusion caused by the fact that the damage caused by the poor - unlike that caused by the affluent - is immediately visible at their doorsteps. The poor "possess neither fields nor livestock. Since they have no access to land, they cannot degrade it"; overall, "consumption and waste per person is also lowest among the poorest ... all in

all, the poor probably tread lightest of all upon the earth, and do less damage to the environment than any other group. They are victims, not perpetrators" .

- ✚ The view of population as an intermediate variable recognizes the value of policies that slow down population growth. On the other hand it is conceptually poor - it contains no useful economic or social analysis and offers no guidance on key possible policy variables and linkages between those.

The pressure of human activities on natural resources can arise from a host of factors: a large or growing population; outside market demands; the nature of agricultural activities; or institutional, social and economic conditions which lead to the extraction of surpluses from the land managers, forcing them in turn to extract from the resources more than is sustainable. Such conditions may be: heavy tax or tribute; very low wages; denial of access to CPRs; low commodity prices due to state intervention or market distortions; indebtedness; and so on.

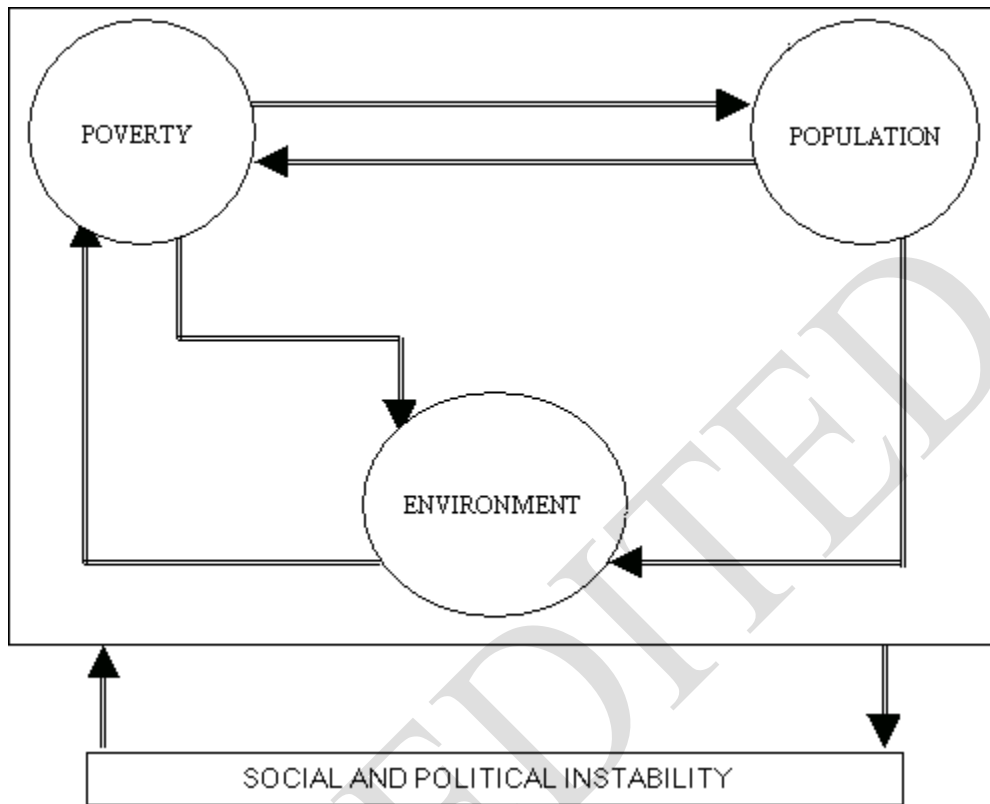
In this context, population factors appear both as part of the basic conditions within which the socio-economic system operates (population density with regard to resources) and of the forces that affect its patterns of change (population growth, urbanization, migration). Density is relevant to the level of direct pressure on resources; population growth and urbanization affect the volume of market demands; urbanization absorbs land, and is conducive to biased pricing policies; a large and growing rural labour force contributes to low wages.

Population dynamics must be taken into account, and it must be regarded as more than an exogenous variable: two-way linkages between population change and other elements of the system must be recognized. A systemic view of the "linkages" is therefore needed. This being said, what specific, self-standing policy recommendations can we reasonably sustain?

3.3 A policy analysis perspective

How should policy analysis orient itself in the "population-poverty-environment nexus"? The negative view of a nexus is that the elements are linked in a vicious circle, so that people are caught in a deadlock if not in a downward spiral. Figure 4 is a simplified image of one such nexus.

Figure 4. "The P-P-E spiral"



The detailed linkages in Figure 4 are as follows:

✦ **"Poverty" affects "population" through:**

- High child death rates lead parents to compensate or insure by having more children.
- Lack of water supply, fuel and labour-saving devices increases the need for children to help in fields and homes.
- Lack of security in illness and old age increases the need for many children.
- Lack of education means less awareness of family planning methods and benefits, less use of clinics.
- Lack of confidence in future and control over circumstances does not encourage planning - including family planning.
- Low status of women, often associated with poverty, means women often uneducated, without power to control fertility.

- ✦ **"Population" affects "poverty" through:**
 - Unemployment, low wages for those in work, dilution of economic gain.
 - Increasing landlessness - inherited plots divided and subdivided among many children.
 - Overstretching of social services, schools, health centres, family planning clinics, and water and sanitation services.
- ✦ **"Poverty" affects "environment" through:**
 - Difficulty in meeting today's needs means that short-term exploitation of the environment must take priority over long-term protection.
 - Lack of knowledge about environmental issues and long-term consequences of today's actions.
- ✦ **"Environment" affects "poverty" through:**
 - Soil erosion, salination, and flooding cause declining yields, declining employment and incomes, loss of fish catches.
 - Poor housing, poor services and overcrowding exacerbate disease problems and lower productivity.
- ✦ **"Population" affects "environment" through:**
 - Increasing pressure on marginal lands, over-exploitation of soils, overgrazing, over cutting of wood.
 - Soil erosion, silting, flooding.
 - Increased use of pesticides, fertilizer, water for irrigation- increased salination, pollution of fisheries.
 - Migration to overcrowded slums, problems of water supply and sanitation, industrial waste dangers, indoor air pollution, mud slides.

The positive view of a nexus is that progress in one of the interlinked sectors is likely to generate positive effects on the others. For instance: "efforts to slow down population growth, to reduce poverty, to achieve economic progress, to improve environmental protection, and to reduce unsustainable consumption patterns are mutually reinforcing".

But, since efforts in one sector will meet constraints rooted in the other sectors, the question arises: if there are vicious circles of population-poverty-environmental change, how much do conventional policy formulations help? For instance, "eradication of poverty will contribute to slowing population growth and to achieving early population stabilization". But it also adheres to the common wisdom that sustained economic growth "is essential to eradicate poverty". On the other hand, rapid population growth is an obstacle to sustained economic growth.

Ostensibly ignoring this vicious circle implies a belief that it can be broken simply by cumulating classical sectoral policies. Thus a more "comprehensive" view of population,

development, poverty and environment did not produce any new policy perspective - because it contained no paradigm of the nature of the articulations between key phenomena. But in policy analysis work we cannot content ourselves with assuming general synergies: we must seek specific sectoral approaches that strengthen, and benefit from, those adopted in the connected sectors. In order to do that, we need to identify and address key articulation points of the single issues.

Taking as a starting point the need for improving environmental policy, here follow a few ideas derived from the preceding considerations.

- ✓ A basic step is the identification of the country's or region's *priority environmental issues*. One sensible approach to that identification, from our viewpoint, would be to quantitatively assess and compare the impacts of the various issues on human populations. The task of assessing, comparing and classifying those impacts is complex, but probably no more than other valuation and decision problems that are tackled in various fields of human activity through multicriteria analysis techniques. The criteria should not be only economic, but include for instance labour use and health indicators, with a gender dimension. The size of populations affected would be an important consideration in assessing priorities. This would go some way towards recommendation to "assess human vulnerability in ecologically sensitive areas and centres of population to determine the priorities for action at all levels, taking full account of community-defined needs".
- ✓ When the possibilities for designing broad strategies from scratch are limited - because there exist on-going sectoral strategies and programs with their institutional stakes - the problem is to provide advice as to how to redirect existing policies to seek [a] greater *internal efficiency* and [b] greater *synergies*.
- ✓ The efficiency concern points to the need to address the *processes* that underlie specific demographic, poverty and environmental outcomes (creating an overall favourable context through legislation, IEC and macro-economic measures is not enough). For example, abating high rural fertility entails an understanding of the economic and social functions of large family sizes in rural societies. It also entails synergetic economic and social policies that modify those functions. Likewise, improving environmental outcomes requires addressing the various actors in those outcomes and their rationales.
- ✓ On this latter point, when looking for policy variables, it may be useful to think in terms of *chains of explanation*: with the land degradation issue, for instance, the chain "starts with the land managers and their direct relations with the land ... [The] next link concerns their relations with each other, other land users, and groups in the wider society who affect them in any way ... The state and the world economy constitute the last links in the chain".

- ✓ The operationally important processes will often be *location or group-specific*: their causes (and consequences) differ from one ecological, economic and socio-cultural context to another. Environmental problems are known to be highly location-specific. Demographic dynamics and patterns can vary significantly among groups of population defined e.g. along socio-economic or cultural lines. Likewise, constraints differ among categories of poor (urban/rural, with/without access to land, early/late in the family life cycle, etc.). Across-the-board policies in these conditions are far less than optimal instruments, and disaggregated scales of analysis (in the geographic sense but also in the social sense) are useful.
- ✓ The concern for synergies points to the need for identifying sectoral policies that are most likely to have a positive effect on a connected sector (and possibly positive feedbacks on the sector directly concerned). This requires a sensible representation of the key linkages in the context at hand (territory and population). In forming such a representation, the theoretical perspectives reviewed above can be useful, but probably no more than as hypotheses, because the respective relevance of population pressure, market failures, will vary from one place to another .
- ✓ Policies should be built upon an understanding of the rationality of *households* - where migration, labour use, mixes of economic activities, production techniques etc. are decided. The household is the right locus to seek policy measures that facilitate population-poverty-environment adaptations.
- ✓ A central concern should be the *productivity of labour* . Women's labour is of special relevance, not only on equity and health grounds, but also because children's labour often is a complement or substitute for it. In such situations, low female productivity has been shown to be an incentive to high "demand" for children. Progress in this respect reduces the need for large families, improves health conditions, alleviates poverty and, if it increases flexibility of time use, enables better management of the local resources and environment. But from the viewpoint of sustainability it is important that this does not bring about a higher rate of exploitation of the resources. Hence, the priority should be on implementing productivity-raising measures in areas least at risk of resource degradation.

Today's consumption is undermining the environmental resource base. It is exacerbating inequalities. And the dynamics of the consumption-poverty-inequality-environment nexus are accelerating. If the trends continue without change - not redistributing from high-income to low-income consumers, not shifting from polluting to cleaner goods and production technologies, not promoting goods that empower poor producers, not shifting priority from consumption for conspicuous display to meeting basic needs-today's problems of consumption and human development will worsen.

... The real issue is not consumption itself but its patterns and effects.

... Inequalities in consumption are stark. Globally, the 20% of the world's people in the highest-income countries account for 86% of total private consumption expenditures - the

- Poorest 20% a minuscule 1.3%. More specifically,
- The richest fifth Consume 45% of all meat and fish, the poorest fifth 5%.
- Consume 58% of total energy, the poorest fifth less than 4%.
- Have 74% of all telephone lines, the poorest fifth 1.5%.
- The richest Consume 84% of all paper, the poorest fifth 1.1%.
- Own 87% of the world's vehicle fleet, the poorest fifth less than 1%.
- Runaway growth in consumption in the past 50 years is putting strains on the environment never before seen.

Take for example the United States. With around 5 percent of the world's population, the US consumes about 40% of the world's resources and emits around 21% of the world's carbon dioxide, a greenhouse-causing gas. The United States, however, is not over-populated, but the consumption-based life style does have its effects.

The wealthy have been able to influence the economic conditions to benefit them and maintain dependency and poverty in the poorer nations. Reducing populations in poorer countries without addressing economic justice issues and so on could lead to further poverty and marginalization of other people while giving a rest bit to the environment, further legitimizing calls that the poor are to blame for most environmental degradation.

Chapter Three

3. Issues related with development

3.1. Sustainability

The increasing stress people, businesses and organizations put on resources and environmental systems such as water, land and air cannot go on forever. To tackle this challenge we need to make sure that we live within environmental limits.

What is sustainable development?

Sustainable development is a socio-ecological process characterized by the fulfillment of human needs while maintaining the quality of the natural environment indefinitely. The linkage between environment and development was globally recognized in 1980, when the International Union for the Conservation of Nature published the *World Conservation Strategy* and used the term "sustainable development."

The concept came into general usage following publication of the 1987 report of the Brundtland Commission — formally, the World Commission on Environment and Development. Set up by the United Nations General Assembly, the Brundtland Commission coined what was to become the most often-quoted definition of sustainable development as development that "meets the needs of the present generation without compromising the ability of future generations to meet their own needs."

This definition is not operational and has created much antagonism and cognitive dissonance. This arises because sustainability is often taken to refer to processes that can be maintained indefinitely. This is, of course, not the case for economic growth and development, just as the world's exponential population growth is unsustainable. Development is thus *unsustainable* in this sense. If it were to mean *development of sustainability* rather than *sustainability of development*, there would be no contradiction, but sustainability is clearly being used as an adjective here. The issue is resolved when it is realized that 'sustainable' has a different meaning in this context; something like 'that which meets the needs of the present without compromising the needs of the future'.

The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and social-political sustainability.

Sustainable development means a better quality of life now and for generations to come. A widely-used definition of 'sustainable development' is: 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.

It means not using up resources faster than the planet can replenish, or re-stock them and joining up economic, social and environmental goals. It also influences decision making within organizations, and therefore can go towards forming principles and business ‘values’ - for example, providing information to the public in an open and accessible way and involving people and communities who are affected by those decisions. Or in openly reporting how they run their business and the care they take about the local environment and the people that work for them.

These principles can also apply to government policies – for example, in planning regulations for green buildings and technologies.

It is also about being clear and responsible about the use of scientific, and other, evidence – for example, about levels of pollution or carbon emissions.

Sustainable development covers a very wide range of activities. Example: In the UK, four key areas have been identified:

- ✚ *Sustainable consumption and production*: changing the way products and services are designed, produced, used and disposed of – in short, achieving more with less
- ✚ *Climate change and energy* – reducing greenhouse gas emissions in the UK and worldwide whilst at the same time preparing for the climate change that cannot be avoided.
- ✚ *Natural resources* – understanding the limits of the natural resources that sustain life, such as water, air and soil.
- ✚ *Sustainable communities* – looking after the places people live and work, for example, by developing green, open spaces and building energy-efficient homes

It seems reasonable to interpret sustainable development as development that can continue “forever” or at least for a very long time; say, for several generations. Fundamentally: sustainable development is increasing well-being over a very long time. Yet more fundamentally: sustainable development is increasing consumption, following its broadest economic interpretation, over a very long time.

It is clear that the time dimension is crucial in sustainable development; it is a dynamic concept. It is a development path that can or cannot be continued over a very long time. Any given point along the path will be difficult, if not impossible, to characterize as sustainable. The reason is that innumerable alternative development paths follow from a given point. Some of these paths will be sustainable and others will not. However, simply being sustainable does not make a development path desirable. It also matters whether it is the sort of development path society wants to follow and this depends on what determines well-being for its members. Measuring well-being at points over time

gives evidence whether the current development path is in line with societal goals and hence worth sustaining or not.

Population and Sustainable Development

Environmentalists and economists increasingly agree that efforts to protect the environment and to achieve better living standards can be closely linked and are mutually reinforcing. Slowing the increase in population, especially in the face of rising per capita demand for natural resources, can take pressure off the environment and buy time to improve living standards on a sustainable basis.

Although it is not clear whether in the long run rapid population growth causes poverty, "it is clear that high fertility leading to rapidly growing population will increase the number of people in poverty in the short run and, in some cases, make escape from poverty more difficult," observes researcher Dennis A. Ahlburg. It is difficult to make investments for the future when resources are already fully used trying to keep up with the current needs of rapidly growing populations.

As population growth slows, countries can invest more in education, health care, job creation, and other improvements that help boost living standards. In turn, as individual income, savings, and investment rise, more resources become available that can boost productivity. This dynamic process has been identified as one of the key reasons that the economies of many Asian countries grew rapidly between 1960 and 1990.

In recent years fertility has been falling in many developing countries and, as a result, annual world population growth has fallen to about 1.4% in 2000 compared with about 2% in 1960. The UN estimated recently that population is growing by about 78 million per year, down from about 90 million estimated early in the 1990s. Still, at the current pace world population increases by about 1 billion every 13 years. World population surpassed 6 billion in 1999 and is projected to rise to over 8 billion by 2025.

Globally, fertility has fallen by half since the 1960s, to about three children per woman. In 65 countries, including 9 in the developing world, fertility rates have fallen below replacement level of about two children per woman. Nonetheless, fertility is above replacement level in 123 countries, and in some countries it is substantially above replacement level. In these countries the population continues to increase rapidly.

About 1.7 billion people live in 47 countries where the fertility rate averages between three and five children per woman. Another 730 million people live in 44 countries where the average woman has five children or more.

Almost all population growth is in the developing world. As a result of differences in population growth, Europe's population will decline from 13% to 7% of world population over the next quarter century, while that of sub-Saharan Africa will rise from 10% to 17%. The shares of other regions are projected to remain about the same as today (169).

As population and demand for natural resources continue to grow, environmental limits will become increasingly apparent. Water shortages are expected to affect nearly 3 billion people in 2025, with sub-Saharan Africa worst affected. Many countries could avoid environmental crises if they took steps now to conserve and manage supplies and demand better, while slowing population growth by providing families and individuals with information and services needed to make informed choices about reproductive health.

Family planning programs play a key role. When family planning information and services are widely available and accessible, couples are better able to achieve their fertility desires. "Even in adverse circumstance—low incomes, limited education, and few opportunities for women—family planning programs have meant slower population growth and improved family welfare," the World Bank has noted.

If every country made a commitment to population stabilization and resource conservation, the world would be better able to meet the challenges of sustainable development. Practicing sustainable development requires a combination of wise public investment, effective natural resource management, cleaner agricultural and industrial technologies, less pollution, and slower population growth.

Better resource management protects the environment and preserves nature's productive capacity. Stronger economies can afford to invest more in protecting the environment. Slower population growth can speed economic growth and conserve natural resources.

Population and development

Economic development refers to the structural transformation of human society from subsistence economy to urban-industrialism, and to the sustained rise in productivity and income those results. The transformation is seen in the structure of production, consumption, investment, and trade; in financial and other economic institutions; in occupations, educational levels, health conditions, and rural–urban residence; and in people's perceptions of the social and natural worlds and of their own agency. Political development is in some respects an overlapping process, yielding the institutions and values of the democratic state. "Development," however, is commonly taken to mean economic development.

Development is linked in various ways to population change. The transformation in demographic regimes from high to low death and birth rates—the demographic transition— can be added to the list of structural changes constituting development: indeed, in terms of its direct effect on human well-being and its social and economic implications, it is arguably the most important of those changes. Population growth, unleashed by mortality decline or migration, is a force of its own in the development process, sometimes seeming to promote development, at other times impeding it, and always diluting its achievements. While countries are the principal level at which such relationships are identified, effects at the local level are often sharper. And population change can also have implications for broader regional development and even for the global economy—directly through migration and disease transmission or indirectly through effects on geopolitics and major environmental systems. Breaking down population growth by age group, source (in particular, natural increase versus migration), and other characteristics reveals further links. The subject of population and development is concerned broadly with all such interactions: with how populations and economies impinge on each other and with the consequences that ensue.

Population size and Development

Under the mercantilist doctrine that prevailed in early modern Europe a larger population was valued as a source of a nation's wealth. Malthusianism punctured that belief. From Malthus onward, both popular and official opinion has tended to see population growth as a threat to development. Increases in production could only too easily be dissipated through additions to population rather than invested in capital accumulation.

Resource scarcities—in arable land, later also in other natural resources—were seen as always looming on the horizon and were brought nearer by demographic expansion. Malthusian views lay behind India's concerns about its population growth both prior to and after independence. They were the basis of China's sudden conversion in the 1970s to a policy of hard-nosed birth control. They attained wide prominence in the West in the same decade through the *Limits to Growth* thesis propounded by environmentalists. Malthusian thinking had a more chequered history in economics. Resource-dependence has been steadily reduced as technology has advanced and human capital has grown. Nonrenewable resources have found vastly expanded supplies in some cases and ready substitutes in others, banishing fears of an era of diminishing returns and rendering earlier worries about the imminent exhaustion of particular resources (coal, for instance) almost quaint. As Barnett and Morse (1963) wrote: “the social heritage consists far more of knowledge, equipment, institutions, and far less of natural resources, than it once did.” Resource constraints cannot be wholly assumed away, especially if development is equated with human well-being. Fresh water is often mentioned as a potentially limiting factor; so-called positional goods, such as unique environments, are by definition scarce

(see Hirsch 1976). Standard measures of economic performance mask the effects of changes in the natural environment—or in the “environmental services” it provides: these may be a significant ingredient of human welfare, but yet remain statistically invisible. Aesthetic criteria generally, and hence a whole range of quality distinctions—in production and consumption as well as in environmental conditions—tend to be neglected when it comes to measurement.

Population–resource interactions are mediated by human institutions: markets or management regimes that serve to ration access to the resource by potential users. In some circumstances, these procedures break down, or possibly they never emerged in the first place, leading to depletion or degradation as the demands on the resource increase. A classic stylized account of this, intended to model possible external effects of population growth, is Garrett Hardin’s (1968) “tragedy of the commons.” The tragedy is the decline through overuse—and through institutional ineffectiveness—of an open access, common-property resource. Analogues of these local-level problems may exist at higher levels of social organization, even internationally.

Population growth and Development

Twentieth-century theorizing about development was influenced by neoclassical growth models that allowed steady expansion of both economies and populations, with technological progress given a central role in outcomes. Any adverse effects of the overall scale of the economy in relation to its resources were assumed negligible—or outweighed by positive effects. Some economists saw population growth actually boosting technological change—a case supported by the work of Ester Boserup on long-run agrarian change. Many others saw population growth as a fairly neutral factor in development performance. The range of viewpoints is captured by two major reports on the subject from the US National Academy of Sciences, from 1971 and 1986: the first found a strong economic case for limiting population growth, the second at most a very weak one. Whatever the theoretical arguments, in the post–World War II decades, at least until the 1980s, aggregate income data did not support a significant negative effect of population growth on development: at the country level the years of fastest economic and demographic growth often coincided.

Effects of development

The effects of economic development on mortality and fertility growth are the subject of the “theory” of demographic transition. This theory came into favor and then into disfavor along with modernization theory, to which it has a close connection. In very brief summary, child mortality began to fall as economic conditions improved and early public health measures were adopted. The larger number of surviving children imposed economic pressures on families. At the same time, industrialization and urbanization

brought wider cultural horizons and greater opportunities for mobility, both social and geographic. The transformed labor market and rising consumption and investment demands, when translated into effects on the utilities and costs of children (notably, education costs), created conditions favoring smaller families. Parents responded by limiting the number of their children.

The contributing factors to the mortality decline have long been clear: more reliable food supplies and better nutrition; improved knowledge and practice of hygiene; public health interventions—in particular, improvement in water supply and sewage disposal; vaccination and other medical advances; better housing; and improved public order. The weighting of these factors in particular historical cases is often a matter of contention. For contemporary poor countries, however, the analogous debate has been over the relative significance of medical knowledge transferred from the developed countries, expansion of public health facilities, and improved social and economic conditions.

In a pioneering study, Samuel H. Preston (1975) showed that there was a reasonably tight but nonlinear relationship between life expectancy and per capita income among countries at a given time, and that this relationship has shifted systematically over time. The approximate relationship around 1990: it is steep at low income levels, but flattens out at higher levels. It is also indicated the shifts in the relationship over time, drawing on sparser historical estimates. The major shifts have been twofold:

- ✚ A decline in the per capita income level (in purchasing-power terms) at which this flattening takes place— that is, in the income level above which further income increases can be expected to make only slight contributions to improving mortality; and
- ✚ An overall upward shift of the life expectancy–income relationship: a country with a given real per capita income today is likely to have considerably lower overall mortality than a country reaching the same income level some decades earlier would have had.

On fertility decline, the large volume of research on the topic has not yielded the degree of convergence that might have been expected. To the extent that fertility decline merely maintains the number of surviving children of earlier and higher-mortality times, fertility transition could be seen as an initially conservative response to changing circumstances.

The stimulus for change would be larger numbers of children in the household and increased crowding in the job market (see Montgomery and Cohen 1998). Moreover, since the uncertainties about child survival at the family level are reduced as mortality falls, birth planning makes more sense. Confining family-level responses to the single dimension of fertility change, however, is an arbitrary constraint. Families have migration

options, especially in an industrializing economy, and they can make adjustments through changes in productivity and labor supply. A simple rule for fertility transition was not to be expected.

Population and Development futures

In broad outline, the global economic and demographic trends observed over the second half of the twentieth century would support an expectation over the next half century of continued, if uneven, improvement in economic conditions and, partly in consequence, an approaching end of the demographic transition. That demographic outcome, indeed, is the future built into the medium-variant population projections of the United Nations, which (in the 2000 revision) portray the world's fertility dropping from 2.8 children per woman in the 1990s to 2.1 ("replacement level") by around 2050, and life expectancy increasing in the same period from 65 years to 74 years. The world population, under this scenario, would rise from 6 billion in 2000 to 9 billion in 2050, but by then the annual increment would have dropped from 80 million people to around 40 million—and zero (and perhaps negative) population growth would be in sight. Closely tied to these trends would be a substantial aging of population, continued rapid urbanization in the less developed regions, and continuation of the major shift in the balance of world population toward the South.

The process of economic globalization that is underway is frequently depicted as a route to affluence open to all, although bringing with it not just new opportunities but also new systemic fragilities. More cautious or circumspect assessments of the future extrapolate emerging problems as well as favorable trends. Such problems include: supporting the necessary scale of transfer payments to the aged as their numbers multiply; avoiding fertility collapse to levels far below replacement, with its eventual implication of radical population decline; maintaining the quality of socialization and education of children in the face of crumbling families and local communities; lessening the ecological damage associated with rising average consumption levels; and coping not only with the large remaining public health agenda in poor regions but also with new or reemerging infectious disease threats. The future food situation, though in the aggregate far from dire by many informed accounts, is increasingly technology-dependent and regionally disparate. The greenhouse effect, the atmospheric warming caused by increased amounts of carbon dioxide and other gases, has the potential to create ramifying changes in the environment, affecting crop production (perhaps positively), disease vectors, natural ecosystems, sea levels, and weather patterns. Greenhouse gas emissions are linked to population growth as well as to industrialization.

Population change can have political consequences; and political developments, in turn, clearly have the capacity to modify future economic and demographic trends. "Failed states," according to Robert D. Kaplan (1996), owe their un governability partly to

population growth and the resource scarcities and urban congestion tied to it. Environmentally related political instability, some have argued, will become common in many regions. But while examples of economic retrogression and associated political turbulence will surely continue to be found in the future, so too will cases of recovery and eventual return to paths of stable positive growth.

At the international level, the drastic changes in population-size relativities among countries that are in train must have major political implications. Combined with persisting economic differences, they create fault lines for international conflict. International migration from poor to prosperous countries is another politically sensitive issue that will not lessen in importance—filling some part of the demographic deficit created by very low fertility, and in doing so forming the increasingly ethnically diverse populations of the Western world. There is scant sign that the subject of population and development will become chiefly of interest to historians.

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Chapter Four

Global environmental concerns

4.1. Climate change issues

4.1.1. Definition of basic terms

Weather: refers to the behavior of the atmosphere on a day-to-day basis in a relatively smaller area.

Climate: in a wider sense is the state, including the statistical description, of the climate system.

Climate variability

It refers to variations in the mean state and other statistics (such as standard deviations, statistics of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events.

Climate change

It refers to a change in a state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It may be due to internal processes and external forcing. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as: *Any change in climate over time, whether due to natural variability or as a result of human activity.*

Exposure

Exposure to climate variation is primarily a function of geography. For example, coastal communities will have higher exposure to sea level rise and cyclones, while communities in semi-arid areas may be most exposed to drought.

Sensitivity

It is the degree to which the community is affected by climatic stresses. A community dependent on rain-fed agriculture is much more sensitive than one where the main livelihood strategy is labour in a mining facility, for instance.

Adaptive Capacity

Adaptive capacity is defined as: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. One of the most important factors shaping the adaptive capacity of individuals, households and communities is their access to and control over natural, human, social, physical, and financial resources.

Vulnerability to climate change

It has been defined as: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Resilience to climate change

It can be defined as: The ability of a community to resist, absorb, and recover from the effects of hazards in a timely and efficient manner, preserving or restoring its essential basic structures, functions and identity. Resilience is a familiar concept in the context of disaster risk reduction (DRR), and is increasingly being discussed in the realm of adaptation. A resilient community is well-placed to manage hazards to minimize their effects and/or to recover quickly from any negative impacts, resulting in a similar or improved state as compared to before the hazard occurred. There are strong linkages between resilience and adaptive capacity; consequently, resilience also varies greatly for different groups within a community.

Adaptation to Climate Change

In order to reduce vulnerability to climate change, we must focus on building adaptive capacity, particularly of the most vulnerable people; and, in some cases, on reducing exposure or sensitivity to climate impacts. We must also ensure that development initiatives don't inadvertently increase vulnerability. We call this process adaptation.

Adaptation is defined as: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. The adaptation of human systems is a process which requires the engagement of a wide range of stakeholders at multiple levels and in multiple sectors. It requires analysis of current exposure to climate shocks and stresses, and model-based analysis of future climate impacts. It demands an understanding of the existing vulnerability of individuals, households, and communities. With this information, adaptation strategies can be designed and implemented. Monitoring and evaluating the effectiveness of activities, as well as sharing knowledge and lessons learnt, are critical components of the process.

Framing adaptation

Adaptation responses can be clustered into the following broad categories:

- ✓ Technological solutions — **grey measures**;
- ✓ Ecosystem based adaptation options — **green measures**;
- ✓ Behavioral, managerial and policy approaches — **soft measures**.

Green and soft measures specifically aim at decreasing the sensitivity and increasing the adaptive capacity of human and natural systems, basically, building resilience.

- ✓ They often provide low-cost solutions and we know enough for their implementation.
- ✓ High-tech and innovative technological solutions typically need funding and require more research, experience and training to be operated.

A suite of adaptation technologies or options — grey, green or soft — that are cost effective have to be identified, tested and scaled-up to respond to climate change.

The terms “adaptation” and “coping” are sometimes used interchangeably, leading to confusion about the similarities and differences between these two important concepts.

Coping

- + Short-term and immediate
- + Oriented towards survival
- + Not continuous
- + Motivated by crisis, reactive
- + Often degrades resource base
- + Prompted by a lack of alternatives

Adaptation

- + Oriented towards longer term livelihoods security
- + A continuous process
- + Results are sustained
- + Uses resources efficiently and sustainably
- + Involves planning
- + Combines old and new strategies and knowledge
- + Focused on finding alternatives

Anticipatory adaptation-adaptation that takes place before impacts of climate change is observed. It is also referred to as proactive adaptation.

Autonomous adaptation-adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. It is also referred to as spontaneous adaptation.

Planned Adaptation- Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Mitigation

An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.

- ✚ Mitigation concerns all policies and measures aimed at
 - ✓ Reducing the emission of greenhouse gases such as CO₂, or
 - ✓ Capturing GHG in forests, oceans or underground reservoirs.
- ✚ Two observations:
 - ✓ The more mitigation is undertaken, the less adaptation will be needed
 - ✓ While mitigation necessitates global analysis and global collective action, adaptation is necessarily local

Key Mitigation Practices

- ✓ Energy Supply
 - Improved supply and distribution efficiency
 - Renewable heat and power (hydro, solar, wind, geothermal)
- ✓ Transport
 - More fuel efficient vehicles; Biofuels
 - Modal shifts from road transport (rail, public transport,..)
 - Non motorized transport (cycling)
- ✓ Buildings
 - Efficient lighting and day lighting
 - More efficient electrical appliances
 - Improved cooking stoves
- ✓ Industry
 - More efficient end-use electrical equipment;
 - Heat and power recovery;
 - Material recycling and substitution;
 - A wide array of process-specific technologies.
- ✓ Agriculture
 - Improved land management to improve soil carbon storage
 - Restoration of degraded lands;
 - Improved rice cultivation techniques and livestock and manure management (CH₄ emissions);
 - nutrient and manure management; (Improved N fertilizer application techniques (N₂O emission));
 - Improved energy efficiency
- ✓ Forestry/Forests
 - Afforestation / reforestation, forest management
 - Reduced deforestation
- ✓ Waste

- Landfill methane recovery
- Waste incineration with energy recovery;
- Composting of organic waste;
- Waste water treatment,
- Recycling and waste minimization

Causes and consequences of climate change

It is widely accepted that the trend in rising global temperatures during the twentieth-century can be attributed to anthropogenic greenhouse gas emissions, stated with 90% certainty by the most recent report of the Intergovernmental Panel on Climate Change (IPCC 2007). Human activities are making the blanket "*thicker*"; the natural levels of these gases are being supplemented by emissions of carbon dioxide from the burning of coal, oil, and natural gas; by additional methane and nitrous oxide produced by farming activities and changes in land use; and by several long-lived industrial gases that do not occur naturally. The principal, human-generated greenhouse gases are; Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O) and Fluorinated Gases (Hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and sulfur hexafluoride (SF₆)).

UNFCCC: The journey

- ✚ The international political response to climate change began with the adoption of the UNFCCC in 1992,
 - ✓ sets out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse gases to avoid “dangerous anthropogenic interference”
- ✚ COP 3 in Kyoto, Japan (1997), agreed to a Protocol to the UNFCCC that commits industrialized countries and countries in transition to a market economy to achieve emission reduction targets.
- ✚ Bali Roadmap: COP 13 and COP/MOP 3 took place in December 2007 in Bali, Indonesia.
 - ✓ Established the *Ad Hoc* Working Group on Long-term Cooperative Action under the Convention with a mandate to focus on key elements of long-term cooperation identified during the Convention Dialogue: **mitigation, adaptation, finance and technology transfer.**
 - ✓ Established two negotiating “tracks” under the Convention (AWG-LCA) and the Protocol (AWG-KP), and set a deadline for concluding the negotiations at COP 15 and COP/MOP 5 in Copenhagen in December 2009.

- ✚ From Bali to Doha;
 - ✓ Copenhagen;
 - ✓ Cancun;
 - ✓ Durban;
 - Durban Package (KP 2, LCA, GCF, ADP)
 - Doha

Climate Change & Response Measures: Its implication to Africa's Development

Even with immediate and complete mitigation of emissions, an unlikely eventuality under the current political consensus, global impacts of such increasing temperatures are unavoidable; far less certain are the regional impacts. It is generally agreed, however, that economically developing and vulnerable countries will be hardest hit, being less able to adapt to future changes in climate.

Of all developing regions, Africa (and in particular sub-Saharan Africa) is likely to be the worst affected by any present-day climate variability and future climate change. The region is the only in the world to have become poorer in the last generation (Ravallion and Chen 2004), and although it comprises only 12% of the world's population (Population Reference Bureau 2009) it accounted for 28% of the world's poverty in 2005 (World Bank 2005, Washington et al. 2006). It has been estimated that 30% of the population of sub-Saharan Africa suffers from food insecurity and extreme poverty (Balasubramanian et al. 2007). As a whole, Africa's population has recently passed the one billion mark and is expected to double by 2050 (Population Reference Bureau 2009). This population explosion, underdevelopment and poverty can be attributed to many socio-economic, political and environmental factors, one of the most important ones being an inability to adapt to extremes of climate (such as flooding and drought) which are prevalent across the continent (Washington et al. C.J.R. Williams (B) and D.R. Kniveton 2006). Tropical Cyclones Gafilo and Eline in 2004 and 2000, respectively, highlight the sudden impacts of climate variability and extreme events on society, whereas more chronic climate extremes such as the East African and Sahelian droughts demonstrate the longer term impacts.

Therefore, even under the current highly variable climate conditions, the majority of sub-Saharan Africa is unable to cope with extremes in climate (e.g. IPCC 2001, Cook et al. 2004, Segele and Lamb 2005, Washington et al. 2006). With projections of future climate change suggesting that the continent will become drier (e.g. Desanker and Magadza 2001, Hulme et al. 2001, Thomas et al. 2005) and extremes more frequent (e.g. IPCC 2007), it is clear that the situation will worsen.

Africa is considered particularly vulnerable to the effects of climate change and climate variability, relative to many other regions of the world. African society possesses a low resilience and limited adaptive capacity to climate-related shocks and stresses, because of widespread poverty, an extensive disease burden and pockets of political instability across the continent. An improved understanding of African climate change and its likely impacts cannot be gained by studying one aspect alone, thus research on the subject of African climate change requires an interdisciplinary approach linking studies of environmental, political and socio-economic spheres. However this interdisciplinary approach has, for the most part, been lacking, with scientists conducting excellent research within their own spheres but often failing to communicate and discuss their findings (and implications) to other disciplines.

Climate change presents additional obstacles to ending poverty and achieving social justice. Rising temperatures, increasingly erratic rainfall, and more frequent and severe floods, cyclones and droughts all have significant consequences for the livelihood security of poor people; and development professionals are seeing first-hand the effects of a changing climate on their work around the world.

Climate Change & Response Measures: Its implication to Ethiopia's Sustainable Development

Why does climate change matter to Ethiopia?

Ethiopia did not cause climate change, but we are confronted by the threat that it poses, and should recognize the opportunity that it presents. Climate change is not a future possibility for Ethiopia, it is a present reality. That is why it is imperative that we start now to protect our people and our environment, while at the same time building a green economy that will help to realize the ambitions set out in the Growth and Transformation Plan.

Climate change highly matters to because Ethiopia's economy and social wellbeing are already exposed to climate variability and weather extremes. The country's GDP rises or falls about a year behind changes in average rainfall, economy is sensitive to climate variability, particularly variations in rainfall and Resources spent on disaster response can tie up a significant share of GDP; recovery, rather than growth, becomes the goal. The country is highly vulnerable to climate change impacts because of population pressure, fragile environments, dominance of climate-sensitive sectors in economic activity, and low autonomous adaptive capacity

Agriculture, primarily rain-fed and highly sensitive to fluctuations in rainfall, forms the basis of the economy providing approximately 46% of GDP and jobs for 80% of the

working population. Chronic food insecurity affects 10% of the population and even in average rainfall years these households cannot meet their food needs and they rely partly on food assistance. Droughts can result in sharp reductions in agricultural output and related productive activity and employment, with multiplier effects on the monetary economy. Floods regularly cause crop and infrastructure damage and widespread suffering and hardship, with, for example, several tens of thousands of people being displaced and over ten thousand hectares of cropland inundated in Afar and Amhara regions in 2010.

The close links between climate and Ethiopia's economy are reflected by the strong relationship between GDP growth rate and rainfall variability. Because Ethiopia's economy and the wellbeing of our people are closely linked to agriculture and the use of natural resources – water, land, forests, biodiversity and fisheries – adaptation and action towards climate resilience will come in part through focusing on improving performance and management in these areas with future climate change in mind. Ethiopia is also vulnerable to the health impacts of climate change, and to climate induced damage to transportation infrastructure. The implications of future climate change will be felt throughout these particularly vulnerable sectors, although secondary impacts will be felt more widely, for example in education and gender equity.

Livestock yields will be impacted directly through temperature effects on annual growth, milk and wool production and reproduction; and indirectly by changes in the quantity and quality of pasture, forage, grass and disease and increases in parasites.

Ethiopia is experiencing the effects of climate change. Besides the direct effects such as an increase in average temperature or a change in rainfall patterns, climate change also presents the necessity and opportunity to switch to a new, sustainable development model. The Government of the Federal Democratic Republic of Ethiopia has therefore initiated the Climate-Resilient Green Economy (CRGE) initiative to protect the country from the adverse effects of climate change and to build a green economy that will help realize its ambition of reaching middle income status before 2025.

The Climate-Resilient Green Economy (CRGE) initiative follows a sectoral approach and has so far identified and prioritized more than 60 initiatives, which could help the country achieve its development goals while limiting GHG emissions. The green economy plan is based on four pillars:

1. Improving crop and livestock production practices for higher food security and farmer income while reducing emissions
2. Protecting and re-establishing forests for their economic and ecosystem services, including as carbon stocks

3. Expanding electricity generation from renewable sources of energy for domestic and regional markets
4. Leapfrogging to modern and energy-efficient technologies in transport, industrial sectors, and buildings.

Rationale for Green Economy

Economic development

Achieve fast economic development in a resource-efficient way while taking advantage of the country's renewable energy resources.

Environmental sustainability

Limit GHG emissions to a minimum and promote carbon sequestration through reforestation, afforestation and reduced forest degradation.



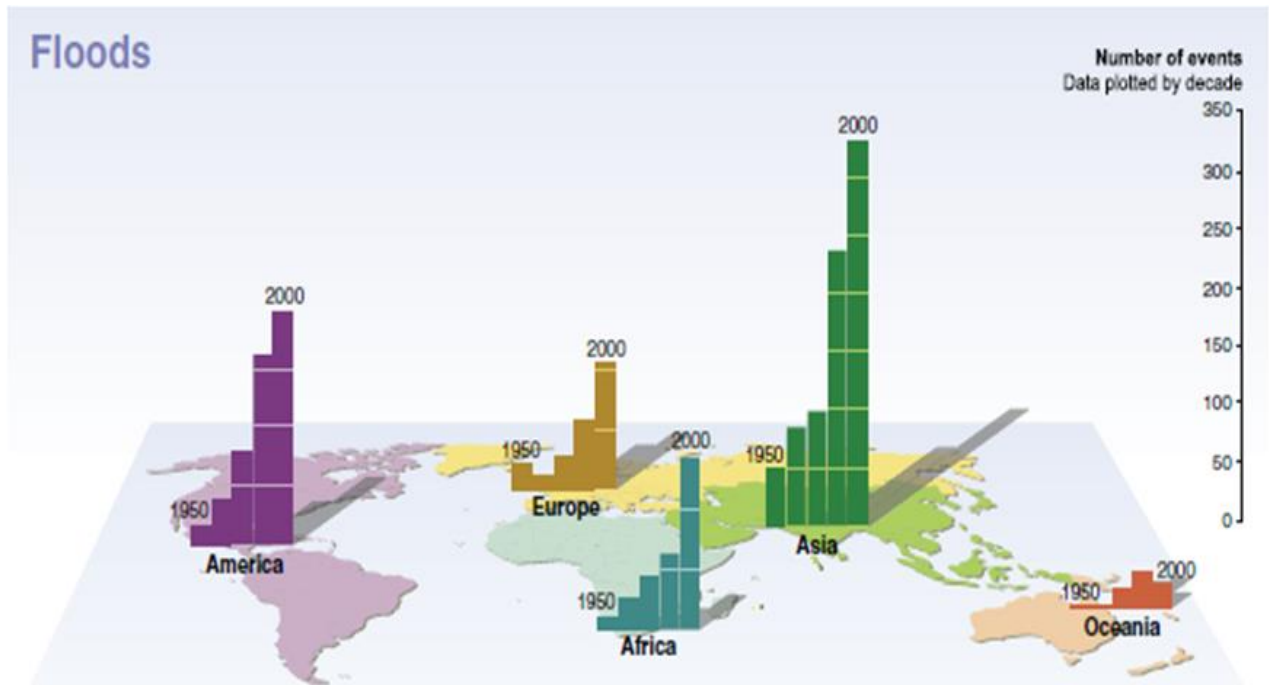
Observed climate change impacts

Temperature variability:

- Average global surface temperature increased by 0.6°C over the 20th century
- 1990s warmest decade; 1998 warmest year in 1000 years
- Over the last 50 years night time minimum increased by $0.2^{\circ}\text{C}/\text{decade}$

Precipitation variability: less confident than temperature changes because of regional processes. A shift in seasons of highest interest, yet uncertainty is the highest.

Extreme events: floods, droughts, tropical storms etc.



Implications for biodiversity

- ✚ Changes in species composition, distribution and abundance
- ✚ Species extinctions
- ✚ Tolerance to new conditions
- ✚ Spread of Invasive species facilitated
- ✚ Shifting distributions
- ✚ Genetic changes

Ecosystem

- ✚ Degradation, alteration and relocation of existing ecosystems
- ✚ Total collapse
- ✚ *“By the 2080s, 22% of the world's coastal wetlands, specifically salt marshes, mangrove forests and inter-tidal habitats, could be lost due to sea level rise alone” (Ramsar 2002)*
- ✚ Decreased productivity of natural ecosystems
- ✚ Coastal agriculture affected by erosion and saline intrusion
- ✚ *“Reduction in yield in some countries in Africa by 2020 could be as much as 50 percent, and crop net revenues could fall by as much as 90 percent by 2100 (Sharma 2007)*

Increasing water scarcity. Other regions suffer from excess water

Africa: “by 2020 between 75 and 250 million people will be exposed to an increase of water stress due to climate change” (IPCC 2007)

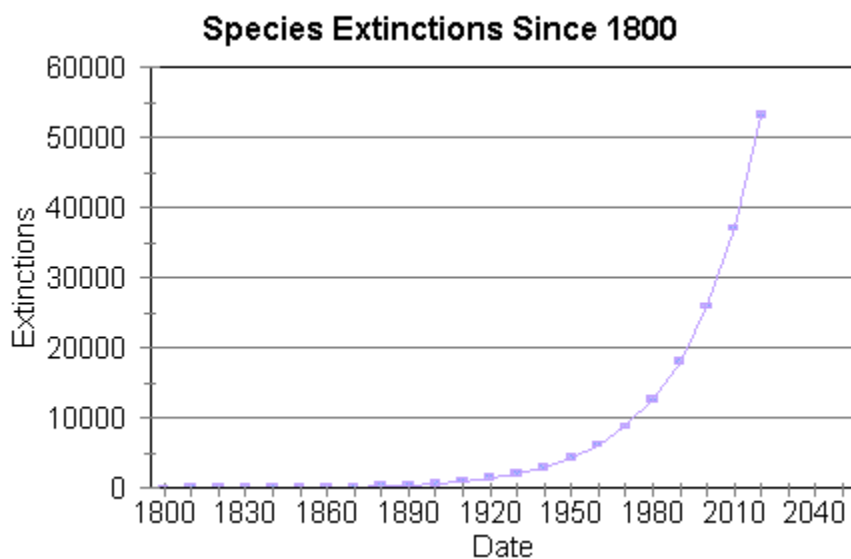
Ecological Degradation: A global snapshot

Five Key Areas of Concern

- Biodiversity Loss & Species Extinction
- Climate Change
- Resource Depletion
- Toxic Contamination
- Habitat Destruction

Biodiversity Loss & Species Extinction

- With the increase in population, one can see the loss of natural resources caused due to various human activities which in turn affects the ecosystems.
- Activities such as overfishing have even caused many species to be on the brink of extinction.
- Forests are being cleared to meet the rising demands for the need of paper, wood or even for land.
- Mining and the burning of fossil fuels have led to further depletion of resources. These are some of the current environmental issues we are facing today.
- With an effort from each individual, we can only hope to save our planet from being destroyed.
- 27,000 species are currently lost each year. At this rate 22% of all species will be extinct in 15 years.
- 50% of our food comes from 3 plants, wheat, corn, and rice



Resource Depletion

- 1.1. billion people do not have access to clean drinking water
- Less than 1% of the world's water can be used for drinking
- Global oil supplies will likely be depleted by 2050

Toxic Contamination

Toxic waste, from consumer products, industrial pollution, tailpipe exhaust, agricultural runoff and poor sewage treatment continue to put dangerous levels of contaminants into our air and water, leaving a long-term scar on the planet. These toxins cause a range of health problems from asthma attacks to cancer to developmental disorders.

Habitat Destruction

- Every second the planet loses two football fields of rainforest (that's 100 acres a minute!)
- Habitat Destruction leads to species extinction, climate change and resource depletion
- Habitat Loss:
 - African Nations: 68%
 - Asian Nations: 69%
 - Mexico 66%

Why is ecological degradation a social justice issue?

- ✓ Disproportionately affects the poor and powerless
- ✓ First World consumption drives resource depletion & industrial contamination in the developing world

_____ *The end!!!* _____