FUNDAMENTALS OF MODERN AGRICULTURE

(GENERAL PRINCIPLES)

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CHAPTER NINE

AGRICULTURE AND THE NATURAL ENVIRONMENT

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CHAPTER OBJECTIVES

At the end of this chapter, readers should be able to:

i. Explain the meaning and functions of the natural environment.
ii. Identify the categories of natural resources and the features of each category.
iii. Explain the nature, causes and remedies to some environmental problems in agriculture such as soil erosion, desertification etc.
iv. Discuss the meaning, elements and importance of agro-climatology.

MEANING AND FUNCTIONS OF THE NATURAL ENVIRONMENT

The natural environment refers to those living and non-living things in the enviornment that are provided by nature. They are those materials in our environment that are used by man for survival and comfort but which are not provided by him. They are also known as natural resources or environmental assets.The functions of the natural environment are:

1. The environment adds beauty to our surroundings and thus facilitate recreational activities.

2. The natural environment play a vital role in many processes such as the carbon cycle, nitrogen cycle etc which are essential to the maintenance of life.
3. Natural environments supply raw materials and energy in the form of oil, coal, gas, fuelwood and minerals.
4. Activities aimed at protecting and conserving the environment create employment for millions of people.
5. A good environment ensures good quality of life since poor environments lead to stress and ill health.
6. Our environment supply services that support life. For example, (the ozone layer) helps regulate the levels of radiation reaching the earth, the failure of which leads to global warming, flooding etc.

Groups of Natural Resources

Natural resources are grouped in two ways:

1. Exhaustible and inexhaustible natural resources.
2. Replaceable (or renewable) and irreplaceable (or non-renewable) natural resources.

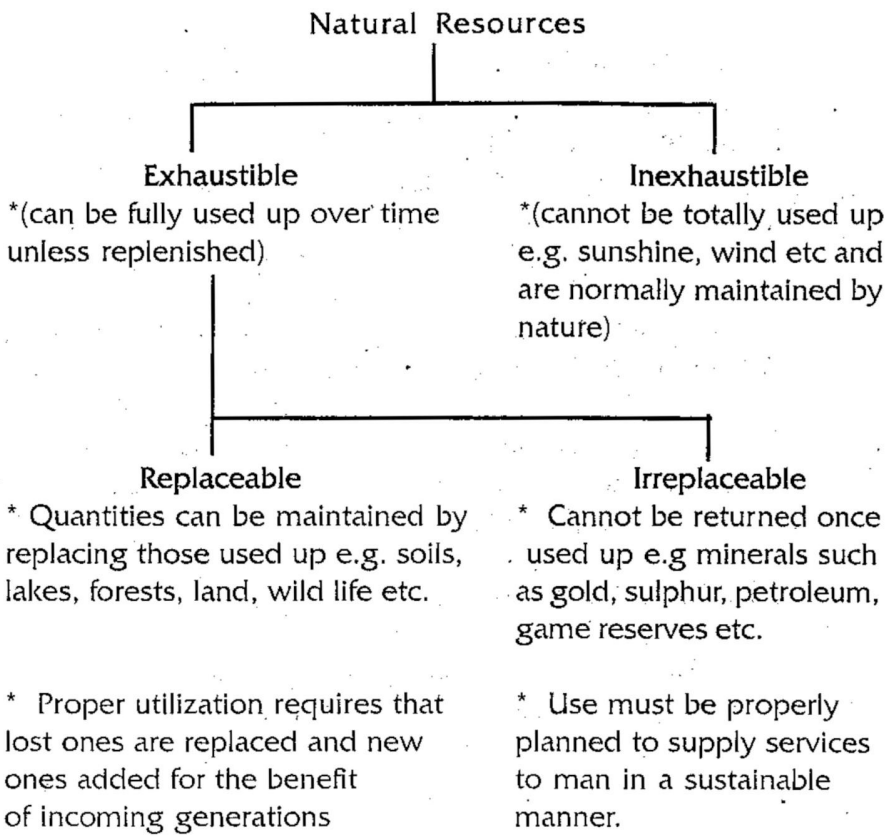

Fig. 9:1 - Classification of Natural Resources

CAUSES OF ENVIRONMENTAL PROBLEMS

Causes of environmental problems are generally grouped into three viz: physical, economic and institutional factors, all of which are however related.

I. Physical or Technical Causes

These are direct causes of natural resource degradation and are the most noticeable. They include:

i. Poor land use practices such as overcropping, total clearing of land, overgrazing, bush burning etc.
ii. Poor irrigation and drainage systems.
iii. Excessive and poor usage of chemical such as fertilizers and pesticides.
iv. Climatic factors such as excessive rainfall, winds etc.

II. Economic Causes

These arise due to bad policy formulation/implementation and the inability of the forces of demand and supply to equitably distribute natural resources among the citizens. The major economic causes of environmental degradation are:

i. Poverty: Poverty leads to overcropping, tree felling and deforestation, overgrazing etc.
ii. High interest rate on credits: This limits farmers ability to obtain credit needed to improve farm operations.
iii. Market imperfections: Lack of penalty for environmental degrading activities makes people less concerned about them.

III. Institutional Causes

Institutions refer to rules of behaviour that affect private incentives and include things like custom and tradition, government policy etc. Institutional failures that result in environmental degradation include:

i Communal land tenure and common-property regime: Where the land belongs to the community and the

control system is poor, people will tend to over exploit resources since someone else will do so if they do not.

ii. Poorly formulated or implemented government policies: Such policies include agricultural price policies, input subsidy, land use policy etc all of which may discourage or create disincentive for good environmental practices.

iii. Poor local knowledge/information about environmental impact of farmers actions and alternatives available.

SOME ENVIRONMENTAL PROBLEMS IN AGRICULTURE

I. Soil Erosion

Soil erosion is the process of gradual removal of the uppermost layer of the earth surface (called soil) by agents of denudation. Soil erosion is of two types namely, normal (or naturally occurring) soil erosion and accelerated (or man-induced) soil erosion. It is accelerated erosion that is often of most damaging to our environment. Effects of soil erosion include:

1. *Loss of soil nutrients and removal of cultivable top soil which is often the most nutritive part of the soil. About 20 million hectares of agricultural land are lost each year due to soil erosion while crop yield falls by 10-40%.*
2. *Reduction of yield in crops.*
3. *Creation of unsightly and undesirable gullies and channels on the soil surface.*

Factors Influencing the Rate of Soil Erosion

The rate at which soil erosion occurs on a land surface depends on some factors such as:

1. The amount, frequency and intensity of rainfall in the area.
2. The character of the soil as its permeability, texture, structure and organic matter content.
3. Amount of vegetable cover such as trees, grasses, shrubs etc on the soil.
4. The slope of the land.

Causes of Soil Erosion

Soil erosion is caused by both natural factors and man's activities.

i. Natural factors include climatic factors such as temperature variations, actions of ice, wind and rainfall. These leads to cracks and crevices on soil surface thereby encouraging break up and loosening of soil which are then easily removed by wind and water run-off.

ii. **Human activities:** Man causes soil erosion by disturbing or destroying the natural vegetation cover of the soil and by stirring the soil itself. This can be in form of:

   a. Overstocking i.e. carrying too many farm animals in an areas for a long period.
   b. Bush encroachment: This destroys grazing land and exposes the top soil to erosion.
   c. Destruction of trees: This exposes the soil to direct effects of agents of denudation.
   d. Grassland burning: This removes the soil's protective covering and exposes the soil to agents of denudation.
   e. Complete tillage: Tillage involves stirring of the soil and the removal of natural cover of vegetation both of which lead to erosion.

II. **Desertification:** Desertification is a gradual natural process of turning a bush covered land to a bare and dry land with very little plants. It is often common in areas that are subject to very little rainfall. Desertification involves the depletion of vegetable cover, exposure of the soil surface to agents of erosion, reduction of the soil's organic matter, soil structure and water holding capacity.

Causes of Desertification

i. Drought: which leads to formation of soil crusts and changes in soil structure.
ii. Natural disasters like forest fire outbreaks.
iii. Poor agricultural practices such as intensive grazing, bush burning and tree felling.

Effects of Desertification

i. Desertification exposes land to further actions of agents of erosion.
ii. It limits the extent of agricultural activity that can take place in an area to only livestock or tough cereals such as millet.
iii. It renders agricultural land unproductive.

Control of Desertification

Desertification can be controlled by:

i. Planting trees on the land.
ii. Adopting good land use practices such as avoidance of overgrazing, bush burning etc.

III. **Savannization:** Savannization is the process by which the bush and trees in an area are gradually replaced by grasses and few scattered shrubs. It leads to loses in soil quality and

domination of the land by grasses. Causes of savannization include overgrazing, soil compaction, overstocking, overcultivation, excessive tree felling and natural disaster like drought, forest fire etc.

IV. **Salinization:** Salinization results when large concentration of salts build up around plant roots in the soil. The alts which cause salinization come from the break up of the rocks and minerals naturally occurring in the soil. Factors that may predispose a soil to salinization incude:

i. Poorly designed irrigation programmes.
ii. Poor drainage of water logged soils.

V. **Deforestation:** Deforestation occurs when forest resources such as trees are removed without being replaced. Deforestation occurs because many poor people in developing countries depend on fuelwood for their cooking and heating needs. Deforestation also arise when forest lands are cleared for development projects such as road construction, housing estate construction etc.

Deforestation leads to:

i. Soil degradation and increased soil erosion, loss of organic matter and desertification/savannization.
ii. Environmental pollution and global warming.
iii. Deforestation also contributes to the loss of large amount of plant and animal genetic stock. Deforestation, savannizatio and desertification are different aspects of the same problem.

VI. **Chemical Pollution:** The misuse of chemicals such as fertilizer and pesticides lead to problems. Such problems include:

i. Land and water contaminations.
ii. Poisoning and health problems.
iii. Reduced fish population or fishes that are unfit for consumption.
iv. Increased pest population as natural enemies of pests are destroyed and the pests develop resistance to chemicals.
v. Adverse effects on the climate and the environment.

The trend in modern agriculture is to discourage or minimize the use of artificial chemicals like pesticides and fertilizers and encourage organic farming or integrated pest management.

AGRO-CLIMATOLOGY

Agro-climatology deals with knowledge about the climate and how its principles are applied to solve practical problems facing agriculture. Climatology is the science that describes and explains the nature of the variations that occur in the climatic conditions from one place to another and the relationship between this and the natural environment and human activities. The two main concepts in climatology are climate and weather. Weather is the day to day state of the atmosphere while climate is the characteristic condition of the atmosphere over a long period.

The major things that are considered in climatology (i.e. the elements of climatology) are: (a) sunshine (b) temperature (c) cloudiness (d) precipitation (e) humidity (f) wind (g) evapotranspiration (h) radiation.

Importance of Agro-Climatology to Agriculture

The study of agro-climatology is important because the climate influences agriculture in many ways. The process of soil formation, drought, flood, type of vegetation etc in a particular area are all determined by the type of climate in that area. In fact, in the less developed countries, the performance of agriculture depends, almost entirely, on whether the climate is favourable or not. Thus the study of agro-climatology enables us to:

i. Carefully plan/time agricultural operations on a day to day basis.
ii. Manipulate nature/modify production techniques to meet particular condition of an area.
iii. Develop new technologies for improving agriculture.

Table 9.1: Some Agro-Climatological Instruments and Their Applications in Agriculture

S/N	Climatic Element	Instrument	Uses	Application in Agriculture
1.	Wind	1. Wind vane	To determine wind direction	Wind direction is important in fumigation of crops
		2. Anenometer	To measure wind speed	Wind speed is important for turning wind mills.
2.	Rainfall	Raingauge	To measure the amount of rainfall A special type (the Dyne's self-recording rain guage) also measures the time of occurrence, intensity and duration of rainfall.	Rainfall is the main source of farm crops
3.	Relative Humidity	Hygrometer	To determine the relative humidity	Relative humidity affects the rate of evapo-transpiration in plants
4.	Tempe-rature	Thermometer	To measure the hotness or coldness of the weather	Temperature affects many processes which are vital in agriculture including transpiration and photosynthesis

Fundamentals of Modern Agriculture

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