UNIT 8: ECONOMICS OF NATURAL RESOURCES - I

UNIT STRUCTURE

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8.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- discuss what is natural resource
- discuss about types of natural resources
- explain about management of exhaustible resources
- describe resource extraction and the environmental cost associated with it.

8.2 INTRODUCTION

Our life, along with the life of all living objects in the Earth, requires a large number of goods and services of the 'Nature' for our day-to-day activities. When we wake up in the morning, the first thing we need is water, which we get from nature. Next, we need food for breakfast, which again comes from nature. To breathe, we need oxygen which comes from nature. Even when we walk in the evening, we need the service of nature. Thus, from morning to night, at every step of our life, we are depended on nature. Water, Air, Forest, Minerals, Coal, Soil, Wild life are examples of Natural Resources.

We receive energy and minerals from nature which are used in the production of goods and services to satisfy human needs. Therefore, a society should know how to exploit resources efficiently and at what rate, so that the stock of resources can regenerate over time without hampering its natural rate of regeneration.

In this unit, we will discuss the types of natural resources. As the exhaustible resources will be depleted so long as the extraction rate is positive, we need to know what

should be the strategy for optimum utilisation of the resources. We will also discuss the resource extraction and the environmental cost associated with it.

8.3 TYPES OF NATURAL RESOURCES

Natural resources are broadly classified into two categories, viz., renewable resources and non-renewable resources.

8.3.1 Renewable Resources

Renewable resources are those natural resources, which can be regenerated. The popular definition of renewable resource is “renewable resource is resource that is replaced by a natural process at a rate that is equal to or faster than the rate at which that resource is being consumed.” In other words, renewable resources are those resources which are regenerative within a given span of time and inexhaustible in nature. Examples of renewable resource are forest, wildlife, hydro power, wind energy, biomass energy etc. Solar energy is also a renewable form of energy and ist the main driving force of the eco-system.

An important point to remember here in case of renewable resource is that although water, forest, wetland, grassland etc are considered to be renewable, but they are renewable only within a certain limit. They may lose their capacity to regenerate if over utilised or degraded beyond their natural regenerative capacity.

We can use the renewable resources directly and sometimes indirectly. Indirectly, these are used to create other more convenient forms of energy. We use renewable resources directly in solar ovens, water and wind mills, geothermal heating etc. You might see wind turbines or production of fuels such as biogas or ethanol from biomass. So, in production of wind energy, biogas etc., we indirectly use renewable resources or energy.

8.3.2 Non-renewable Resources

Non-renewable resources is that stock of resources whose exact quantity is not known but whatever be the amount of stock, it is fixed and cannot be re-grown in one’s lifetime. Thus, once we exhaust these reserves, the same cannot be replenished. Fossil fuels such as coal, petroleum and natural gas are considered non-renewable resources. These resources are opposed to renewable resources such as forest, timber, which can regenerate naturally.

Major non-renewable resources include: forest resources, water resources, mineral resources, food resources, energy resources and land resources.

- *Forest Resources:* Forests are self-sustained wooden tracks with biotic community dominated by trees. Dense Forests are defined as those with a canopy cover of more than 70 percent, open forests as those with canopy cover between 40 to 70 percent and scrub as those with canopy cover of 10 to 40 percent. Evergreen Forests are those forests compromising thick and dense canopy of all trees, which predominately remain green throughout the year. Mangrove is described as a dense thicket or woody aquatic vegetation of forest cover occurring in tidal waters, near estuaries and along the confluence of delta in coastal areas.

  Some of the major importance of forest resources are as follows:

  - Supply of timber, fuel wood, fodder and a wide range of non-wood products.
  - Natural habitat for bio-diversity and repository of genetic wealth.
  - Provision of recreation and opportunity for ecotourism
  - Forests ensure environmental functions such as biodiversity, water and soil conservation, water supply and climate regulation.

LET US KNOW

Forestry in India: As in 2010, the Food and Agriculture Organization of the United Nations estimates India's forest cover to be about 68 million hectares, or 22% of the country's area and by 2015 FAO Global assessment observers the forest cover increasing to 70.68 million hectares occupying 23.8% of the total land area of the country. The 2013 Forest Survey of India states its forest cover increased to 69.8 million hectares by 2012, per satellite measurements; this represents an increase of 5,871 square kilometers of forest cover in 2 years. However, the gains were primarily in northern, central and southern Indian states, while north eastern states witnessed a net loss in forest cover over 2010 to 2012.

Deforestation: Deforestation, clearance, or clearing is the removal of a forest or stand of trees from land which is then converted to a non-forest use. Deforestation can involve conversion of forest land to farms, ranches, or urban use. The most concentrated deforestation occurs in tropical rainforests.

Since time immemorial, humans have depended heavily on forests for food, medicine, shelter, wood and fuel. With growing civilisation the demands for raw material like timber, pulp, minerals, fuel wood etc. have shot up resulting in large scale logging, mining, road-building and clearing of forests. Excessive use of fuel wood and charcoal, expansion of urban, agricultural and industrial areas and

overgrazing have together led to over-exploitation of our forests leading to their rapid degradation.

- *Water Resources:* Water resources in India include data on precipitation, surface and groundwater storage and hydropower potential. India experiences an average precipitation of 1,170 millimetres (46 in) per year, or about 4,000 cubic kilometres (960 cu mi) of rains annually or about 1,720 cubic metres (61,000 cu ft) of fresh water *per person* every year. Some 80 percent of its area experiences rains of 750 millimetres (30 in) or more a year. However, this rain is not uniform in time or geography. Most of the rains occur during its monsoon seasons (June to September), with the north east and north receiving far more rains than India's west and south. Other than rains, the melting of snow over the Himalayas after winter season feeds the northern rivers to varying degrees. The southern rivers however experience more flow variability over the year. For the Himalayan basin, this leads to flooding in some months and water scarcity in others. Despite extensive river system, safe clean drinking water as well as irrigation water supplies for sustainable agriculture is in shortage across India. Our country harnessed 761 cubic kilometres (183 cu mi) (20 percent) of its water resources in 2010, part of which came from unsustainable use of groundwater. Of the water she withdrew from its rivers and groundwater wells, India dedicated about 688 cubic kilometres (165 cu mi) to irrigation, 56 cubic kilometres (13 cu mi) to municipal and drinking water applications and 17 cubic kilometres (4.1 cu mi) to industry.

  Some of the major importance of water resources are as follows:

  - About 70 percent of the fat free mass of the human body is made of water. To function properly, the body requires between one and seven litres of water per day to avoid dehydration; the precise amount depends on the level of activity, temperature, humidity and other factors. Most of this is ingested through foods or beverages other than drinking straight water.
  - Water plays many critical roles within the field of food science. It is important for a food scientist to understand the roles that water plays within food processing to ensure the success of their products.
  - Hydroelectricity is electricity obtained from hydropower. Hydroelectric power comes from water driving a water turbine connected to a generator. Hydroelectricity is a low-cost, non-polluting, renewable energy source.
  - Approximately 70 percent of the 4,000 km^3 of water humans withdraw from freshwater systems each year is used for irrigation.

- *Mineral Resources:* Mineral are naturally occurring, inorganic, crystalline solids having a definite chemical composition and characteristics physical properties. There are thousands of minerals occurring in different parts of the world. However, most of the rocks, we see everyday are just composed of a few common minerals like quartz, feldspar, biotite, dolomite, calcite, laterite etc. These minerals, in turn, are composed of some elements like silicon, oxygen, iron, magnesium, calcium, aluminium etc.

  Minerals find use in a large number of ways in everyday use in domestic, agricultural, industrial and commercial sectors and thus form a very important part of any nation's economy. The main uses of minerals are as follows:

  - Development of industrial plants and machinery.
  - Generation of energy e.g. coal, lignite, uranium
  - Construction, housing, settlements.
  - Defence equipments – weapons, armaments.
  - Transportation means.
  - Communication- telephone wires, cables, electronic devices.
  - Agriculture- as fertilizers, seed dressings and fungicides.

  India has a large number of economically useful minerals and they constitute one-quarter of the World's known mineral resources. India is rich in 35 minerals like iron, aluminium, manganese, chromium, limestone, Dolomite, Mica etc. India is deficient in lead, copper phosphate, potassium, nickel, gold and silver.

  Minerals are limited in quantity and are being depleted very fast. Following are the steps for conservation of mineral resources:

  - Application of eco friendly mining methods.
  - Reuse and recycling of metals.
  - Search for new deposits.
  - Recovering all possible elements as co-product or by by-products.
  - Optimum and economic use of minerals.
  - A complete data base of reserve, production and expected future demand of minerals.

- *Food Resources:* Food is a biological drive. Each organism needs food. All relations that exist among living organism are oriented towards food. Nature offers different source of food. Therefore, for food security, man has to be dependent on natural food resources.

Primitive societies obtained food through hunting and gathering. Today man obtains food from cultivated plants and domesticated animals. Although some food is obtained from ocean and fresh water, 95 percent of human population's protein demand is met from agricultural crops and animals. Most of our food comes from plants.

LET US KNOW

World Food Problems/ Food Crises: During the last 50 years World grain production has increased almost three times, thereby increasing per capita production by about 50%. But, at the same time population growth increased at such a rate in LDCs that it outstripped food production. Every year 40 million people die of undernourishment and malnutrition. That means that every year our food problem is killing as many people as were killed by the atomic bomb dropped on Hiroshima during World War – II

The World Food Summit, 1996 has set the target to reduce the number of undernourished to just half by 2015, which still means 410 million undernourished people on earth.

- *Energy Resources:* Energy consumption of a nation is usually considered as an index of its development. This is because almost all the developmental activities are directly or indirectly dependent upon energy. We find wide disparities in per capita energy use between the developed and the developing nations. The first form of energy technology probably was the fire, which produced heat and the early man used it for cooking and heating purposes. Wind and hydropower have also been in use for the last 10,000 years. In 1970's due to Iranian revolution and the Arab oil embargoes the prices of oil shot up. This ultimately led to exploration and use of several alternative sources of energy.

  A source of energy is one that can provide adequate amount of energy in a usable form over a long period of time. These sources can be of two types:

  - *Renewable Resources* which can be generated continuously in nature and are inexhaustible e.g. wood, solar energy, wind energy, tidal energy, hydropower, biomass energy, bio-fuels, geo-thermal energy and hydrogen. They are also known as non-conventional sources of energy and they can be used again and again in an endless manner.
  - *Non-renewable Resources* which have accumulated in nature over a long span of time and cannot be quickly replenished when exhausted, e.g. coal, petroleum, natural gas and nuclear fuels like uranium and thorium.

Let us now discuss various forms of renewable and non-renewable energy resource.

- *Renewable Energy Resources:* This includes:
  - *Solar Energy*: Sun is the ultimate source of energy, directly or indirectly for all others forms of energy. The nuclear fusion reactions occurring inside the sun release enormous quantities of energy in the form of heat and light. The solar energy received by the near earth space is approximately 1.4 kilojoules/second/m^2 known as solar constant.

    Traditionally, we have been using solar energy for drying clothes and food-grains, preservation of eatables and for obtaining salt from sea-water. Now we have several techniques for harnessing solar energy.
  - *Wind Energy*: The high speed winds have a lot of energy in them as kinetic energy due to their motion. The driving force of the wind is the sun. The wind energy is harnessed by making use of wind mills. The blades of the wind mill keep on rotating continuously due to the force of the striking wind. The rotational motion of the blades drives a number of machines like water pumps, flour mills and electric generators. A large number of wind mills are installed in clusters called wind farms, which feed power to the utility grid and produce a large amount of electricity. These farms are ideally located in coastal regions, open grasslands or hilly regions, particularly mountain passes and ridges where the winds are strong and steady. The minimum wind speed required for satisfactory working of a wind generator is 15 km/hr.

    Wind energy is very useful as it does not cause any air pollution. After the initial installation cost, the wind energy is very cheap. It is believed that by the middle of the century wind power would supply more than 10% of world's electricity.
  - *Hydropower:* The water flowing in a river is collected by constructing a big dam where the water is stored and allowed to fall from a height. The blades of the turbine located at the bottom of the dam move with the fast moving water which in turn rotates the generator and produces electricity. We can also construct mini or micro hydel power plants on the rivers in hilly regions for harnessing the hydro energy on a small scale, but the minimum height of the water falls should be 10 metres. The hydropower potential of India is estimated to be about 4×10^{11} KW-hours. Till now we have utilized only a little more than 11% of this potential.

    Hydropower does not cause any pollution, it is renewable and normally the hydro power projects are mutli-purpose projects helping in controlling

floods, used for irrigation, navigation etc. However, big dams are often associated with a number of environmental impacts.

- *Tidal Energy*: Ocean tides produced by gravitational forces of sun and moon contain enormous amounts of energy. The 'high tide' and 'low tide' refer to the rise and fall of water in the oceans. A difference of several meters is required between the height of high and low tide to spin the turbines. The tidal energy can be harnessed by constructing a tidal barrage. During high tide, the sea-water flows into the reservoir of the barrage and turns the turbine, which in turn produces electricity by rotating the generators. During low tide, when the sea-level is low, the sea water stored in the barrage reservoir flows out into the sea and again turns the turbines.
- *Biogas:* Biogas is a mixture of methane, carbon dioxide, hydrogen and hydrogen sulphide, the major constituent being methane. Biogas is produced by anaerobic degradation of animal wastes in the presence of water. Anaerobic degradation means break down of organic matter by bacteria in the absence of oxygen.

  Biogas is non-polluting, clean and low cost fuel which is very useful for rural areas where a lot of animal waste and agricultural waste are available. India has the largest cattle population in the world and has tremendous potential for biogas production.
- *Coal:* Coal was formed 255- 350 miliion years in the hot, damp regions of the earth during the carboniferous age. The ancient plants along the banks of rivers and swamps were buried after death into the soil and due to the heat and pressure gradually got converted into peat and coal over millions of years of time. There are mainly three types of coal, namely anthracite (hard coal), bituminous (soft coal) and lignite (brown coal). Anthracite coal has maximum carbon (90%) and calorific value (8700kcal/kg). Bituminous, lignite and peat contain 80%, 70% and 60% carbon, respectively. Coal is the most abundant fossil fuel in the world.
- *Petroleum:* It is the lifeline of global economy. There are 13 countries in the world having 67% of the petroleum reserves which together form the OPEC (Organisation of Petroleum Exporting Counties). About $1/4^{th}$ of the oil reserves are in Saudi Arabia.

  At the present rate of usage, the World's crude oil reserves are estimated to get exhausted in just 40 years. Some optimists, however, believe that there are some yet undiscovered reserves. Even then the crude oil reserves will last for another 40 years or so.

- *Liquefied Petroleum Gas (LPG):* The main component of petroleum is butane, the other being propane and ethane. The petroleum gas is easily converted to liquid form under pressure as LPG. It is odourless, but the LPG in our domestic gas cylinders gives a foul smell. This is, in fact, due to ethyl mercaptan, a foul smelling gas , added to LPG so that any leakage of LPG from the cylinder can be detected instantaneously.

  Oil fields in India are located at Digboi (Assam), Gujarat plains and Bombay high, offshore areas in deltaic coasts of Godavari, Krishna, Kaveri and Mahanadi.
- *Natural Gas:* It is mainly composed of methane (95%) with small amounts of propane and ethane. It is a fossil fuel. Natural gas deposits mostly accompany oil deposits because it has been formed by decomposing remains of dead animals and plants buried under the earth. Natural gas is the cleanest fossil fuel. It can be easily transported through pipelines. It has a high calorific value of about 50KJ/G and burns without any smoke.
- *Nuclear Energy:* Nuclear energy is known for its high destructive power as evidenced from nuclear weapons. The nuclear energy can also be harnessed for providing commercial energy.

- *Land Resources:* Earth's one-fourth area is covered by land which is largely covered with natural forests, grasslands, wetlands and man-made urban and rural settlements along with agriculture. Out of total land surface11 percent is cultivated, 52 percent is under forest cover, meadows and pastures, 20 percent deserts, 2.6 percent is occupied by human settlements, while rest is covered by ice, glaciers etc. Nearly 80 percent land is covered by soil. In India, agriculture occupies 43 percent land, forest 23 percent, pastures 4 percent and human habitation 8 percent. Land availability in India is 0.34 percent hectre per person. To prevent land degradation judicious land use is must.

  Land is a basic natural resource that provides habitat and sustenance for living organisms, as well as being a major focus of economic activities. Land has the following functions:
  - It is the basis for many life support systems, through the production of biomass that provides food, fodder, fiber, fuel, timber and other biotic materials for human use, either directly or through animal husbandry including aquaculture and inland and coastal fishery.
  - Land is the basis of terrestrial biodiversity by providing the biological habitats and gene reserves for plants, animals and micro-organisms, above and below ground.

- Land and its use are a source and sink of greenhouse gases and form a co-determinant of the global energy balance as reflection, absorption and transformation of radioactive energy of the sun, and of the global hydrological cycle.
- Land is storehouse of raw materials and minerals for human use.
- Land has a receptive, filtering, buffering and transforming function of hazardous compounds.
- Land provides the physical basis for human settlements, industrial plants and social activities such as sports and recreation.

8.4 MANAGING EXHAUSTIBLE RESOURCES

Exhaustible resources will be depleted so long as the extraction rate is positive. Are our exhaustible resources being depleted too rapidly? To answer question like this we need to know the optimal rate at which to extract/deplete exhaustible resources. With that in view we will present here some simple and intuitive results involved in the theory of depletion.

What are the conditions that must hold while depleting an exhaustible resource over time, that is, along an optimal depletion path? The supply (and extraction) behaviour of a ***price-taking owner*** of an exhaustible resources such as oil differs from that of an ordinary good or resource. An exhaustible resource is limited in quantity and is not producible like an ordinary good. Ordinary goods produced in the economy using available methods of production can be replicated. Since exhaustible resources are created by geological processes with geological time spans, they can be regarded as fixed in quantity, although the total quantity available may not be known.

Price-Takin owner

Competitive owner who s his natu resources in market wh he does have a la enough mar share to be a to influe market prices

A price-taking firm supplying ordinary goods will adjust production in all periods so that its marginal cost (mc) of production in each period equals price (p) in that period. If the *mc* is less than *p,* the supplier can raise current profits by increasing production. However, when the firm is the extractor of an exhaustible resource, such behaviour might require extraction of more stocks than is available to the firm.

Cases like this, then, require some modifications of the standard theory. Since an exhaustible resource is limited in quantity and is not producible, extrication and sale of a unit today involves an *opportunity cost:* the value that might have been obtained at some future date. This opportunity cost is usually given the name *user cost (UC).* The presence of user cost is central to the economics of exhaustible resources. User cost does not exist for conventional reproducible goods since the consumption of an amount now does not reduce the quantity that can be consumed in the future; additional quantities can always be produced. However, a barrel of oil extracted today is a barrel unavailable for extraction in the

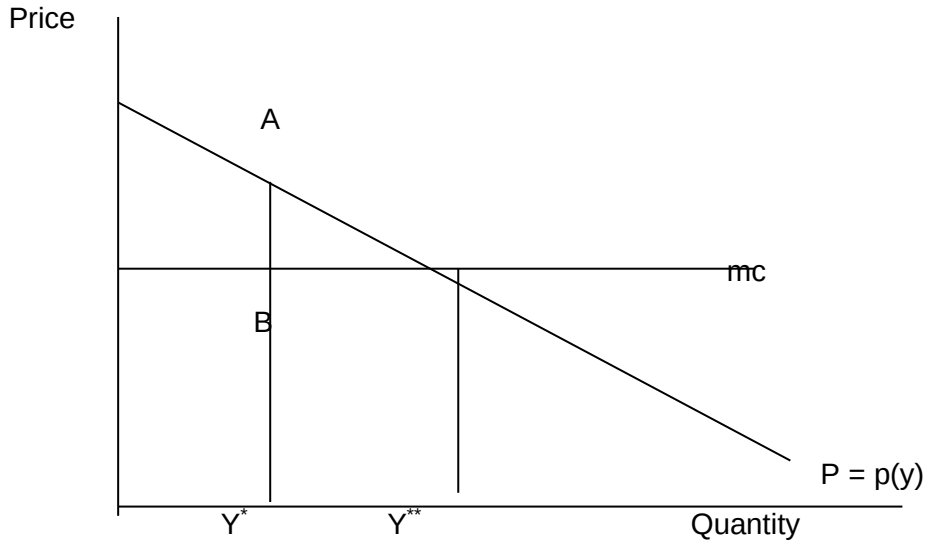
future. In deciding whether to extract and sell an additional barrel today, the extractor must consider not only the cost of pumping the barrel, but also the cost of foregoing the highest return that could have been earned if the oil had instead been pumped and sold in the future. Hence, it is necessary to have a more inclusive definition of marginal cost and we call it *augmented marginal cost (amc)*. The augmented marginal cost (amc) is, then, defined as the marginal cost of extraction (mc) plus the user cost (uc).

When *mc* is redefined in this way, it is optimal for a competitive resource owner (firm) to extract the resource in each period to the point where its *amc* equals the market price (p). Instead of the usual efficiency condition, price (p) = marginal extraction cost (mc), we have:

$$p = mc + uc$$

This is the first condition of optimal depletion. As shown in Figure 8.1, it implies that less of the resource will be extracted today than if it were a producible ordinary good or a resource. Given the inverse demand function p = p(y), where p is the price and y

Figure 8.1: ……..



is the quantity extracted, only Y^* units (rather than Y^{**} where p=mc) will be extracted by a resource planner or a price-taking firm seeking to allocate extraction efficiently over time. This leaves a positive difference AB (the opportunity cost/user cost) between *p* and *mc.*

Beneath the apparent simplicity of this rule lies a wealth of subtlety. The rule implies, for example, that the current extraction rate by a private owner of a natural resource depends not only on the current price, as in the standard theory, but also on expectations about future prices. These price expectations determine the opportunity cost of additional current extraction. A competitive supplier that expects future prices to be sufficiently low compared with the current price may extract and sell intensively in the current period, judging the opportunity cost of additional extraction to be small. But if future prices are

expected to be sufficiently high, the same current price may induce no extraction whatsoever, today.

For some further results, let us, for simplicity, assume just two periods: the resource owner either extracts and sells the resource today, in period O, or retains it in the ground until the next period 1. Let the price he can obtain for a unit of the resources today be p_0 and the price he expects to prevail for a unit in the next period be p_1. The cost per unit of extracting the resource and delivering it to be the buyer is C, which is not expected to vary between periods 0 and 1, that is C = mc remains constant.

Because the owner has a fixed stock (to be supplied from) of the resource, any unit sold in period O will reduce the quantity that can be sold in period 1. If he sells the unit in period O he will receive net revenue of $p_0 - C$ but forgo revenue of $p_1 - C$ in the following period. The value in period O of the net revenue foregone is its present value $(p_1-C)/(1+ r)$ where r is his discount rate.

Hence his return from selling a unit today will be:

$$(p_0 - C) - (p_1-C)/(1+ r)$$

$(p_1-C)/(1+ r)$ is the opportunity cost of his decision to sell a unit today. It is the user cost of his decision. It arises because he is faced with the alternative of selling it in the following period. If

$$(p_0 - C) > (p_1-C)/(1+ r)$$

He will be better off selling his resources in the current period. If, on the other hand,

$$(p_0 - C) < (p_1-C)/(1+ r)$$

He will be better off by leaving it in the ground. His optimum amount of current extraction is given where

$$(p_0 - C) = (p_1-C)/(1+ r) \qquad (1)$$

This implies that $p_0 = C - (p_1-C)/(1+ r)$ (2)

Equation (1) states that our earlier result that the current price of the resourcemwhen it is extracted optimally, should be equal to the *mc* plus the user cost *(uc)*.

With reproducible resources there is no element of user cost since resources are produced in each period to satisfy the demand in that period and there is no carry over from period to period. Hence, as we have seen earlier, for a reproducible resource the optimum output is given where $p_0 = C$.

Transposing equation (1) , we have

$$(p_1-C)/ (p_0 - C) = 1 + r \qquad (3)$$

Which implies that $(p_1-C) = (p_0 - C)(1+ r)$ (4)

This equation (3 & 4) is the second condition of optimal depletion and is usually described as the fundamental equation of exhaustible resource extraction.

A numerical example may help to illustrate this fundamental condition. Suppose the interest rate is 10 percent and the net price *(p - mc)*, that is, user cost per unit of the resource is Rs. 20. If the net price *(user cost)* is not expected to grow by 10 percent to Rs. 22 next year, it pays to extract more of the resource in the current period, because the resulting income from sales will earn 10 percent interest if invested in interest bearing assets. If the net price is expected to go above Rs. 22 that is, to grow faster than the rate of interest – the producer will have no incentive at all to extract in the current period. This is because any unit extracted today will (even after interest earning) be worth less in a year than a unit extracted and sold a year from now.

If *mc* of extraction is small relative to the price of the resource, equation (3) & (4) approximate to

$p_1 / p_0 = 1 + r$ or $p_1 = p_0 (1 + r)$

Thus, along the optimum path resource prices grow at the discount rate. The higher the discount rate the faster will the price of the resource rise along the optimum path. A higher discount rate reduces the user cost of the resource and causes mine owners to deplete their resource at a faster rate. In reality, of course, extraction costs are never zero. Whenever they are positive, a price increase equal to the interest rate would cause the net price to rise by more than the interest rate.

8.5 RESOURCE EXTRACTION AND ENVIRONMENTAL COST

Extraction of a natural resource may impose an environmental cost on society. In situations like this property-rights are not usually well-defined and hence this cost is not internalised by the extractors. The aesthetic costs of strip mining, the occupational health hazards associated with coal mining, and the acids leached into streams from mine operations are all examples of associated environmental costs. The cost of extraction and sale (including user cost) is borne by the resource owner and taken account of (internalised) in the calculation of how much of the resource to extract. The environmental damage, however, is an external cost and is not borne by the owner and as such it will not be part of the extraction decision. It is important to know how the market allocation, based on only the former cost would differ from the optimal allocation (depletion), which is based on both.

The inclusion of environmental costs results in higher resource prices, which tend to lower demand. All other things being equal, it would allow the resource to last longer. On the other hand when environmental side-effects are ignored by the resource extracting firm, the price of the exhaustible resource would be too low, demand too high, and the resource would be extracted too rapidly over time.

The presence of environmental costs, in this way, forms an important intersection between the fields of environmental economics and natural resource economics. Arguments developed above confirm that environmental and natural resource decisions are intimately and inextricably linked.

CHECK YOUR PROGRESS

Q 1: What are the types of natural resources?

Q 2: What do you mean by renewable resource?

8.6 LET US SUM UP

- Natural resources are classified into two categories, viz., Renewable resources and Non-renewable resources
- Renewable resources is that natural resources, which can be regenerated. The popular definition of renewable re.source is “renewable resource is resource that is replaced by a natural process at a rate that is equal to or faster than the rate at which that resource is being consumed.”
- Non-renewable resources is that stock of resources whose exact quantity is not known but whatever be the amount of stock, it is fixed and cannot be re-grown in one’s lifetime.
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- Water resources in India include information on precipitation, surface and groundwater storage and hydropower potential.
- Mineral are naturally occurring, inorganic, crystalline solids having a definite chemical composition and characteristics physical properties.
- Food is a biological drive. Each organism needs food. All relations that exist among living organism are oriented towards food.
- Energy consumption of a nation is usually considered as an index of its development.
- Earth’s one-fourth area is covered by land which is largely covered with natural forests, grasslands, wetlands and man-made urban and rural settlements along with agriculture.
- Extraction of a natural resource may impose an environmental cost on society.

8.7. FURTHER READING

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8.8 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: Natural resources are to two types, viz., renewable resource and non-renewable resource.

Ans to Q No 2: Renewable resources is that natural resources, which can be regenerated. The popular definition of renewable resource is “renewable resource is resource that is replaced by a natural process at a rate that is equal to or faster than the rate at which that resource is being consumed.”

8.9 MODEL QUESTIONS

Q 1: Difference between renewable resource and non-renewable resource.

Q 2: Explain the optimal rate at which exhaustible resources are to be extract in the context of managing exhaustible resource.

Q 3: Explain the environmental cost in relation to resource extraction.

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