Economics of Renewable Resources

1. Concept

Renewable natural resources include those resources useful to human economies that exhibit growth, maintenance, and recovery from exploitation over an economic planning horizon. The economics of such resources has traditionally considered stocks of fish, forests, or freshwater, much like a banker would tally interest on cash deposits. A renewable resource is one that can be used repeatedly and does not run out because it is naturally replaced. A renewable resource, essentially, has an endless supply such as solar energy, wind energy, and geothermal pressure. Other resources are considered renewable even though some time or effort must go into their renewal (e.g., wood, oxygen, leather, and fish). Most precious metals are renewable also. Although precious metals are not naturally replaced, they can be recycled because they are not destroyed during their extraction and use. Therefore, it can be said that it is a kind of natural resource which will replenish to replace the portion depleted by usage and consumption, either through natural reproduction or other recurring processes in a finite amount of time in a human time scale. Renewable resources are a part of Earth's natural environment and the largest components of its ecosphere. A positive life cycle assessment is a key indicator of a resource's sustainability. Most renewable resources are biological, although some are non-biological.

Biological Renewable Resources: Renewable resources that are biological in nature (bio-resources) include the following:

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- wild animals that are hunted as food or for bio-materials, such as deer, moose, hare, ducks, fish, lobster, and seals
- forest biomass that is harvested for lumber, fiber, or energy
- wild plants that are gathered as sources of food
- plants cultivated as sources of food, medicine, materials, or energy
- the organic-based capability of soil to sustain the productivity of agricultural crops

Non-Biological Renewable Resources: The following are renewable resources that are non-biological:

- sunlight, of which there is a continuous input to Earth
- surface water and groundwater, which are renewed through the hydrologic cycle
- winds, which are renewed through the heat-distribution system of the atmosphere
- water currents and waves, which are renewed through the heat-distribution system of the oceans, as well as the tidal influence of the Moon.

2. Management of Renewable Resources

Populations of animals and plants, and their assemblages known as communities and ecosystems (such as a tract of forest), can be harvested in a sustainable manner – that is, without depleting the size of the resource or its capability to renewal. Essentially, this is due to the fact that, within limits, bio-resources are able to regenerate after some of their biomass is harvested. As long as the rate of harvesting does not exceed that of regeneration, a bio-resource can be used in a sustainable way.

Ultimately, the upper limits of the productivity of an individual organism are limited by genetically determined factors that influence its fecundity, longevity, and growth rate. To reach that potential limit of productivity, an organism must experience optimal environmental conditions. In a collective sense, genetic factors also set a ceiling on the potential productivity of populations or organisms, as well as communities and larger ecosystems. However, in the real world it is typical that environmental conditions are not optimal, and so the actual (or realized) recruitment, growth, and maturation of individuals and biomass are less than their potential amounts. As a result, it is possible to increase the size of a harvest by the use of management practices that enhance the productivity of bio-resources. When these practices are used in a coordinated way, they are called a management system.

The principal economic question in the management of renewable natural resources has been: how much of a resource should be harvested during the present vs. future time periods? Time is

typically considered over the horizon of a single representative manager or economic operation. For instance, in ocean fisheries the economic question has been how much to harvest this season and how much to leave in the sea as a source of future growth next season. For a commercial forest operation, the economic question has concerned the length of time between harvests that maximizes a forest owner's profits. Similar examples comparing discounted income flows could be considered for renewable water, soil, or animal resources. The question of when and how much to harvest has been posed as a balancing act between current and future benefits and costs. Renewable resource management is an emerging field that focuses on the ecosystem structures and processes required to sustain the delivery, to humanity, of ecosystem goods and services such as food, clean water and air, essential nutrients, and the provision of beauty and inspiration. Renewable resource management recognizes humans as integral components of ecosystems and is used to develop goals that are consistent with sustainability and ecosystem maintenance.

The Renewable Resource Management Domain provides students with an understanding of: 1) the interactions between physical and biological factors that determine the nature and dynamics of populations and entities in the natural environment; 2) the ways in which ecosystems can be managed to meet specific goals for the provision of goods and services; 3) the economic and social factors that determine how ecosystems are managed; 4) the ways in which management of natural resources can affect the capability of natural ecosystems to continue to supply human needs in perpetuity; and 5) the approaches and technologies required to monitor and analyze the dynamics of natural and managed ecosystems.