Natural resources and associated problems

Water resources

All life form is critically dependent upon water. In the present century, water issues are becoming the most critical and complex problem facing human beings. The International Conference on Water and the Environment convened by the World Meteorological Organization (WHO) and held in Dublin, in 1992. Ireland adopted the famous Dublin Principles, which are

Principle No. 1 – Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment,

Principle No. 2 – Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels,

Principle No. 3 – Women play a central part in the provision, management and safeguarding of water,

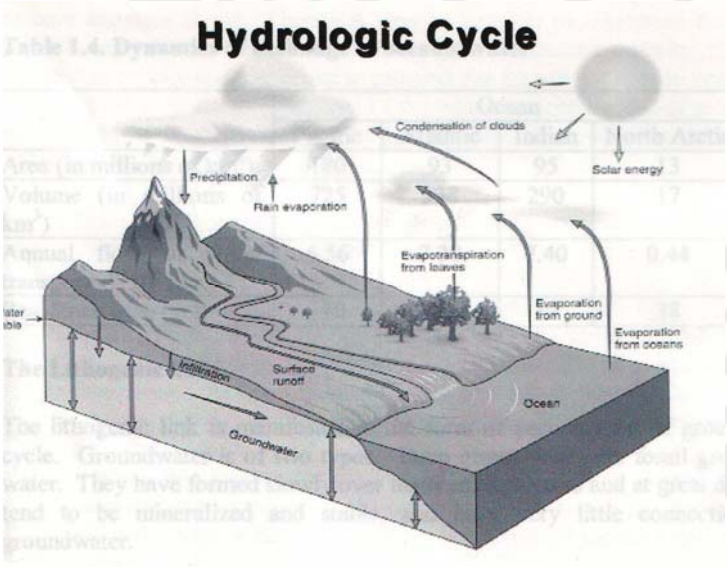
Principle No. 4 – Water has an economic value in all its competing uses and should be recognized as an cecon0omic good.

Over all these years, therefore the message has remained the same: water is a precious resource that must be assessed and managed with care for the benefit of mankind and the natural environment.

The total amount of water in the hydrosphere: 1386 M m^3. Out of this, saline waters constitute 97.5% and fresh water 2.5%. The greater portion of freshwater (68.7%) is locked up in the form of ice and permanent snow cover in the Antar c-tic, and the Arctic, and high mountain chains, like the Himalayas and Alps. Groundwater constitutes 29.9% of freshwater, 0.9% of fresh water exists in the form of soil moisture, swamp water and permafrost. Surface water in the

rivers, reservoirs and lakes account for 0.26% of freshwater, which alone is renewable (Shiklomanov 1998, p.4).

Water is different from other natural resources in being mobile. Most of the water on earth is involved in a continuous movement called the Water Cycle. Water evaporates from the surface of the oceans, seas, lakes, rivers, etc., forms clouds and moves inland. When the water vapor in the clouds condenses, it precipitates as rain or snow depending upon the ambient temperature. Part of the precipitation on land forms surface runoff, and part percolates downward forming groundwater. The force of gravity moves surface water and groundwater into depressions (river valleys) and forms rivers which feed the oceans. Part of the rainfall is retained in the soil as soil moisture, which undergoes evaporation (including transpiration). The vapors of the atmosphere are carried by air currents, condense and form precipitation, and a new cycle starts.



The water cycle involves interaction with lithosphere, atmosphere and biosphere. It links all the forms of hydrosphere – namely, oceans, rivers, soil moisture, groundwater and atmospheric water. The water cycle is energized by solar energy and gravity. Evaporation and condensation of water vapor take place under the influence of solar heat, where as gravity controls the falling of rain drops, the flow of rivers, the movement of groundwater and soil moisture.

Frequently, the two processes operate together – for instances, both thermal processes and gravity are involved in the circulation of the atmosphere.

Forest resources

Forests and other wooded lands have been recognized and highly valued as important natural resource for centuries. The list of benefits that people gain from forests is very impressive. Forest resources play a vital role not only for the economic, social, and cultural well-being of local and regional communities, but also for the maintenance of life on earth as a whole. The majority of forest functions, both wood and non-wood goods and services, are well known.

The Food and Agriculture Organization of the United Nations (FAO) and UN Economic Commission for Europe (UNECE) have implemented assessments of forest resources at the regional and global levels for more than half a century.
The estimates provided in the FRA Forest Resources Assessment 2000 report for the area covered by forests in the world was around 3.9 billion ha, which corresponds to approximately 30% of the world's land area. About 95% of the forest cover was in natural forest and 5% in forest plantations. Natural forests in this context, refers to forest stands predominantly composed of self-sown native trees (trees which have germinated and grown from spontaneous seedfall, either wholly naturally or influenced by various silvicultural activities).

The net change of the forest area (the difference between the area deforested and the expansion of natural forest and forest plantation) was approximately 9.4 million ha/year in the period 1990-2000, against 0.4 million ha outside the tropics. Increases in forest area are estimated to be on the order of 3.3 million ha in the non tropics and 1.9 million ha in the tropics, totaling an annual increase of 5.2 million ha (1.6 million ha from afforestation and 3.6 million ha from natural expansion of forests). All these figures represent annual estimation for the period 1990-2000. The remote sensing survey in Forest Resources

Assessment 2000 revealed that the deforestation process in the tropics is dominated by direct conversion of forest to agriculture.

Of the total forest area, 47% is concentrated in the tropics, 33% in the boreal zone, 11% in the temperate areas, and 9% in the subtropics. The distribution of the forest area by region is presented in Table 1.

Table 1: Forest area by region (FAO Global Forest Resource Assessment, 2000)

Region	Land area (ha x 10^6)	Total forest (natural forest and forest plantations)				Natural forests (ha x 10^6)	Forest plantations (ha x 10^6)
		Area (ha x 10^6)	% of land area	% of all forests	Net change		
Africa	2978	650	22	17	-5.3	642	8
Asia	3085	548	18	14	-0.4	432	116
Europe	2260	1039	46	27	0.9	1007	32
North and Central America	2137	549	26	14	-0.6	532	18
Oceania	849	198	23	5	-0.4	194	3
South America	1755	886	51	23	-3.7	875	10
World Total	13064	3869	30	100	-9.4	3682	187

Traditionally, in tropical countries forest management strategies have been based on the premise that sustainable forest management being the responsibility of a professional forest service, and by focusing forest production measures predominantly on commercial timber production. I the mid 1970s it became recognized that this strategy was too top-down –oriented and that it focused predominantly on national interests rather than on the needs of local

communities. Therefore it did not contribute much towards improving the welfare and well being of large segments of the population living in or near forests. Consequently, a new strategy for forest management was proposed, in which explicit attention was given to the forest-related needs of rural communities and to community participation in the sustainable management of forest resources. This new strategy was termed social forestry or community forestry. This strategy has become widely accepted, and in the last decades of the twentieth century much experience has been gained about how to involve local communities actively in forest management.

India

CFM in India is known as Joint Forest Management (JFM) (Table 5), under a model whereby the forest people is in the management and protection of forests, signifying the birth of JFM, later interpreted at state level where each state forest department has control over forest policy (Table 5).

JFM in India was, until recently, reserved for degraded forest lands. Guidelines passed in 2000 allow JFM to be implemented in forests with over 40% crown cover. The 1988 National Forest Policy is federal law, but is adapted by each state, so that the exact arrangements of JFM Resolutions differ between states. Twenty-two of India's 26 states have implemented JFM resolutions, and both the minutiae of the Resolution and the motivational levels of each state forest department influence its success.

JFM has been criticized for transferring too little power to community members. In some cases, JFM is seen as a means for the FDs to organize local labor to improve public lands. Others note a tendency for JFM to be imposed on tribal people without consultation or consideration of their rights. Although results vary between states, JFM has achieved many of its goals, and has succeeded in increasing awareness about resource fragility, arresting depletion of forests, and the regeneration of degraded forests.

Table 5 : Definition of Joint Forest Management

Definition	Structure	Products	Purpose
Joint Forest Management (JFM) is a forest management strategy under which the Forest Department and the village community enter into an agreement to jointly protect and manage forest land adjoining villages and to share responsibilities and benefits.	The village community is represented through an institution specifically formed for he purpose. This institution is known by different names in different states (e.g., Vana Samaraksha Samitis in Andhra Pradesh and Hill Resource Management Societies in Haryana) but most commonly referred to as Forest Protection Committee or FPC. In some states, panchayats can also enter into JFM agreement with the Forest Department .	Under JFM, the village community gets a greater access to a number of non Timber Forest Products (NTFPs) and a share in timber revenue in return for increased responsibility for its protection from fire, gazing and illicit harvesting. The details vary from state to state as each state has issued its own JFM resolution / rules.	The essential difference between 'social forestry' and JFM is that while the former sought to keep people out of forests, the latter seeks to involve them in the management of forest lands. JFM also emphasizes joint management by the Forest Department and the local community.

According to state forest report 2005 the forest cover of the country has been estimated to 677088 sq km. which is 20.60% of the total geographical area. Madhya Pradesh has the largest area of 76.013sq km. under forest cover

constituting 11.22% of the total forest area followed by Arunachal Pradesh (10.01%), Chattisgarh (8.25%), Orissa (7.15%), Maharastra (7.01%). The seven north east states together account for 25.11% of the total forest area of the country whereas the tribal districts (188) comprises 60.11% of the total forest area of the country.

According to state forest report (2005) recorded forest and tree cover of some of the major states and West Bengal. The total forest area is 769.126 sq. km. which is 23.41% of the total geographical area.

State	Total Forest Area(Sq. km.)	% of Geographical area
Andaman & Nicobar Islands	7171	86.93
Sikkim	5841	82.31
Manipur	17418	78.01
Mizoram	16717	79.30
West Bengal	11879	13.99

Mineral resources

Mineral resources are a classic form of resource that must be carefully managed. Mineral supplies are finite and nonrenewable. The Extraction and processing of minerals can be extremely damaging to the environment. Yet modern technological society is heavily dependent upon minerals. As the world population continues to grow, and more nations become increasingly “developed”, the need to extract and utilize mineral resources will increase.

A mineral is a naturally occurring substance of definite chemical composition and identifiable physical properties. An ore is mineral or combination of minerals from which a useful substance, such as a metal, can be extracted and used to manufacture a useful product.

Minerals are formed over a period of millions of years in the earth's crust, iron, aluminum, zinc, manganese and copper are important raw materials for industrial use, important non-metal silica. Stone used for building material, such as granite, marble, limestone, constitute another category of minerals. Minerals with special properties that humans value for their aesthetic and ornamental value are gems such as diamonds, emeralds, and rubies. The luster of gold, silver and platinum is used for ornaments. Minerals in the form of oil, gas and coal were formed when ancient plants and animals were converted into underground fossil fuels.

Mines are of two types – surface (open cut or strip mines) or deep or shaft mines.

Mine safety **:** Mining is a hazardous occupation, and the safety of mine workers is an important environmental consideration of the industry.

Mining poses several long-term occupational hazards to the miners. Dust produced during mining operations is injurious to health and causes a lung disease known as black lung, or pneumoconiosis. Fumes generated by incomplete dynamite explosions are extremely poisonous.

The largest human excavations in the world are open-pit mines. Metal smelters typically produce enormous quantities of air pollution, including sulfur dioxide (causing acid deposition) and many toxic heavy metals – lead, cadmium, and arsenic among them. An estimated 8% of worldwide sulfur emissions into the atmosphere come from smelters. Dead zones, in which no vegetation or animal life can survive, cover thousands of acres (thousands of hectares) around many large smelters. The mining industry routinely uses hundreds of tons of mercury, cyanide compounds, and other very toxic substance

to remove metals from ores. Acid drainage flows from abandoned mines and tailing piles. Remove overburden (rock and soil removed during mining), tailings, and other wastes pile up in massive amounts. On a global scale, mining operations have become a force as powerful as natural erosion processes. It has been estimated that more than 23 billion metric tones (25 billion tons) of non-fuel minerals are removed from the Earth annually (less than half of this is actually “used” or “consumed”), and including the overburden, the total amount of material artificially moved by humans in mining each year may be twice the amount of sediment carried annually by all of the world’s rivers.

Recycling

As we have seen, in an absolute sense, the stock of any mineral on and within the Earth’s crust is finite and can be decrease. Metals and many other substances can be recycled. In effect, recycling can be viewed as increasing the effective or usable amount of a substance that we have at our disposal. Moreover, recycling often consumes less energy than extracting raw, virgin material.

Furthermore, even if recycling extends the effective amount of a substance over a number of years, it does not increase the amount of the substance at any one time.

Recycling also contributes to pollution, diverts resources such as fresh water, and requires the use of energy. Granted, recycling usually requires much less energy than mining and refining raw ore (producing aluminum from recycled goods uses 90% to 97% less energy than is required to produce the same aluminum from raw ore).

It is virtually impossible to recycle some substances in certain uses. Many uses of materials are dissipative –under normal use, they are degraded and dispersed. Examples of such materials include dyes, paints, inks, cleansers, solvents, cosmetics, fertilizers, and pesticides.

Summary

- Modern technological society is dependent on mineral resources, but of course minerals have been utilized by humans since prehistory.
- Mineral resources can be classified as metallic minerals and nonmetallic minerals; the latter category includes structural materials (such as building stone), industrial minerals (such as fertilizer components and nonmetallic minerals used in manufacturing), and energy minerals (fossil fuels, not technically minerals, and uranium ore, which is actually a metal).
- An ore is a mineral deposit that can be economically mined.
- Mineral resources are ore deposits that have not yet been exploited.
- Mining and smelting operations can cause severe environmental degradation. In the United States, nonfuel mineral mining produces over a billion tons of waste each year.
- Since the Industrial Revolution over 200 years ago, mineral use has increased by a factor of one hundred or more, and for some specific minerals, the increases have been by factors measured in the thousands.
- Prices of many minerals are low because they do not include externalities – environmental, social, and other costs that are associated with procurement of the mineral; mining may be subsidized by the government or the ore may be virtually free to the miner.

- Mineral scarcity can be dealt with by expanding the resource base (discovering new mineral deposits), recycling, substitution of one mineral or substance for another, and conservation of mineral resources (including the manufacturing of more durable goods that last longer).

Case Study

Sariska Tiger Reserve, Rajasthan

The Forest Department has leased land for mining in the Sariska Tiger Reserve area by denotifying forest areas. The local people have fought against the mining lobby, and have filed a public interest litigation in the Supreme Court in 1991, Rajendra Singh, secretary of TBS, points out that as many as 70 mines operate in close proximity to the forest.

Environmental problems

Mining operations are considered one of the main sources of environmental degradation. The extraction of all these products from the lithosphere has a variety of side effects. Depletion of available land due to mining, waste from industries, conversion of land to industry and pollution of land, water and air by industrial wastes, are environmental side effects of the use of these non-renewable resources.

Land resources

Landforms such as hills, valleys, plains, river basins and wetlands include different resources generating areas that the people living in them depend on.

The roots of trees and grasses bind the soil. If forests are depleted, or grasslands overgrazed, the land becomes unproductive and wasteland is formed.

Land on earth is as finite as any of our other natural resources. India has a geographical area of 329 Mha (2.45% of the World area).

Land degradation

Farmland is under threat due to more and more intense utilization. Every year, 5 to 7 million hectares of land worldwide is added to the existing degraded farmland, when soil is used more intensively by farming, it is eroded more rapidly by wind and rain. Over irrigating farmland leads to Salinization, as evaporation of water brings the salts to the surface of the topsoil so that crop roots are affected and the crop deteriorates. The use of more and more chemical fertilizers poisons the soil so that eventually the land becomes unproductive.

Soil erosion

The characteristics of natural eco-system such as forests and grasslands depend on the type of soil. Soils of various types support a wide variety of crops. The misuse of an ecosystem leads to loss of valuable soil through erosion by the monsoon rains and, to a smaller extent, by wind. The roots of the trees in the forest hold the soil. Deforestation thus leads to rapid soil erosion. Soil is washed into streams and is transported into rivers and finally lost to the sea. The process is more evident in areas where deforestation has led to erosion on steep hill slopes as in the Himalayas and in the Western Ghats. These areas are called 'ecologically sensitive areas' or ESAs. To prevent the loss of millions of tons of valuable soil every year, it is essential to preserve what remains of our natural forest cover. It is equally important to reforest denuded areas.

Case Study

Selenium – Punjab

In 1981-82, farmers from Hoshirapur and Nawanshehar Districts approached scientists of the Punjab Agricultural University (PAU), Ludhiana, as wheat crops had turned white. Soil analysis indicated Selenium (se) levels in the area were

above toxic limits. Se is a naturally occurring trace element, essential for animal and human health, but the gap between requirement and excess is narrow. Soils containing 0.5 microgrammes of se per kg (μg/kg) or more are injurious to health. In some areas of Punjab, se levels ranges from 0.31 μg / kg to 4.55 μg/kg. Rice cultivation requires the presence of standing water being highly soluble, Se dissolves and comes to the surface. The water than evaporates leaving the se behind.

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