DIECTORATE OF DISTANCE EDUCATION
AND
CONTINUING EDUCATION

Environmental Education & Policies

M.SC. ENVIRONMENT STUDIES

MANONMANIAM SUNDARANAR UNIVESITY
TIRUNELVELI

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ENVIRONMENTAL EDUCATION AND POLICIES

Introduction – Meaning and scope- Background and principles- objectives

Introduction

The imminent threat to humanity comes from the destruction of the ear this environment. Without realising that the earth is the only planet that can sustain all living things, man is continuously destroying his environment. The most urgent problem is to maintain the balance of nature and to make the earth a healthy and safe place to live in for the present and future generations.

The problem of environmental degradation is not limited to any particular region or country but affects the entire world. In fact the concern for environmental problems has never been so high as it is now. " Pollution is making the earth unsuited to life" " Rivers and lakes are drying" " "Deserts are on the march"- These are the familiar slogans we hear every now and then. Our attitudes towards the use of environmental resources must change. We must educate ourselves to treat the environment that sustains us with great reverence, care and caution. It is this realization that gives environmental education a place of prime importance.

Meaning and scope

Environmental education is education through, about and for environment. Its scope is therefore very wide. It begins with using Environment as a medium of learning and includes all that Kalidasa, Wordsworth and others have said in appreciation of Nature and also all that scientists and scholars have disclosed about our physical and social environment and finally it includes all that we say and do for conserving our resources and for beautifying our surroundings including urban and country planning.

Environmental education may be defined as " The process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelations between man his culture, and his biophysical surroundings. Environmental Education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality". (IUCN 1970)

United states Environmental Education Act, 1970 also clearly defines Environmental Education. :

Environmental Education means the educational process dealing with man's relationship with his natural and man made surroundings and includes the relation of population, pollution, resource allocation, depletion, conservation, transportation, technology, urban and rural planning to the total human environment.

Environmental Education is a lifelong process and therefore should aim at not merely imparting knowledge and understanding of the environment but application of that knowledge to improve one's own nearer and distant environment besides equipping the masses with needed skills and values necessary to appreciate and treat our life supporting biosphere resources reverentially and also to make them relish nature with restraint. Therefore Environmental Education means

- Education for Environment
- Education about Environment
- Education through Environment

Levels of effective Environmental Education

In order to be effective and sustainable, Environmental Education can be divided into three levels. The first level of Environmental Education could focus on developing environmental sensitivity at the level of the individual. The content and methodology of environmental education at this level aim at creating environmental awareness.

The second level of Environmental Education would need to focus on " enhancing personal motivation to act on environmental issues". This level enables the social groups to plunge into concrete environmental actions.

The third level of environmental education deals with promoting "Environment Action" that enables individuals to form a cohesive organization in order to implement concrete initiatives to improve the situation because it is often said "Together we flourish Divided we perish".

These three levels should be seen as a process, development and continuum wherein, at each stage new knowledge, skills and consciousness are introduced and developed which are necessary for sustainable and successful environmental action.

Basic Goals of Environmental Education

The basic tenets of environmental education as set out by Belgrade Charter (1975) in its global framework for environmental education are as follows:

1. **Awareness**
   To help individuals and social groups acquire an awareness of and sensitivity to the total environment and its allied problems.
2. **Knowledge**
   To help individuals and social groups acquire basic understanding of the environment and its associated problems.
3. **Attitudes**
   To help individuals and social groups acquire social values and to motivate them to protect ones own environment
4. **Skills**
   To help individuals and social groups acquire necessary skills to solve one's own environmental problems.
5. **Evaluation ability**
   To help individuals and social groups evaluate measures taken to correct environmental education programmes in terms of ecological, political, economic, social, aesthetic and education factors.

6. **Participation**
   To help individuals and social groups develop a sense of responsibility and urgency regarding environmental problems so as to ensure appropriate action to solve those problems.

Scope of Environmental Education

Environmental Education may be incorporated in the school curriculum in two ways. It could be either taught as a separate subject or integrated with other subjects. It should be incorporated at school, college and university levels. It is a continues process throughout one's life. At primary levels, awareness may be created and the children should be taken to seas, forests, waterfalls etc so that they will develop an abiding love for nature. As they grow older, technical knowledge and practical training have to be imparted through trained teachers to motivate them to protect their environment. At

university level the urge to protect one's own environment should arise from within without any motivation from outside.

Environmental Education should focus on

1. Environment –in its totality – Natural and built in technological and social development.
2. Environmental Education should be interdisciplinary in its approach,
3. Environmental Education should be a lifelong process starting from primary and continuing through all formal and non-formal stages.
4. Environmental Education should enable planners to lay stress in planning and execution of development projects
5. Environmental Education should enable learners to have a cardinal role in planning and development activities and to raise their voice if any projects are planned at the expense of environment
6. Environmental Education should help in sustainable use of basic resources
7. Environmental Education should help learners to identify the environmental problems and to swing into action.

The Environmental Education can be integrated with regular subjects as follows

Chemistry – Air and Water Pollution- Ozone depletion- Water and Air quality Measurement – Green house effect – Exploitation of ground water and its depletion effects.

Botany – Importance of trees – Medicinal plants and its role in human welfare - Plants as indicator of pollution- Pesticides and its impact- Agriculture –its impact on environment

Zoology – Wild Life Protection- Sanctuaries – Vermicomposting- Fish biodiversity and its conservation measures- Endangered and endemic species conservation.

Physics – Energy conservation- Renewable energy-Solar cookers- Wind mills-Biogas energy utilization- Radiation and its impact on-Nuclear energy

Geography – river systems-linking of rivers-importance of forest areas-mineral and industrial survey

History – the rise and fall of civilization-wars and hazards-Nuclear warfare

Economics-environmental audit –Enviro-economics

Although enough awareness is there, there is a lot more to be done in terms of education, motivation and actual action not only to check environmental degradation but also to ensure sound and healthy environment for all. Environmental Education should provide multidimensional opportunities for gaining insight into environmental problems and many viable routes in eliciting action- that finally contributes to human and social transformation and ecological preservation.

BACKGROUND AND PRINCIPLES

BACKGROUND

It was during the United Nations Conference on Human Environment, Stockholm, Sweden, 1972, that for the first time governments at the highest level came together to take stock of what mankind had done to the environment of which he was an integral part. Industrialized countries expressed their shock of what had happened to them in the process of industrialization and fast development while developing countries expressed that poverty and under-development were the major factors of their environmental degradation (United Nations, 1972). Thus, a global concern was expressed and needed actions were formulated.

Recommendation 96 of the Stockholm Conference stated that "the Secretary-General, the Organizations of the United Nations System, especially the United Nations Educational, Scientific and Cultural Organization and the other international agencies concerned, should after consultation and agreement, take the necessary steps to establish an international programme in environmental education, interdisciplinary in approach, in-school and out-of-school, encompassing all levels of education and directed towards the general public, in particular the ordinary citizen living in rural and urban areas, youth and adults alike with a view to educating him as to the simple steps he might take within his means, to manage and control his environment" (United Nations, 1972). Thus, environmental education was recognized and its development was recommended by the world community as a measure for the understanding, protection and improvement of the environment and its quality.

In response to the above recommendation, UNESCO in cooperation with UNEP launched the UNESCO-UNEP International Environmental Education Programme (IEEP) in 1975, which is housed in UNESCO Headquarters in Paris. IEEP's objectives are to assist governments, national regional and international institutions to incorporate environmental education (EE) into formal and non-formal education systems and programmes in order to:

- Make people aware of the nature of the relationship between humanity and the environment on which he depends
- Impart knowledge and skills to understand and solve environment and development related problem, and
- Enable people to acquire the attitudes and motivations leading to sound decisions and civic actions for the protection and improvement of the environment and its quality.

For the clarification of the concept, goals, objectives and guiding principles of environmental education and formulation of strategies for its development at national, regional and international levels, UNESCO in cooperation with UNEP organised, in the context of IEEP activities, the first Ministerial Intergovernmental Conference on Environmental Education in 1977 at Tbilisi (USSR).

PRINCIPLES

The guiding principles of Environmental Education developed and endorsed at Tbilisi Conference (UNESCO-UNEP, 1977) are,

- ✓ To consider the environment in its totality – natural and built, technological and social (economic, political, technological, cultural, historical, moral, aesthetic)
- ✓ To be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and non-formal states

- ✓ To be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective
- ✓ To examine major environmental issues from local, national, regional and international point of view so that students receive insights into environmental conditions in other geographical areas
- ✓ To focus on current and potential environmental situations while taking into account the historical perspective
- ✓ To promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems
- ✓ To explicitly consider environmental aspects in plants for development and growth
- ✓ To enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences
- ✓ To relate environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years
- ✓ To help learners discover the symptoms and real causes of environmental problems
- ✓ To emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills
- ✓ To utilize diverse learning environments and a broad array of educational approaches to teaching/ learning about and from the environment with due stress on practical activities and first-hand experience.

In the above context, environmental education serves as a common denominator in educational renewal at all levels of education-by enhancing interdisciplinary among the different subjects and by relating education to the real life of its target groups. Environmental education advocates problem-solving approach as a skill, which could help and guide its target groups in the solutions of current and future environment and related problems.

GOALS

The goals of EE formulated and adopted at the Tbilisi Conference (UNESCO-UNEP, 1977) are:

- o To foster clear awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas
- o To provide every person with opportunities to acquire the knowledge, values attitudes, commitment and skills needed to protect and improve the environment and
- o To create new patterns of behavior of individuals, groups and society as a whole towards the environment

Objectives of Environmental Education

Many experts feel that there can be no hope of finding solutions to environmental problems until and unless general education at all levels is suitably modified to enable people from all walks of life to comprehend the fundamental interaction and interrelationship between man and his environment from childhood. It is through Environmental Education that a new global ethic can be developed and an environmentally literate population created. In order to create this, all types of institution, namely, schools, extension agencies, government departments, voluntary agencies and teacher training institutions will have to form a network for Environmental Education.

In this context, the objectives of EE can be listed as follows:

- ❑ To develop awareness in the child of the various features of his immediate environment, enabling him to use his own environment as a source of stimulus to learning.

- To develop knowledge to help social groups and individuals gain a variety of experiences and acquire a basic understanding of the environment and its associated problems.
- To develop a scientific attitude in children and social groups through environmental studies and to enable them to acquire a set of values and feelings of concern for the environment
- To acquire skills for identifying and solving environmental problems
- To help children assimilate the methods of scientific enquiry, commonly referred to as process skills. The important ones among them are: observing, classifying, measuring, recording, experimenting, hypothesizing, communicating and inferring. All these skills are to be taught to the children with the help of objects and features of the child's own surroundings.

Need to Change Attitudes For Sustainable Development

Sustainable development as put forward by Brundtland Commission 1987 can be defined as forms of economic growth and activities that do not deplete or degrade natural resources on which present and future economic growth and life depend. Sustainable society is one that manages its economy and population size without causing irreparable environmental damage by overloading the planet's ability to absorb environmental insults, replenish its resources, and sustain human and other forms of life over a specified period- usually hundreds to thousands of years. Sustainable living means taking no more potentially renewable resources from the natural world than can be replenished naturally and not overloading the capacity of the environment to cleanse and renew itself by natural processes.

Policy and Practice for sustainable Development – Attitudinal change – Need of the hour

Progress towards a sustainable pattern of development will demand significant changes in economic and social activities in order to eliminate their adverse impact on the environment. Production Technology, managerial and work practices and people's attitudes and behavior need to change in order to make them compatible with a healthy and sustainable environment. Environmental training and education is a major tool in bringing these changes about.

The International Chamber of Commerces (ICC) Business Charter for Sustainable Development.

The ICC charter was developed in response to our common future, the report of 1987 world commission on environment and development (Brundtland Commission). The ICC charter emphasizes the importance of establishing appropriate management structures. It recommends that environmental management be among the highest corporate priorities. That policies, programmes and practices be established to support this goal and that these should be integrated into all the enterprises functions. As far as employee's environmental education is concerned, it calls on business to " educate, train and motivate employees to conduct their activities in an environmentally responsible manner. Accordingly environmental training should be multidisciplinary, focusing on the complex interactions between environmental phenomena and human activity. Many learners experience difficulty in accepting beliefs. For example modern day agriculture practices have negative impact upon the external environment. Hybrid seed, excessive irrigation, chemical fertilizers, and pesticides usage, monoculture practice all these are

detrimental to soil health as well as to human and livestock health. Farmers who use intensive agricultural practices are the main reason major pollutions of soil and water.

Existing agriculture practices need to change in order to reverse environmental degradation. Farmers need to reduce the use of fertilizers and pesticides. Farmer's production objectives need to change, with the emphasis moving away from maximizing output towards optimizing income of ensuring sustainability. Rotating crops, while use of pesticides can be reduced by reliance on the natural enemies of pests can reduce the need for fertilizers. What is needed in change of mindset? Changing Farmer's conventional practices requires new attitudes. Farmers must be motivated towards environment through a change in attitudes supported by an understanding of basic environmental concepts.

The waste wise project in Bangalore shows how a comprehensive view of solid waste problem can evolve from grass root level. The project explores alternatives to the conventional solid waste system based on waste reduction system, separation of compostible, recyclable, reusable and non-compostable wastes. The waste wise group hopes to transform approaches to solid waste management by building on social and environmental motivation. Separating wastes to enhance their value for recycling can become part of an environmental ethic in the city.

The ultimate goal in environmental education is a development model that is sustainable in the long run. In the developing countries sustainability can only be achieved by introducing environmentally sound production practices in agriculture, fishing and forestry, controlling population growth and managing urbanization. Sustainability also requires changes in individual behavior, particularly consumption behavior. This holds true especially with regard to change of attitude to carry paper or cloth or gunny bags instead of insisting the shops tp pack the goods in polythene bags a menace to our environment.

To conclude only a transition to a pattern of sustainable development can avoid further environmental degradation and ensure human race a healthy, stable environment and a better quality of life for the present and future generations.

Earth Summit (1992' – Rio Earth Summit) :

A central objective of the 1992 Rio Earth Summit was to replace the current anthropocentric and environmentally damaging forms of economic development with eco centric and sustainable ones. All the global interests represented in Rio reached a negotiated consensus on the principles of ecological accountability and action directives under the Agenda 21. After the 2002 Johannesburg Summit, sustainable development (SD) is the frontline human struggle to balance the conflicting goals of preservation of biodiversity and exploitation of natural resources for human development.

Deep ecology (coined by Arne Naess) prescribes extreme ecocentric remedy: to stop all logging, protect rain forests, naturally reduce populations growth rates, adapt to life styles back in time and even abandon science. World population, however, is expected to stabilize at around 12 billion at the end of next century- twice that of what is today. The economic and social forces intertwined with such an enormous increase in population may unleash conflicts of social interests and generate powerful incentives to destroy biodiversity.

The International Institute for Sustainable Development (IISD) prescribes a wide range of creative programmes under Agenda 21. Conservation of rain forests is being promoted by creation of biospheres, rural village committees to reduce pressures of local population on forests, developing alternate biomass fuels, agro forestry and a debt from nature policy under which a country's foreign debt may be waived off in exchange for preservation of specific areas. But most of the current biotechnology R&D is focused into areas that have tremendous market potential such as human nutrition and health. The idea of human progress through science and technology to create and sustain a consumer

(market) economy has come under severe criticism by environmentalists and ecologists because of its negative impact on biodiversity and environment. Edward Goldsmith, a renowned conservationist and the editor of *The Ecologist* magazine, is a strong proponent of self-imposed simple lifestyles and rural communities/ villages as a hub of all developmental activities modeled by Mahatma Gandhi as a universal developmental model.

Identification of key thresholds to regional biodiversity, formulation of clear monitoring protocols, management strategies and a timely delivery of information regarding these key aspects to the rural communities are necessary for conservation as well as development of regional biodiversity. In the context of developing countries like India, the infrastructure in the form of Panchayat Raj or similar administrative network for rural development need to be primed for involving the local bodies in biodiversity management so that benefits are sustainable.

In the earth summit held at Rio, Brazil (1992) two important treaties were signed by a number of countries. They are namely

- Conservation of BD and
- UN convention on climatic change

Convention on Biodiversity

The objectives of this convention to be pursued in accordance with its relevant provisions are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources and to technologies and by appropriate funding.

Convention on climate change

The ultimate objective of this convention and any related legal instruments that the conference of the parties may adopt is to achieve, in accordance with the relevant provisions of the convention, stabilization of green house gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climatic system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in sustainable manner.

The historic 1992 United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro focused on an enormously comprehensive proposal for international partnership in protecting and preserving the global environment and Agenda 21 provides this seminal document not only in its final version, but complete with early drafts and developmental iterations, background papers, attendant proposed treaties, selected “non papers” unced proceedings and subsequent General Assembly debates.

Agenda 21 provides the most workable, realistic positions yet presented a global cooperation in such critical areas as:

- Protection of oceans, seas and coastal areas
- Rational use of and development of marine resources
- Sustainable development policies for developing countries
- Management of radio active wastes, toxic chemicals and hazardous wastes
- Transfer of environmentally sound technology
- Protection of atmosphere
- Cultivate deforestation, desertification and drought
- Biotechnology

International Environmental Law

Environmental protection is a major problem of the present society. Global environments and the entire biosphere is changing fast as a result of the impact of science and technology that brings about ecological changes in the structures of earth with an adverse impact on global environment. According to the United Nations Declaration of 1972, maintenance of wholesome human environments is the concern of all mankind.

If the human conduct is not guided by the teachings of the environmental sciences, the "tragedy of the commons" results. Each person maximizes a narrow immediate gain, while failing to see how a natural resource may be depleted or a pollutant may harm a distant person. It socio-economic development is to be sustained overtime, it can not afford to waste its capital or freely discard its unwanted by products. The role of environmental law is to compensate for such unction's in the economic and social sectors.

The seasonal habits of summer song birds that migrate to southern hemisphere are in good shape means it is because of environmental law. The drinking water supplied in international aeroplane is consistently potable because of Environmental law. Chlorofluorocarbons, it is stated in environmental law must be recycled and reclaimed. The environment law protects the stratosphere 15 miles above the earth. With regard to hazardous wastes cross a border to a country where they cannot be safely stored or treated, their country from where they originated must take them back states international environmental law.

Each of these instances illustrates how pervasively the relatively new field as environmental law has expanded internationally. These laws attempt to protect people's health and to restore or maintain the national environment. Since it's beginning in the 1970s, environmental law has come to play a role in practically every sector of society, in all countries. It is the principal component of the legal system for sustainable development in each country.

International environmental law links individuals and their local governments into a worldwide network. This system is not often perceived locally, because each country's own legislation and institutions are assigned the job of applying the shared environmental rules. However, when one considers how the trade of a food products like coffee can carry pesticide residues, how tourists, business staff or visitors move daily around the world, it is roughly equivalent environmental protection measures. Law is the mechanism for defining and applying those services.

Moreover, environmental law is unlike the model of classic international law in which a few agreed norms guide how independent sovereign states act to establish their own rules and keep their national territory safe by a balance of power. The new paradigm of environmental law provides for rules, which are based on ecology and other sciences, the "Laws of nature", exist quite apart from the will of sovereign states. These environmental rules cut across all artificial national borders just as watersheds or wind patterns do. Environmental law functions wherever nature's systems are found and adapts human behaviour to work within the constraints of the environment.

International environmental law may be understood by examines four aspects.

1. An overview of how its operate generally followed by
2. A description of the separate bodies of laws for oceans, the atmosphere, rivers, living species, lands and space
3. The related regimes for transnational trade, public health, technology transfer and socio-economic development which increasingly entire environmental law requirements
4. The trends shaping international environmental law suggest that these laws will play a much more important role in the future than they do today.

The paradigm of International Environmental Law

Environmental Law internationally is composed of a spectrum of rules with in nations, the legislatures enact status and agencies adopt regulations. Local or regional authorities enact laws within their assigned competencies. Among nations, treaties and similar agreements are agreed to, and international organizations composed of nations adopt policy regulations recommending how governments should behave. The former are called “hard law” and the latter “ soft law”. In addition, general principle of law, grounded in basic morality, guide nations as they do individuals, finally unwritten custom can be said to be law of it is adhered to fairly consistently and acknowledged as binding.

Each of these types of law mutually reinforces the other paradigm of how environmental law functions inter-nations can be illustrated by a loop with these five stages.

a) A national or local government may adopt a law for instep to abate pollution of a river or set harvest limits on a fish source.

b) When two or more governments share control over the same resources, such as a river or fish species, they find that their law cannot be effective it they inconsistent.

c) As regional or international agreements emerge to integrate various government control over the same resource, then their may arise to need in invite governments that have not enacted they respect environmental laws to do so.

d) Governments with more experience and more advanced environment regions make improvements in the techniques and urge these refinements on the international agreements and through them all to the less advanced government

e) Refinements in an environmental techniques or political pressure to enhance environmental protection, drive once set of governments or an international organization improve its own system of environmental protection.

This paradigm can be seen at work in the evolution of treaty one between Canada and the USA. Under 1909 Treaty, both national set up an international joint commission which as been at work ever since to resolve disputes of natural resources on the border. One such dispute produced world-renowned trail smelter Arbitration (1941) in which a tribe ruled that the forms from a smelter in Canada had damaged agricultural lands in the USA. The orbital tribunal ruled, “no state has the right to use or permit the use of its territory of another or the properties or person there in, when the case is of serious consequence and the injury is established by clear and convincing evidence”. This rule is widely recognized as a binding general principle and is incorporated into both treaties and soft law instruments such as principle 21 of the 1972. Stockholm declaration on the human environment or the 1992 Rio de Janeiro declaration on environment and developments through the international joint commission, Canada and the USA have gone on to adopt the great lake water quality agreements (1978 & 1985) to design on active ecosystem management regime for the showed resources of the great lakes.

While this paradigm can be functionally identified to exist at present, and especially when it works successfully, it is not well understood or even perceived by politicians or the news media. The political or journalistic time frame is the next election or news deadline. The functioning of international environmental law is long term and gradual. When the international civil aviation organization in Montreal adopts a rule to ensure that all international flights have potable water abroad, even when coming to or from cities where such water is scarce and all air lines and airport succeed in adhering to this rule, no media is unresolved, such as the decisions by ice land, Norway or Japan to exercise their legal right policy preferences of the international whales against the commission, that one phase of the paradigm receives wide publicity.

Internationally, the Association of South East Asian Nations (ASEAN) has negotiated a treaty on the conservation of natural resources. Although not yet ratified, this agreement already guides each ASEAN member in developing its own national legislation.

There are several reasons why environmental law has emerged rapidly as a new field of law. The advances in environmental sciences have disclosed the magnitude of problems hitherto unnoticed, and global telecommunications share these with all nations. The deteriorating worldwide trends in environmental quality have stimulated a popular demand for effective governmental measures to counter those trends. These are the substantive themes, which the paradigm of international environmental law addresses.

They vary environmental problems that once as or deterioration of the stratosphere ozone hole over the Antarctic, Global warming due to CO_2 and CFC emissions, melting of frozen waters in glaciers and ice caps due to global warming, deforestations in temperature and tropical forest, desertification in African and Asia, dissection of wetlands estuaries and tropical forest and mounting nature of solid waste due to chance in the life style and finally exploiting population growth.

The four broad areas of international environmental laws compromise oceans, atmosphere, living resources such as flora and fauna and showed territories land uses. Within emergences of mega cities of sprawling industrialization pollution grows and waste accumulate.

The next few decades are crucial for the future of humanity, pressures on the planet are new unprecedented and are accelerating at rates and scales new to human experience. Each over of change represents formidable challenge in its own right, but the fundamental challenge stems from their systemic character. They lock together environment and development, once thought separate, they lock together 'sectors' such as industry and agriculture, they lock counties together as the effects of national policies and actions pill over national borders. Separate policies and institutions can no longer cope effectively with these interlocked issues. Nor can nations, acting unilaterally. The real world of interlocked economic and ecological systems will not change, the policies and institutions concerned must.

In fact, the real world is rapidly changing and environmental law is quietly reshaping institutions daily. The shared objective of all local, regional, national or international governmental agencies shaping and applying environmental law today is to build the new regime envisioned by the Brundtland report. These goals appear in the "World Conservation Strategies" adopted by the oldest international environmental authority, the international union for the conservation of nature and natural resources (1948) IUCN. The world conservation union published its most recent strategy entitled caring for the earth. A strategy for sustainable living in 1992, in partnership with the UN Environment programme and the worldwide fund for nature.

The 1992 UN conference on environment and development (UNCED) held in Rio de Janeiro did a great deal to further that same vision. Over two years of preparatory meetings and at the Rio "Earth summit" 178 nations hotly debated and agreed on an action plan 'Agenda 21' that is currently the world's most important soft law document. This detailed text outlines specifically the law reforms that will be required in each sector of human activity, in order to combat the deteriorating global trends and to restore or maintain a healthy and productive environment worldwide.

Recommendations concerning Environmental Education, strategies and action plans

Environmental education and training should be viewed as a life long process. As all human activities have an impact on the environment it is absolutely necessary to mobilize various providers of environmental education and training at different phases over a lifetime. As with most training, the institutional framework, the approaches and the methods used in environmental training tend to differ according to country's traditions and training practices. The choice of institutional strategies and methods for delivering such training is considerable including institutional based and classroom

training. Environmental training must take into account learner's conception about environment. If environmental education and training is to reach everybody, it should be delivered through different institutions such as schools, enterprises, centres of environmental education, community organizations, NGO's, universities and mass media. The mass media can be effectively used to inform the public about environmental issues and ways and means of solving environmental problems. Schools are in a good position to instill basic concepts of environment with their models, charts etc. Training institutions can best develop occupation- specific environmental knowledge and skills. Enterprises can often provide environmental training tailored to the job. Community organization and NGOs often active at the grass roots level can educate members of the community, in particular women and informal sector workers. Finally universities and other higher education and training institutions have the risk of training environmental professionals. These different trainers should complement and reinforce each other.

Methodology for imparting environmental education through formal education

The environmental education is the educational processes through which is imparted to its target groups in schools, homes, factories, farms etc the environmental sensitivity, awareness, knowledge, understanding, attitudes, skills, commitment and civic actions needed for understanding protection and improvement of the environment. In other words, the museum of environmental education is to foster environmental literacy among all the citizens who are expected to have ethical responsibility about once our environment and its related issues.

For the incorporation of EE into education process it is essential to establish the needed mandate and make the educational institutes to abide by it. Otherwise EE will form a peripheral and not the core area of study in the school curriculum. Thanks to the recent Supreme Court's judgment that EE is made compulsory at school, college why even at university level.

Basic tenets and interactive approach to EE

Recommendation 96 of Stockholm conference 1972 on the human environment called for the development of environmental education as are of the most critical elements of an all out attack on world's environmental crisis. The objectives of EE as set out by Belgrade Charter (1975) are awareness, knowledge, attitudes, skills, evaluation and participation.

Teacher training

There is urgent need for an environmental training teacher to undergo rigorous training on the ways and means of imparting EE. First and foremost a suitable curriculum may be evolved by understanding local environmental problem and situation. The curriculum should be updated as and when necessary. The curriculum should incorporate

-Objective and goals of EE

-Environmental issues

-Various aspects of environments & institutional methodologies.

The amalgamation of the above elements and their organization at grade or age levels would form the environmental education dimension of the curriculum. Pertinent environmental contents will give the curriculum its essential local dimension.

The curriculum may be delivered through different methods at pre-school, school or college and university level. At pre-school, the children may be taken to forest, water falls, mountain tops, seas and rivers so that they may learn to understand Nature's gifts. They will begin to love Nature from childhood onwards. At school level modules may be prepared on certain concepts such as ozone depletion, afforestation and its impact, rainwater harvesting, solid waste management etc. Learning by doing may be insisted upon at school level. Even they may be taught to solve certain environmental problems taking us every day. At university level the students by themselves should come forward to reach the public an environmental cleanliness and protection through NSS, NGC and NCC Activities.

However research shows that formal education is not successful for two reasons. Firstly the logistical problems of its widespread implementation ensure that there is not sufficient amount of it. Secondly even when well-designed programmes of EE do exist it appears that other influences on people's lives are far more significant than education programmes in the development of their environmental understanding, awareness, concern and action – and formal education programmes take little or no account of these.

A strategy for imparting EE

The static model shows the three elements as primarily located within one of the three approaches to teaching and learning (about in and for the environment) it should be emphasized that, inevitably, they merge and overlap. Such are the limitation of two-dimensional representation

Research has demonstrated that these may indeed be more significant than planned formal educational programmes in the development of environment understanding is concerned and wherever possible, educators need to be aware of prior knowledge is build upon in a meaningful way. Formative influences, through a combination of life (i.e., further significant experiences) and formal education programmes, hopefully, individuals may acquire the necessary range of knowledge and understanding, skills, attitudes and values that foster personal concern is enable the ability to act in pro-environmental ways.

Perhaps one further, and indeed 'final' version of the model should be made, which returns us to the issue of the limitations of two-dimensional representation. So far, the model's components have been presented solely in two dimensions, suggesting that relationships between them are comparable. In reality this is not the case, 'Since the core' of formative influences is pre-supposed and cannot be planned for in the same sense as other components. The core is independent of yet interrelates with the experiences of planned programmes, and so is better regarded as a foundation that continues to feed into and nurture other experiences.

Strategies and Action Plan for Imparting EE

Priorities or imperatives for enabling environmental education to meet its promise and potential in the 21st century include a widespread strategy and implementation of planning modals and related instructional programmes at all level of education starting right from pre-school through higher education, initial teacher training and professional development of teachers which stresses:

- Recognize and build upon prior knowledge and of formative influences and life experiences
- Recognize the importance of knowledge gained through living and in interacting with communities around as distinct from formal knowledge gained in classroom through verbal language medium.
- Recognize the value of environmental education with greater emphasis on aesthetic and spiritual experiences.
- Make EE issue based and Action oriented, for e.g., Teach water harvesting and its importance in water starved area.
- Make EE interdisciplinary
- Follow International guidelines but incorporate locally appropriate goals.
- Take into account learns gap in knowledge misconceptions biased stereotyped ideas.
- Provide exposure to different perspectives on the cause of and solution to environmental problems
- Take account of rigorously carried out research findings that determinate the teaching and an learning process in EE

The educators advocate a shift in emphasis away form environmental education as being about the environment (based on scientific domain) towards all encompassing education for the environment. What is needed is a balance of approach covering all aspects of environment. Perhaps the pendulum has swing to far in favour of calls to educate for the environment. The type of education that focuses upon a particular issues and seeks ways and means to solve that are by drawing upon knowledge opportunistically – is what is needed at present. No doubt education about the environment should go within socially critical education but surely if any degree of true and comprehensive understanding of the world environment is to be achieved even in small measure then education about the environment should go alongside, inter-linked with, issue based, action attended socially critical education. So too goes education in the environment forms essential foundation for formative influences of the personal, aesthetic and other intrinsic factors of the interwoven society reinforcing each other.

Finally we can say for certain that formal programmes of environmental education alone are not suffice to motivate the people "to same the planet" which is sinking keyword redemption. Formal education should be supplemented by multimedia approach i.e., Use of varied types of media print. Electronic, Folk, oral media etc. to inculcate right type of attitude towards one's own environment. Planning, implementation and evaluation of EE programmes alone can have desired impact upon the society in order to achieve sustainable future for our prodigy.

Clearly education and communication are inseparable that has impact upon people's thinking and actions.

Environmental Education (Formal as well as informal) builds up motivation, skills and understanding on which environmental citizenship rests. Environmental communication is aimed at changing practices and behaviour in eliciting actions in relation to environmental issues.

Our task as environmental education lies in trying to implement programmes of education that informs on people about the complexities of the environment in which they are growing up, empower them to address environment development issues and provide them with opportunities to be inspired by the joys, wonder and mysteries of the natural world and human achievement striking for excellence.

Human impact and Earth surface and oceans

Man in the earlier days lived in tune with Nature and treated Nature reverentially. Not only Man lived in this life supporting planet earth but other animals and plants as well. The mutually supportive role of all living beings is a crucial factor for a balanced and harmonious living. In fact even Taitariopanistad looks at the relationship between man and his environment in its totality. Vedic seers, poets and thinkers drew lesson from Nature.

However, with increasing population he from transformed from hunter-gatherer to producer. Slowly there upon as Industrial Revolution and urbanization dawned the reverential relationship of man with nature borned exploitative Man's greed

replaced need and the result what we see today. Modern Science gives us the arrogance, technology the mean, increasing population the alibi and poverty the justification to destroy nature. Add to these the world's social economic under that enables a few to dispossess the many, and you have the recipe for a crisis of sustainability. The current global lifestyle is not sustainable. This means that humans are consuming faster than the earth can replenish and dumping waste faster than the earth can hold and assimilate. The growth of world population and production combined with unsustainable consumption patterns places increasingly severe stress on the life supporting capacities of an planet. These interactive forces affect the use of land, water, air, energy and other resources. Human dimensions are key elements to consider in this intricate set of relationships and they should be adequately taken into consideration in comprehensive policies to sustainable development. Such policies should address the linkages of demographic trends and factors, resource use appropriate technology dissemination and development.

The cause for environmental degradation is growing members of people and rising levels of consumption pattern, per capita that deplete life sustaining Natural Resources that result in chronic water shortages, loss of arable land, destruction of Nature habitats that spread many types of epidemics ultimately threatening economic and social progress.

Human impact upon Earth's vital Resources

(World watch institute and world Resources institute Washington' report)

Productive land

In the last 50 years about 8.1 million Sq. K.M. of once productive land (crop land, forests, grass lands) become desert worldwide.

Cropland Topsoil

Topsoil is eroding faster than it forms on about 35% of the world's cropland. This leads to a loss of about 24 billion metric tons (26 billion tons) of Topsoil every year. India losses 6000 metric tons of Topsoil every year along with 600 metric tons of nutrients too. Topsoil water logging has medical 1/10 the of worlds cropland.

Forest Cover

Almost half of the world's final expanse of tropical forests has been cleared and 202,0000 Sq. Km are degraded. Within another 50-60 years to come almost there may be little of the relics may be left for future generations. One third of the people of an earth have to depend or cutting of forest trees to meet their daily fuel needs. Also many of the remaining areas of diverse, ancient forest are being cleared and replaced with more vulnerable tree forms replacing wild life habitats and biodiversity.

Grasslands

Millions of hectares of grasslands have been overgrazed especially in Africa and Middle East's where they have been converted to deserts. Almost 2/3rds of US' Range lands are in poor condition.

Water

Coastal and Wetlands

Among world's wetlands nearly 25 to 50% have been drained, built upon or seriously polluted. Worldwide millions of wetlands are lost each year.

Oceans

Greater volume of waster dump in Air, land and rivers end up in Oceans. The sink for solid and liquid wastes. Oil slicks floating plastic debris, polluted estuaries and beaches and contaminated fish shellfish are visible signs that we are using the oceans as the world's largest trash dump.

Lakes

Thousands of lakes in Eastern N. American and in Scandinavia have become so acidic that they contain no fish: thousands of other lakes are drying. Thousands are depleted of much of their O_2 because of inputs of various chemicals produced by human activities.

Atmosphere

An estimated 2.7 million to 3.0 million people are killed every year. About 6% of all deaths annually due to atmosphere pollution. About 9-death in every10 are cause due to air pollution cause by industries other type of activities of humans in the developing world where 80% of all people live. About 2.5 billion people almost all in the developing countries suffer from high level of indoor pollution which may be attributed to burning wood, animal dung, crop residues, usage of coal for cooking of heating. Most of the victims are girls and women who are primarily responsible for house hold works in developing countries most of which depend on fossil fuels for cooking purpose.

Outdoor air pollution harms more than 1.1 billion people mostly in cities. WHO estimates that about 700,000 deaths could be prevented in developing countries if three atmospheric pollutant carbon monoxide, suspended particulate matter and lead were brought down to safer lands another serious threat to atmosphere is global warming due to emission of green house gases CO_2, chlorofluorocarbons etc. Studies project that by 2100 the earth's surface temperater could increase between 1.0 % 3.5 Celsius, which will result in melting of, green lands ice sheet even. As a consequence the global sea level rise as much as 7 meters.

Even a rise of one metre in the sea level would incendate many low lying coastal areas around the world. For instance much of the Nile River Delta would disappear.

WETLANDS

Wetlands are "Areas of marsh, fen, peat land or water whether natural or artificial, permanent or temporary with water, that is static or flaming. Fresh, brackish or salt including areas of marine water the depth of which does not exceed 6 metres. Wetlands can also be defined as those areas in undated or saturated by surface ground water at a frequency and duration sufficient to support and that, under normal conditions do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs and similar areas. In general, wetlands are areas of land that remain water logged for a substantial period of the year.

Tropical wetlands cover 2.64-million km^2 world wide whereas in temperate and boreal regions occupy about 5.72 million km^2. They support a wide variety of plant and animal sp. Wetland ecosystems are among is of the most threatened of all environmental resources- due to loss of wetland area, which has been converted to industrial, agricultural and residential use.

In recent years wetlands have assumed a good deal of attention. It was given impetus thanks to the conference held in Ramsar in Irain in 1971 when the initial listing of wetlands of Natural importance was made and the contracting parties agreed to take necessary steps to safeguard these wetlands for posterity. India as one of the original signatories has made impressive efforts in initiating the work for conservation and management of wetlands. Australia where half of the wetlands have vanished during the last centuries now epitomizes the grinning public interest wetlands.

The Ramsar convention at Iran

The convention as wetlands of international importance especially as waterfowl habitat often known as the Ramsar convention from its place of adoption Iran in 1971 is an intergovernmental treaty, which provides the framework for international cooperation for conservation of wetlands.

By 1991 more than 60 countries had joined the convention, thereby agreeing to accept a number of obligations, which are as follows:

- To designate wetlands of international importance for inclusion in a list referred do as "Ramsar Sites".
- To maintain the inherent ecological character of Ramsar Sites.
- To recognize they're planning so as to achieve the wise use or all the wetlands as their territory.
- To designate the wetlands as Natural resources

Importance of Wetlands

Wetlands have played a crucial role in human history, major stages in the evolution of life itself probably occurred in nutrient rich coastal waters. Some of the first prehistoric cultures such as those of early Mesolithic settlements around the post glacial take margins of coastal regions of Europe and those of Coastal Indian Communities in North America dependent on wetlands for food and materials for building, shelter and clothing.

- Flood control is one of the vital functions of wetlands that act like sponges, storing and slowly releasing rain fall and run off thus reducing flood peak.

- Wetlands have binding effect of their vegetation helps in stabilization of banks and shores.

It counteracts forces of erosion by accelerating of sediments.

- Wetlands play a key role in ground water Recharge
- Regular deposition of nutrient rich silt contributes to the success of agriculture along large rivers.
- Wetlands can immobilize and transform a wide ray of environmental contaminants and nutrients.
- Wetlands act like a "Sink" preventing build up of nitrates.
- Wetland flora in particular is able to absorb nutrients & contaminants.

Wetlands loss – Threats to Wetland

Over the years wetlands loss is a global concern. The rate of wetland loss is not quantified except in a few countries due to its enormity. Over 90 wetlands were seriously threatened in Asia alone. Various threats to wetlands include pollution, reclamation., shrinkage, tourism, over exploitation, change in water quality, encroachment, eutrophication, and siltation, siltation and pollution result in reduction of migrating birds.

Wetland conservation measures

- Mapping of wetlands through Remote sensing-a mandatory for gaining clear-cut knowledge of physical dimensions of Wetlands. Orissa Government has already shown the way following this method.
- Baseline data systematic studies are needed as the status of wetlands in India
- Constant water quality monitoring – a must for Wetlands conservation measures.
- Afforestation in catchment Area: Extensive afforestation measures are needed so that critical areas in catchment can be strengthened
- Natural wetland policy has been formulated- a great boar to wetland conservationists.

In addition to all these wetlands also provide unique ecological services in storing and purifying water. Wetlands storage of floodwaters is worth an estimated $3 to $4 billion per year. Wetlands also improve water quality by acting as natural water purification systems, removing silt and absorbing nutrients and toxins. The flow of ground water through coastal marshes prevents salt-water intrusion that would otherwise contaminate wells. Coastal wetlands help stabilize shorelines of reduce storm damage.

Thus wetlands are indeed a boon to aquatic ecosystem which need to be protected in its entire splendor for the benefit of humanity and environment as well.

SAVANNAS AND THEIR DESTRUCTION

A Savanna is grassland with scattered trees or scattered clumps of trees, a type of community intermediate between grassland and Forest. Tropical savannas are found in warm regions with 40 to 60 inches of rainfall but with a prolonged dry season. When fires are an important part of the environment. The largest area of this type is in Africa but sizable tropical savannas or grasslands also occur in South America and Australia.

Since both the trees and grass must be resistant to drought and fire, the number of species in the vegetation is not large compared to adjacent equatorial forests Grasses in Savanna belong to such genera as Panicum, Pennestum, Adropogon and imperata, which from the dominant vocer while the scattered trees, are of entirely different species from those of the Rain Forest. In Africa the picturesque baobab trees (Adansonia), arborescent euphorbias and palms clot the landscape. Often single species of both grass and trees may be dominant over large areas.

In number and variety the populating of hoofed mammals of the African Savanna is unexcelled any where in the world. Numerous species of Antelope, wild Beest, Zebra, and giraffe graze or browse and are sought by him and other predators in areas in which the "big game' has not been replaced by man and his cattle.

Land – use decision regarding African Savannas and their diversity of ungulate grazers soon have to be made by the emerging Nations of that area. Many ecologist believe it would be feasible to harvest Antelopes, hippopotamus, and wild beasts on a sustainable yield basis than to exterminate them and substitute by cattle not only because of the diversified use they make of natural primary production, but also because the wild animals are immune to many topical diseases and parasites to which cattle are highly susceptible. A view of the African savanna country-consists of the three conspicuous components namely grasses, scattered trees and mammalian herbivorous.

Cause for destruction of savannas :

After forests, grass lands are one of the biomes most heavily used by biomes, prairies, savannas, open wood lands and other grass lands occupy about one quarter of the world's lands surface. The 3.8 billion ha of pastures and grazing lands in their biomes make up about twice the area of all agricultural crops. More than 3 billion cattle, sheep, goats, camels, buffalo, and other domestic animals as there lands make a valuable contribution to human nutrition.

Because grasslands are attractive for human occupation more often these are converted to cropland, urban areas or human dominated landscapes. World wide the rate of grassland disturbance each year is 3 tonnes that of tropical forest. Although they may appear to be uniform and monotonous to the untrained eye, native prairies and Savannas can be highly productive and species rich. More threatened American plant species occur in range lands than any other major biome.

Savannas are abused by overgrazing – especially in arid areas – rain runs of quickly before it can soak into the soil to nourish plants or replenish ground water. As a result springs and wells dry up and seeds cannot germinate in the dry, overheated soil. The barren ground reflects more of sun's heat, changing wind Batter, driving away moisture leader clouds and leading to further desiccation. The result –Deserts are formed by desertification.

This process is ancient but in recent years over population that force people to pure and otherswise fragile lands have accelerated it. According to the international soil references and information center in the Netherlands nearby three quarters of all rangelands in the world show signs of either degraded vegetation of soil erosion. The higher percentage of moderate, severe and extractive land degradation is in Mexico and Central America. Can we reverse this process? A big question that looms large in the mind of environmentalists. In same places people are reclaiming the deserts and repairing the effects of neglect and misuse.

Measures to conserve savanna

As over grazing is the root cause of destruction a small number of livestock may be allowed to roam in layer areas which will eat only the tender best rasting graves and

forbs first (wouldn't you) leaving tough unpalatable species to flourish and dominate the vegetation.

Shunt duration, rotational grazing i.e. confining animals to a small area for shorter time stimulates the effects of mild heads.

Native species also may have different feeding preferences and need for water of shelter than cows and sheep. The African sahel for instance can only provide enough grass to raise about 20-30 kg (44 – 66 lbs) of beef per hectare. Ranchers can produce three times as much meat with the wild native species in that same area because these animals browse a wider variety of plants species.

Through creation of parks and Natural preserves we can save the savannas

IUCN Ecological plan of action

- Launch consciousness raising exercise to bring the issue of biological resources to the attention of policy makers
- Design national conservation strategies that take explicit account of values
- Expand of parks and preservers to establish a comprehensive systems of protected areas
- Undertake a programme and training to improve the scientific skill and technological grasp of those charge with management of savannas
- Work through conventions and treaties to express the interest of the community of nations in the collective heritage of biological diversity
- Establish a set of economic incentives to make the species conservation a competitive form of land use.

The IUCN has developed a world conservation stray for natural resources that includes the following three objectives

- ✓ To maintain essential ecological processes and life support systems (such as soil regeneration and protection, nutrient recycling and water purification) on which human survival and development depend
- ✓ To preserve genetic diversity essential for breeding programmes to improve cultivated plants and domesticated animal and
- ✓ To ensure that any utilization of wild species and ecosystems is sustainable in the long term.

Human Impact on Soils

Man has influenced almost every part of the habitable world and during his short time on earthman has thought charges that are a monument to his ability to master his often-hostile environment. Very recently only we have come to understand how fundamental a part man play as in his environment and that any interference with it may have results that go for beyond the original change.

Agriculture both causes and suffers from environmental degradation of soil. The cause of this extreme degradation varies. In Ethiopia, it is water erosion. In Somalia it is wind. In Uzbekistan (Russia) it is due to salt and toxic chemicals. In India wind water & excessive use of chemical are responsible for soil erosion. Worldwide Physical degradation includes compaction of soil by heavy machinery or trampling by cattle, water logging by excessive irrigation and poor drainage and laterization (solidification of iron & aluminum which topical soil when exposed to sun & rain. Chemical degradation includes nutrient depletion, Salinization (Salt accumulation), Acidification & Pollution Laterization Nearly half of the forested area of the earth is covered by topical rain forests. These forest have an appearance that seems to be quinterrence of fertility. Below the rich and luxuriant growth of trees and cuppers the topsoil is brown and deep. Many farmers carried away by this deception appearance of topsoil colour have felled away great many trees of rain forests and planted crops. Disaster soon followed the forest heavy rain-washes away the topsoil and crop with it. The floodwater leader with silt blocks rivers and buries farmland miles away. The between rainstorms the ground dries out and sets rock hard and soil microorganisms are killed by heath of the direct exposure to sun. This residual soil, and aluminum rich laterite is quite useless for cultivation. It acts in the complex of rain forests as a transitory staging post for the salts that are produced when vegetation rots. Normally the more valuable nutrients are quickly absorbed by other vegetation. Thus luxuriant forest growth is deceptive. It is like as shop window is which all the stocks are displayed and nothing is held in reserve. In this case conservation means learning the forest alone, however great the need for agriculture or any other type of production land may be.

Water logging, Salinization and Sodification

All plants need water to grow, agriculture accounts of the largest single share of global water use. Some 73 % of all fresh water drawn from rivers, lakes, and ground water supplies is used for irrigation. About 15% of all cropped word wide is irrigated. Excessive use not only wastes water, it often results in water logging Water logged soil is saturated with water which results in the death and decay of plant roots due to lack of oxygen.

Salinization is the accumulation of mineral salts in the soil-often problem associated with irrigation water that dissolves & mobilizes salts in the soil. As the water evaporates i.e. leaves behind a salty crust on the soil surface that is lethal to most plants. Flushing with excess water can wash away this salt accumulation but the net result is even more saline water for down stream users.

Worldwide irrigation problems area major source of land degradation and crop losses. The world watch institute reports that 60 million ha (150 million Acres) of cropland have been damaged by salinization and water logging. Water conservation techniques can greatly reduce problems arising from excess water use – that makes more water available for other uses where water is in short supply.

Although salinzation and sodification occurs naturally in semi arid and arid environments, they are often exacerbated as a result of human activity. In part of Southwest Australia for example removal of indigenous Eucalyptus forests has resulted in extensive salinization and sodification of soils. This occurred because the deep-rooted trees have been replaced by shallow rooted grasses and crops. The important cause of salinization is poor irrigation practice. Over watering leads to a rise in water table, which in turn cause enhanced capillary action. Similarly poor maintenance of irrigation channels and canals results in leakage of water onto adjacent agriculture land. This has contributed to increased soil salinity and sodicity in parts of Indus valley and Pakistan. Salinization and sodification all not only associated with arable land but may also occur in pastoral land use system.

Soil salinity and sodicity have a detrimental effect on both chemical & physical aspects of soil quality. It is associated with elevated pH under which condition nutrients are not readily available for plants. Elevated salts and Na+ concentration in soil also are highly toxic to plants. Appropriate irrigation and drainage techniques may help to mitigate the problems of salinization and sodicity.

Soil Erosion

Soil erosion occurs when the rate of removal of soil by water or wind exceeds that of soil formation that takes 100-4000 years for the formation of 1cm soil according to FAO statement 1983. The extent of soil erosion is governed by a number of factors. Those of particular importance include erosivity of the eroding agent, erodibiltiy of the soil slope steepness of length, land use practices and conservation strategies. These factors are summarized in the universal soil loss equation which has been widely used in the modeling and predication of soil erosion e.g. Colby-Saliba (1985).

E= R.K.L.S.C.P

E= Mean Annual soil loss

R= Rainfall erosivity index

K= Soil erodibiltiy index

L= slope length

S= slope steepness

C= cropping factor – Ratios of soil loss under given crop to that form base soil

P= conservation factor

-Ratio of soil loss where contouring and strip cropping are practiced to that where they unused (Morgan 1986).

Land use is the most significant factor is soil erotica for 2 reasons, I (.) land are practice deprive in the soil its vegetation cover which are prime to be carried away by wind or water. II (.) They involve mechanical disturbance of the soil due to use of heavy machinery.

MECHANISMS OF SOIL EROSION

Wind and water are the main agents that one soil around. When little rivulets of running water gather together and cut small channels in the solid the process is called rill erosion. When rills enlarge to form bigger channels or rivers that are too large robe removed by normal tillage operations we call the process gully erosion. Stream back erosion refers to the washing away of soil from the banks of established streams, creeks and rivers as a result of removing trees and brush along the stream banks and of cattle damaging the banks. Most of the soil erosion on agricultural land is rill erosion.

Some of the highest erosion rates in the world occur in the US and Canada. The US department of agriculture reports that 69 million ha (170 mill acres) of US farm land and range are eroding at rates that bring down long-term productivity. 5 tons/acre (11tons/Hec) is generally considered maximum tolerable rate of soil loss because under optimum conditions.

IMPACT OF SOIL EROSION

The consequences of soil erosion occur both on and off site. On site effects are particularly important on agricultural land where the redistribution of soil within a field, the loss of soil from a field, the breakdown of soil structure and the decline in organic matter and nutrient result in reduction of cultivable soil depth and a decline in soil fertility. Erosion also reduces available soil moisture resulting in more drought prone conditions. Net result is loss of productivity. It also leads to decline in the value of the land as it changed from productive farmland to wasteland. Many hydroelectricity and irrigation projects have been ruined as a consequence of erosion.

EROSION CONTROL

A number of mechanical field practice used to control soil erosion are as follows.

- Contouring i.e.. Carrying out ploughing. Planting and cultivation on the contour can reduce soil loss from sloping land compared with cultivation up and down the slope.
- Contour blends i.e. There are earth banks 1.5 – 2m wide thrown across the slope to act as a barriers to run off, to form a water storage area as their up lope side.
- Terraces i.e. there are earth embankments constructed across the slope to intercept surface run off and convey it to a stable outlet as a non-erosive velocity and to shorten slope length.
- Waterways preferably made of grass to convey run of water at a non-erosive velocity.
- Stabilization structures may be constructed using locally available materials for gully erosion control.

HUMAN IMPACT UPON OCEAN AND SEAS

The marine environment – including oceans seas and adjacent coastal areas – form an integrated whole that constitute global life supporting systems – a positive asset – that prevents opportunities for sustainable development. International law of the sea referred to in chapter 17 of Agenda 21 of Rio summit sets for the rights and obligations of states that provides basis upon which rests the principles for protection and sustainable development of the marine and coastal environment and its resources. This requires new approaches that are integrated in content and are precautionary and anticipatory in ambit as reflected in the following programmed areas.

1. Integrated management and sustainable development of coastal areas including exclusive economic zones.
2. Marine environmental protection.
3. Sustainable use and conservation of marine living resources of the high seas.
4. Sustainable use and conservation of marine living resources under national juris-diction.
5. Addressing critical uncertainties for the management of marine environmental change.
6. Strengthen international including regional cooperation and coordination.
7. Sustainable development of islands.

NEED FOR COASTAL AREA PROTECTION

The coastal area contains diverse and productive habitats important for human settlements, development and local subsistence. More than half of the world population lives within 60km of the shoreline and this could rise to three quarters by the year 2020. Many of the world's poor are eroded in coastal area and its resources are most vital for many local communities and indigenous people. The exclusive economic zone (EEZ) is also an important marine area where are the states managed the development and conservation of natural resources for the benefits of this people. For small islands states or countries these are the areas most available for development activities.

Degradation of marine environment can result from a wide range of sources hand based sources contribute 70% of marine pollution, while maritime.

Extinct species

Sometimes we introduce new species in an attempt to solve problems created by previous introductions but end up making the situation worse. In Hawaii and on several Caribbean islands, for instance, mongoose were imported to help control rats that had escaped from ship and were destroying indigenous birds and devastating pineapple plantations. Since the mongooses were diurnal (active in the day), however, and rats are nocturnal they tended to ignore each other. Instead, the mongooses killed native birds and further threatened endangered species. Our lessons from this and similar introductions have a new technological twist. Some of the ethical questions currently, surrounding the release of genetically engineered organisms are based on concerns that they are novel organisms, and we might not be able to predict how they will interact with other species in natural ecosystems- let alone how they might respond to natural selective forces. It is argued that we can't predict either their behaviour or their evolution.

Successful exotics tend to be prolific, opportunistic species. Sailing ships visiting oceanic islands, for example, brought rats, goats, cats and pigs. All these animals are prolific, quickly developing large populations. Goats are efficient, nonspecific herbivores; they eat nearly any vegetation from grasses and herbs to seedlings and shrubs. In addition, their sharp hooves are hard on plants rooted in thin island soils. Rats and pigs are opportunistic omnivores, eating the eggs and nestlings of seabirds that tend to nest in large, densely packed colonies, and digging up sea turtle eggs. Cats prey upon nestlings of both ground- and tree-nestling birds. Native species, those that originate in an area or have occupied the area for a very long time, are particularly vulnerable to exotics because they have not evolved under circumstances that required them to have defensive adaptation to these predators.

Succession requires the continual introduction of new community members and the disappearance of previously existing species. Sometimes communities can be completely altered, however, by the introduction of the exotic species organism originating in completely different locations. Usually we think of exotic species has introduced by humans from different continent. Because these organisms arrive without their natural predators, they can invade aggressively, drastically altering local

environments. European rats in Polynesia, for example, have decimated breeding birds on many islands, and Kudzu, a Japanese vine, has run rampant in much of the southern United States. Many ecologists consider exotic species invasions the most pressing hazard for biological communities in the coming century.

Exotic organisms aliens introduced into habitats where they are not native – are one of the greatest threats to biodiversity worldwide. Exotics can be thought of as biological pollution. Freed from the predators, parasites, pathogens, and competition that kept them in check in their native home, formerly mild-mannered species can turn into super-aggressive "weedy" invaders in a new habitat. There are now more than 4,500 alien species in North America. A few of those causing most trouble include:

- Kudzu vine (*Pueraria lobata)* has blanketed large areas of the southeastern United States. Long cultivated in Japan for edible roots, medicines, and fibrous leaves and stems used for paper production, kudzu was introduced by the U.S. Soil Conservation Service in the 1930s to control erosion. Unfortunately, it succeeded too well. In the ideal conditions of its new home, kudzu can grow 18 to 30 m (60 to 100ft) in a single season. Smothering everything in its path, it kills trees, pulls down utility lines, and causes millions of dollars in damage every year.
- Leafy spurge (*Euphorbia esula*), a relative of the familiar Christmas poinsettia, has spread across millions of hectares of the northern Great Plains since it was first introduced in the 1870s in the seeds of Mennonite farmers from Russia. A short, bushy, green weed with small yellow flowers, the entire plant – leaves, stems, roots, flowers, and seeds – is poisonous. It reduces the carrying capacity of western range by three-quarters when it invades because cattle can't eat it and it crowds out native grasses and forbs. North Dakota alone loses $7 million per year in forage and beef production due to leafy spurge, and spends another $6 million annually in control programs.
- Purple loosestrife (*Lythrum salicaria)* grows in any wet soil. Originally cultivated by gardeners for its beautiful purple flower spikes, this tall wetland plant escaped into New England marshes about a century ago. Spreading rapidly across the Great Lakes, it now fills wetlands across much of the northern United States and southern Canada. Because it crowds out indigenous vegetation and has few native predators or symbionts, it tends to reduce biodiversity wherever it takes hold.
- Zebra mussels (*Dreissena polymorpha)* probably made their way from their home in the Caspian Sea to the Great Lakes in ballast water of transatlantic cargo ships, arriving sometime around 1985. Gluing themselves to any solid surface, zebra mussels reach enormous densities – up to 70,000 animals per square meter- covering fish spawning beds, smothering native mollusks, and clogging utility intake pipes. Found in all the Great Lakes, zebra mussels have recently been spotted in the Mississippi River and its tributaries. Public and private costs for zebra mussel removal now amount to some $400 million per year. On the positive side, mussels have improved water clarity in Lake Erie at least fourfold by filtering out algae and particulars.
- Asian long-horned beetles (*Anoplophora galabripennis)* are one of the most recent exotic threats in the United States. Probably transported in imported logs or wooden packing crates from China, these wood-eating insects were first spotted in Amityville, N.Y., in 1996. The beetle larvae burrow into living tree trunks. Sap flow to leaves may be cut off, and trees may fall over simply because tunneling badly weakens the trunks. These shiny black bugs with distinctive white spots and enormous feelers are especially fond of some of our primary shade trees-maples, oaks, and poplars. If they spread widely they could cause billions of dollars in damage. Chicago suburbs cut and burned 2,000 shade trees after discovering a long-horned beetle infestation in 1999.

The flow of organisms isn't just into North America; we also send exotic species to other places. The Leidy's comb jelly, for example, a jellyfish native to the western Atlantic coast, has devastated the Black sea, now making up more than 90 percent of all

biomass at certain times of the year. The American bristle worm has invaded the Baltic Sea and now is almost the only thing living on the bottom of some bays and lagoons. Eliminating these alien specie once they dominate an ecosystem is difficult, if not impossible.

Degradation of Marine Environment

Degradation of the marine environment can result from a wide range of sources. Land based sources contribute 70% of marine pollution while maritime transport and dumping at sea activities contribute 10% each. The contaminants that pose the greatest threat to the marine environment are sewage, nutrients, synthetic organic compounds, sediments, litter and plastics, metals, radio-nuclides, oil/hydrocarbons and polycyclic aromatic hydrocarbons (PAHS). Many of the polluting substances originating from land-based sources are of particular concern to the marine environment since they exhibit at the same time toxicity, persistence and bioaccumulation in the food chain.

Degradation of marine environment can also result from a wide range of activities on land. Human settlements, land use, construction of coastal infrastructure, agriculture, forestry, urban development, tourism and industry can affect the marine environment. Coastal erosion and siltation are of particular concern. Marine pollution is also caused by shipping and sea-based activities. Approximately 6,00,000 tons of oil enter the oceans each year, as a result of normal shipping operations accidents and illegal discharges. Discarded plastic flotsam and jetsam are becoming a ubiquitous mark of human impact on the oceans. Since plastic is lightweight and non-biodegradable, it is carried thousands of miles on ocean currents and lasts for years. Even the most remote beaches of distant islands are likely to have bits of polystyrene foam containers or polyethylene-packing materials that were discarded half a world away. Nearly 6 million tons of plastic bottles packaging material and other materials are loosed from ships every year into the ocean where they ensnare and choke sea birds, mammals and even fish.

Oil pollution affects beaches and open seas around the world. Oceanographers estimate that somewhere between 3 to 6 million tons of oil is discharged into world's oceans each year from oil tankers, fuel leaks and coastal industries, 1989. Exxon Valdez spill in Alaska was dramatic and headline making accident.

Fortunately awareness of ocean pollution is growing. Oil spill clean up technologies and response teams are improving, although natural bacteria eventually decompose most of the oil. Beach pollution- mainly plastic debris, sewage waste, oil and chemical contaminants are becoming more common, volunteer efforts are helping to reduce beach pollution locally. In a day volunteers in Texas gathered more than 300 tons of plastic refuse from Gulf coastal beaches.

Prevention of pollution

Coastal states commit themselves to integrated management and sustainable development of coastal areas and the marine environment under Natural jurisdiction. Coastal states with the support of international organization should undertake measures to maintain biological diversity and productivity of marine species and habitats under natural jurisdiction. Inter alia, these measures might include: surveys of marine biodiversity, inventories of endangered species and critical coastal and marine habitats. Coastal states should promote and facilitate the organization of education and training in integrated coastal and marine management and sustainable development, so what is needed at present is precautionary and anticipatory rather than a reactive approach to prevent degradation of marine environment. This requires, inter alia, the adoption of precautionary measures, environmental impact assessments, clean production technologies, recycling, waste audits and minimization, improvement of sewage treatment facilities, quality management criteria for proper handlings of hazardous substances and a comprehensive approach to damaging impact from air, land and water.

Development of Women and Natural Resource Management

Development, as the improved well-being of all, was equated with the westernization of economic categories about economic development and natural resource utilization that had emerged in the specific context of industrialization and capitalist growth in a centre of colonial power, were raised to the level of universal assumptions and applicability in the entirely different independent Third World countries. Yet, as Rosa Luxemburg has pointed out, early industrial development in Western Europe necessitated the permanent occupation of the colonies by the colonial powers and the destruction of the local 'natural economy'.

The UN Decade for women based on the assumption that the improvement of women's economic position would automatically flow from an expansion and diffusion of the development process. Yet, by the end of the Decade, it was becoming clear that development itself was the problem. Insufficient and inadequate 'Participation' in 'development' was not the cause for women's increasing under development; it was rather, their enforced but asymmetric participation in it, by which they bore the costs but were excluded from the benefits, that was responsible.

Basically, where community management existed, responsibility for resource management was linked to resource use. Government take over of forests and the privatization of the commons have effectively broken this link, and eroded the social base of these protective systems. Forests and village communities are no longer the collective responsibility of villagers: they have become a commodity to be individually exploited.

Cost of modern technology

Modern technology for increasing agricultural output has also had high environmental costs. The green revolution technology, in particular, with its high dependence on chemical inputs and an assured water supply, while dramatically increasing output in the short term, has over time led to falling water tables due to the discriminate sinking of tube-wells, waterlogged and saline soils from many large irrigation schemes, declining soil fertility with excessive fertilizer use, water pollution with pesticides, the loss of genetic variety with monocultural cultivation and the marginalisation of indigenous knowledge systems.

Population growth has impinged on these processes more as an exacerbating cause than as a primary cause of degradation. Commercial exploitation and the appropriation of forests and village communities by a few pushes the vast majority to subsist on depleting resources, causing there further decline. The poor, in particular, who depend on these resources, may be seen here as victims of the crisis not its causes.

Finally, the high energy-intensive consumption patterns of the elite, the types of products consumed and the technologies used to produce them, have all contributed to the pace of environmental degradation.

Women more affected

These processes, however, have not affected everyone equally. Landless and land-poor households are the most severely affected; especially those located in environmentally higher risk areas, such as hills and semiarid plains. And within poor households, the negative effects are borne disproportionately by women and female children.

The gender-specific effects arise especially from preexisting inequalities, notably:

- An equal gender division of labour: Women and female children do much of the gathering and fetching from forests, village communities, rivers and wells, and poor peasant women's daily work routine can total 12 to 15 hours, typically many hours more than worked by men.
- Gender inequalities in the intra-household distribution of available resources: There is systematic anti-female bias in access to health care and to some extent also food within rural families, especially in northern India, revealed by

the range of indicators, but most starkly in sex ratios (female per 1000 males). These are female adverse in virtually all of India, except Kerala. In the absence of a bias, given the biological longevity of woman, in the population, as in most part of the world.

- Gender inequalities in access to productive resources, especially arable land, and associated technology; Woman also has fewer earning opportunities, enjoy lesser job-search mobility and typically receive lower pay for the same or similar work. Given woman's limited access to private property resources, to cash and to make marketed goods, their dependence on common property resources has always been much more substantial that of men of the same households.
- Women's unequal access to knowledge systems predicated on modern science and technology and a low valuation of their traditional knowledge systems.
- Women's unequal access to decision-making authority at all levels, including decisions about natural resource use.

Consequences

Natural resource depletion impinging on these preexisting inequalities can have especially six significant gender effects:

1. ***On time :*** Since in poor rural households it is women and female children who mainly collect firewood and fodder, it is their time and energy, which gets extended when forests and village communities decline. In many areas, distances traveled and time taken for these tasks have increased several fold.
2. ***On income :*** The decline in forests and village communities has reduced women' incomes from gathered items and affected cattle-dependant livelihoods. In addition, the extra hours needed for gathering have cut into crop production time, affecting crop incomes, especially in hill communities where, with high male migration women are often the primary cultivators.
3. ***On nutrition :*** As the area and productivity of village communities and forests fall, so does the contribution of gathered food in the diets of poor households. Fuel wood shortages too can have adverse nutritional effects as people try to economize by shifting to less nutritious foods, which need less fuel to cook or by eating cold leftovers or missing some meals altogether. As rural women in their conventional wisdom observe: "It's not what's in the pot that worries you but what's under it."
4. While these adverse nutritional consequences impinge on the whole household, women and female children, especially in northern India, bear an additional burden because of the high gender bias in family food distribution.
5. ***On health :*** Nutritional deficiencies have direct health consequences. In addition, because of the nature of tasks poor rural women perform (fetching drinking water, washing clothes in streams, or transplanting rice), they are more directly exposed than are men to water-borne diseases, and to the pollution of rivers and ponds with fertilizers and pesticides run-offs. In some regions, several times the acceptable levels of chemical residues have been found in the milk of nursing women agricultural workers. The burden of family ill health associated with water pollution likewise falls largely on women.
6. ***On social support networks:*** Population displacements arising from the submersion of villages due to the social support networks with kin and other villagers, built up especially by women. These networks provide small loans of food and cash, or labour exchange and tide poor families through periods of shortage. Their disruption usually goes uncounted in cost-benefit exercises of large irrigation schemes and rehabilitation programmes associated with such schemes seldom enable the recreation of these social security networks.

7. ***On women's indigenous knowledge:*** The gathering of food and medicinal items from forests and village communities demands on elaborate knowledge of the properties of plant species, which those women, who are gathers gained through long experience. The disappearance of forests and village communities is destroying the material basis of this knowledge.

Also, in many regions peasant women were responsible for indigenous seed selection and preservation. With the large-scale shift to hybrid seed varieties this control has passed into the hands of national and international laboratories. While traditional knowledge systems are being devalued, the women who possess and depend on this knowledge have little access to the institutions, which create what is seen as scientific knowledge and modern technology.

In this sense, what we see today is not just a crisis of sustenance for the poor and for women; it is also the loss of knowledge critical for generating sustainable livelihood systems. The noted class gender effects prevail in some degree in most region of India, but their intensity depends on the gender vulnerability, environmental risk and poverty incidence in a region.

Gender vulnerability is especially high in the northern states characterized by highly female adverse sex ratios, low female literacy, a strong ideology of female seclusion and women's limited effective access to property, especially arable land. South India, in contrast has sex ratios which are much closer to parity (Kerala has a sex ratio of 1036, similar to Europe), female literacy rates are relatively high, female seclusion practices are absent, and women have some what greater effective rights in property.

Similarly, environmental vulnerability, as measured by rainfall levels and forest cover, is much greater in Northwest and Western South Asia than in the Northeastern belt. Again, in terms of poverty, regions with the lowest incidence are located largely in Northwestern India, and those with the highest incidence are mostly in Eastern India.

Women are best off where vulnerability on all three counts- gender, environment and poverty- taken together is relatively low, as in parts of Southern and Northeastern India, and worst off where vulnerability on the three counts taken together highest, as in parts of Eastern India. It is noteworthy that the most agriculturally prosperous regions in Punjab and Haryana are also among the most gender biased, underlining a highly gender in egalitarian distribution of benefits from economic prosperity.

Deforestation and desertification

The earth's tropical forests are some of the richest and most divorce terrestrial ecosystems, although they now occupied less than 10% of the earth's land surface, these forests contain more than two thirds of all higher plant biomass and atleast half of all the plant animal and microbial species in the world.

Desertification

Desert is an area of low rainfall i.e., less than 20cm per year. It also experiences low temperature in winter and high temperature in summer. It has its own characteristics flora, fauna and microbial communities. The soil is often fertile enough to support agriculture if enough water can be supplied; many desert areas throughout the world have been converted into productive farmland through irrigation. Thus the desert area is synonymous with 'arid region'. In India, such conditions exists in 'That' covering an area of 1.3million Sq.km. it is not an isolated desert, it has connection with the great Sahara desert of the world. Indian that desert covers a vast tract of Rajasthan, a portion of Gujarat, Punjab and Haryana. In contrary desertification are systematic processes of conversion of productive land to unproductive arid region. This involves the interplay of climate, edaphic or biotic factors. It is principally a man-made problem, which leads to the environmental degradation of fertile lands. The major causes are :

- Inappropriate land use practices i.e., cultivation on the marginal lands affecting adjacent fertile land

- ❖ Over-exploitation of water and land resources through intensive farming
- ❖ Uncontrolled grazing and indiscriminate felling of trees

There is large number of indicator systems for assessment to degrees of desertification. These are biological, agricultural or social indicator systems. The monitoring of extent of desertification is highly essential for developing combating technologies. There are a number technologies adopted for combating the desertification problems under different edaphic and climatic condition. These are shelterbelt creation, and dune stabilization, water resource conservation, use of saline water crop production and adaptation of biologically productive land use.

When grazing lands are abused by overgrazing – especially in arid areas- rain runs off quickly before it can soak into the soil to nourish plants or replenish ground water as a result of which springs and wells dry up. Seeds cannot germinate in dry parched land. The barren ground reflects none of sun's heat, changing wind patterns, driving away moisture-laden clouds and leading to further desiccation. This process of conversion of once-fertile land to desert is called desertification.

By carefully monitoring the numbers of animals and the condition of the range, ranchers and pastoralists (people who live by herding animals) can adjust to variations in rainfall, seasonal plant conditions, and nutritional quality of forage to keep livestock healthy and avoid overusing any particular area. Conscientious management can actually improve the quality of the range.

Desertification process is ancient, but in recent years expanding populations and political conditions that force people to overuse fragile lands has accelerated it. According to the International Soil Reference and Information Centre in the Netherlands, nearly three-quarters of all rangelands in the world show signs of either degraded vegetation or soil erosion. The highest percentage of moderate, severe, and extreme land degradation is in Mexico and Central America. Can we reverse this process? In some places, people are reclaiming deserts and repairing the effects of neglect and misuse.

Diminishing forests

A century ago, an estimated 12.5 million Km square of tropical lands were covered with closed – canopy forest. This was an area larger than the entire United States. The Food and Agriculture Organization (FAO) of the United Nations estimates that about 0.8 percent of the remaining tropical forest is cleared each year.

There is considerable debate about current rates of deforestation in the Tropics. In 1999, satellite data showed more than 31,000 fires in a single month in Brazil. Remote sensing experts calculated that 8 million ha (about 20 million acres) per year were being cut and burned in the Amazon basin alone. However, there are different definitions of deforestation. Some scientists insist that it means a complete change from forest to agriculture, urban areas, or desert. Others include any area that has been logged, even if the cut was selective and regrowth will be rapid. Furthermore, savannas, open woodlands, and early successful following natural disturbance are hard to distinguish from logged areas. Consequently, estimates for total tropical forest losses range from about 5 million to more than 20 million ha per year. The FAO estimates of 14.5 million ha (about 2 percent of the remaining forest) cut per year are generally the most widely accepted.

By most accounts, Brazil has the highest rate of deforestation in the world, but it also has by far the largest tropical forests. Indonesia and Malaysia together may be losing as much primary forest each year as Brazil, even though their original amount was far lower. In 1997, forest fires on Borneo and Sumatra produced clouds of smoke that made air unbreathable in Singapore, the Philippines, and even parts of Thailand and China. In Africa, the coastal forests of Senegal, Sierra Leone, Ghana, Madagascar, Cameroon, and Liberia already have been mostly destroyed. Haiti was once 80 percent forested: today, essentially all that forest has been destroyed, and the land lies barren and eroded. India,

Burma, Cambodia, Thailand, and Vietnam all have little old-growth lowland forest left. In Central America, nearly two-thirds of the original moist tropical forest has been destroyed, mostly within the last 30 years and primarily due to conversion of forest to cattle range. (See related story on "Disappearing of Butterfly Forests" at www.mhhe.com/apps.)

Causes for deforestation

A variety of causes lead to this deforestation. Logging for valuable tropical hardwoods, such as teak and mahogany, is, of course, a major factor. Loggers may take only one or two of the largest trees per hectare, but because the canopy of tropical forests is often strongly linked by vines and interlocking branches, felling one tree can bring down a dozen others.

Forests world wide have been and are being threatened by uncontrolled degradation and conversion of other types of land uses, influenced by increasing human needs; agricultural expansion; and environmentally harmful mismanagement, including, for example, lack of adequate forest-fire control and anti-poaching measures, unsustainable commercial logging, overgrazing and unregulated browsing, harmful effects of airborne pollutants, economic incentives and other measures taken by other sectors of the economy. The impacts of loss and biological diversity, damage to wildlife habitats and degradation of watershed areas, deterioration of the quality of life and reduction of the options for development.

Forest protection

The present situation calls for urgent and consistent action for conserving and sustaining forest resources. The greening of suitable areas, in all its component activities, is an effective way of increasing public awareness and participation in protecting and managing forest resources. It should include the consideration of land use and tenure patterns and local needs and should spell out and clarify the specific objectives of the different types of greening activities.

What can be done to stop this destruction and encourage tropical forest protection? While much of the news is discouraging, there are some hopeful signs for forest conservation in the Tropics. Many countries now recognize that forests are valuable resources. Costa countries have one of the best plans for forest guardianship in the world. Attempts are being made there to not only rehabilitate the land (make an area useful to humans), but also to restore the ecosystems to naturally occurring associations. One of the best known of these projects is Dan Janzen's work in Guanacaste National Park. Like many dry. Tropical forests, the northwestern part of Costa Rica had been almost totally converted to ranchland. By controlling fires, however, Janzen and his coworkers are bringing the forest back. One of the keys to this success is involving local people in the project. Janzen also permits grazing in the park. The original forest evolved, he reasons, together with ancient grazing animals that are now extinct. Horses and cows can play a valuable role as seed dispersers.

People also are working on the grassroots level to protect and restore forests in other countries. India, for instance, has a long history of nonviolent, passive resistance movements- called 'Satyagraha'- to protest unfair Government policies. These protests go back to the beginning of Indian culture and often have been associated with forest preservation. Gandhi drew on this tradition in his protests of British colonial rule in the 1930s and 1940s. During the 1970s, commercial loggers began large-scale tree felling in the Garhwal region in the state of Uttar Pradesh in northern India. Landslides and floods resulted from stripping the forest cover from the hills. The firewood on which local people depended was destroyed, and the way of life of the traditional forest culture was threatened. In a remarkable display of courage and determination, the village women wrapped their arms around the trees to protect them, sparking the Chipko Andolan Movement (literally, movement to hug trees). They prevented logging on 12,000Km^2 of

sensitive watersheds in the Alakanada Basin. Today, the Chipko Andolan movement has grown to more than four thousand groups working to save India's forests.

Population and the Environment

As the 21st century begins, growing numbers of people and rising levels of consumption per capita are depleting natural resources and degrading the environment. In many places chronic water shortages, loss of arable land, destruction of natural habitats, and widespread pollution undermine public health and threaten economic and social progress. Many experts think that current trends cannot continue much longer without dire consequences.

In most developed countries population is growing slowly or no longer growing at all, but levels of per capita consumption are so high that the environment is under pressure. Most developing countries face even greater pressures, however. Population is growing rapidly, while consumption is increasing as living standards improve. Every person has an equal right to achieve a high standard of living. But, if every person in the world consumed as much as the average American or Western European, the demand for natural resources would exceed nature's supply.

"There is no question that improving standards of living for the current poor of the world, plus providing for the billions still to come, will increase global demand for food, water, energy, wood, housing, sanitation, and disposal of wastes," writes Richard E. Benedict, former US assistant secretary of state responsible for population and environmental policies. One of the world's main challenges is practicing sustainable development- that is, improving living standards today without foreclosing the opportunities of future generations to meet their needs.

Demographical change and sustainability

Demographic trends and factors and sustainable development have a synergistic relationship. The growth of world population and production combined with unsustainable consumption patterns places increasingly severe stress on the life-supporting capacities of our planet. These interactive processes affect the use of land, water, air, energy and other resources. Rapidly growing cities, unless well-managed, face major environmental problems. The increase in both the number and size of cities calls for greater attention to issues of local government and municipal management. Human dimensions are key elements to consider in this intricate set of relationships and they should be adequately taken into consideration in comprehensive policies for sustainable development. Such policies should address the linkages of demographic trends and factors, resource use, appropriate technology dissemination, and development. Population policy should also recognize the role played by human beings in environmental and development concerns. There is a need to increase awareness of this issue among decision makers at all levels and to provide both better information on which to base national and international policies and frame work against which to interpret this information.

Strengthening research programmes that integrate population, environment and development

In order to integrate demographic analysis into a broader social sciences perspective of environment and development, interdisciplinary research should be increased. International institutions and networks of experts should enhance and knowledge, and disseminate the experience gained in multidisciplinary approaches and in linking theory to action.

Better modeling capabilities should be developed, identifying the range of possible outcomes of current human activities, especially the interrelated impact of demographic trends and factors, per capita resource use and wealth distribution, as well

as the major migration flows which may be expected with increasing climatic events and cumulative environmental change that may destroy people's local livelihoods.

Existing plants for sustainable development have generally recognized demographic trends and factors as elements that have a critical influence on consumption patterns, production, lifestyles and long-term sustainability. But in future, more attention will have to these issues in general policy formulation and the design of development plans. To do this, all countries will have to improve their own capacities to assess the environment and development implications of their demographic trends and factors. They will also need to formulate and implement policies and action programmes where appropriate. Policies should be designed to address the consequences of population growth built into population momentum, while, at the same time incorporating measures to bring about demographic transition. They should combine environmental concerns and population growth issues within a holistic view of secure livelihoods; good health; quality of life; improvement of status and income of women and their access to schooling and professional training, as well as fulfillment of their personal aspirations; and empowerment of individuals and communities. Recognizing that large increases in the size and number of cities will occur in developing countries under any likely population scenario, greater attention should be given to preparing for the needs, in particular of women and children, for improved municipal management and local government.

Need for public awareness

Socio-demographic information should be developed in a suitable format for interfacing with physical, biological and socio-economic data. Compatible spatial and temporal scales, cross-country and time-series information, as well as global behavioural indicators should be developed, learning from local communities perceptions and attitudes. Awareness should be increased at all levels concerning the need to optimize the sustainable use of resources through efficient resource management taking into account the development needs of the populations of developing countries.

Awareness should be increased of the fundamental linkages between improving the status of women and demographic dynamics, particularly through women's access to education, primary and reproductive health care programmes, economic independence and their effective, equitable participation in all levels of decision-making. Results of research should be disseminated through technical reports; scientific journals, the media, workshops, forums or other means so that decision makers can use the information at all levels and increase public awareness.

Improving prospects for low-income Households through redirecting Government programmes

Will there be enough food to go around? Rapid population growth, environmental degradation, and inadequate international food distribution raise this question. About two billion people lack food security- defined by the UN Food and Agriculture Organization (FAO) as a "state of affairs where all people at all times have access to safe and nutritious food to maintain a healthy and active life". In many countries over the past two decades growth in the food supply has lagged behind population growth. Worldwide, the grain harvest increased about 1% annually between 1990 and 1997, a rate of growth substantially slower than the average population growth rate in the developing world, at 1.6%.

In 64 of 105 developing countries studied by FAO between 1985 and 1995, food production lagged behind population growth. Among regions, Africa fared the worst during this period. Food production per person fell in 31 of 46 African countries. Moreover, water shortages are becoming constraints on development in general and on food production in particular. While population tripled in the last century, water withdrawals grew six fold. Countries fall into three groups:

1. Those that have the agricultural capacity to be self-sufficient in food production;
2. Those that are not self-sufficient in food production but have enough other resources to import adequate supplies of food; and
3. Those that are not self-sufficient in food production and do not have the financial resources needed to fill the gap with imports.

In the first group, the agriculturally self-sufficient countries are some European countries plus Australia, Canada, and the United States. These countries have sufficient cropland to meet most of their own food needs now and probably for many decades to come. In fact, many of these countries produce substantial surpluses of food, which they export. They probably could produce enough to meet the food needs of all food-deficit countries, if those countries could afford to buy the food. Countries in the second group, food importers, include Japan, Singapore, some European countries, and the oil-producing states of the Arabian Gulf.

The third group consists of the "low-income food-deficit countries," to use the term coined by FAO. The low-income food-deficit countries compromise most of the developing world, including nearly all of sub-Saharan Africa. Today about 3.8 billion people- nearly two-thirds of the world's population-live in low-income food-deficit countries. In these countries millions know hunger, malnutrition, and even starvation when harvests fail, unless other countries provide emergency food aid in time. Worldwide, about 825 million peoples are chronically malnourished, according to a recent estimate by FAO. Many low-income food-deficit countries have among the world's highest population growth rates. By 2050 about 6 billion people will live in countries that have food deficits today.

Achieving food security means addressing several related issues: slowing population growth, increasing food production, and safeguarding the environment. Since, of course, not every country can be self-sufficient in food production, international trade will become increasingly important in the future to achieve food security worldwide. In low-income food-deficit countries slower population growth would allow time to achieve food security.

To provide food security for all of the 8 billion people projected by 2025, the world would have to double food production over current levels. Achieving this goal would require a second "Green Revolution" in agriculture, like the one in the 1960s that boosted food production in the face of population increases.

Recent years have brought some promising developments. These include a new strain of super rice capable of boosting yields by 25% improved varieties of corn that could increase yields perhaps by 40% and that could be grown on marginal land, and a new blight-resistant potato. To achieve food security, the food-deficit countries must reverse the current course of land degradation and begin to manage soil and water resources on a sustainable basis. There are many ways to protect agricultural land. In many areas, for example, irrigated land could be managed better by using hand pumps and traditional water harvesting techniques rather than relying on large-scale automated sprinkler systems.

Already, population growth and rising use per capita are creating water shortage in many countries. A country is said to experience water stress when annual water supplies drop below, 1,700 cubic meters per person. When supplies drop below 1,000 cubic meters per persons per year, the country faces water scarcity for all or part of the year. Swedish hydrologist Malin Falkenmark developed these concepts of stress and scarcity to gauge current and future water needs against available supplies.

Caught between growing demand for fresh water on one hand and limited and increasingly polluted supplies on the other, many countries face difficult choices. Findings solutions requires responses at local, national, and international levels- a "Blue revolution" that focuses on integrated management of watersheds and shared water

basins. Community-led initiatives to manage water resources better can help urban dwellers gain access to safe, piped water supplies, thus improving sanitation and public health. Governments can develop national water management policies that not only improve supply but also manage demand better with appropriate pricing- for example, ending subsidies that in effect encourage overuse.

POPULATION GROWTH AND ITS EFFECT ON RESOURCES AND ENVIRONMENT

In recent years scientist have become increasingly concerned about the long-term effects of deteriorating environmental conditions on the health not only of human but also of nature itself. “we are no longer talking only of an increased exposure to specific extraneous hazards as a cause of bad health. We are also recognizing the depletion or disruption of natural biological processes that are the basic source of sustained good health,” points out epidemiologist Tony McMichael of the London School of Hygiene and Tropical Medicine.

At increasing risk, according to McMichael, are the ecosystems that determine food productivity and such global systems as the hydrological cycle- in which water evaporates from bodies of water and returns to them after falling as precipitation and the stratospheric “ozone shield” that protects against excessive solar ultraviolet radiation. Such environmental changes would have a wide variety of negative effects on human health.

Some ecologists use the term “environmental distress syndrome” to identify deteriorating environmental conditions and resulting threats to health. Paul Epstein of Harvard Medical School lists four symptoms of this syndrome.

- Re-emerging infectious diseases, including typhoid, cholera, and pneumonia, and the emergence of new diseases, such as drug-resistant, tuberculosis and human reproductive disorders linked to industrial chemicals.
- Loss of biodiversity and the consequent loss of potential sources of new medicinal drugs and food crops
- The decline in pollinators, such as bees, birds, bats, butterflies and beetles, which are indispensable to the reproduction of flowering plants.
- Proliferation of harmful algae along the world’s coastlines, leading to more deadly outbreaks of diseases such as ciguatera poisoning and paralytic shellfish poisoning.

The organisms that transmit such diseases as malaria, dengue fever, and schistosomiasis are sensitive to temperature, humidity, rainfall patterns, and wind. Increases in temperature tend to accelerate the life cycles and decrease the incubation periods of the parasite or virus. These changes extend the time during which the diseases are transmitted and encourage their spread to new areas. Global climate change also has direct effects upon the transmission of diseases. For example, global warming would increase the need for irrigation. In hot climates the prevalence of schistosomiasis already has increased due largely to the expansion of irrigation systems and dams. These systems support more water snails; an intermediate host of the schistosomiasis worms, and brings more people into closer contact with worms.

POPULATION, RESOURCES PRESSURES AND POVERTY

As the century begins, natural resources are under increasing pressure, threatening public health and development. Water shortages, soil exhaustion, loss of forests, air and water pollution, and degradation of coastlines afflict many areas. As the world’s population grows, improving living standards without destroying the environment is a global change.

In the past decade in every environmental sector, conditions have either failed to improve, or they are worsening:

Public health

Unclean water, along with poor sanitation, kills over 12 million people each year, most in developing countries. Air pollution kills nearly 3 million more. Heavy metals and other contaminants also cause widespread health problems.

Food supply

Will there be enough food to go around? In 64 of 105 developing countries studied by the UN Food and Agriculture Organization, the population has been growing faster than food supplies. Population pressures have degraded some 2 billion hectares of arable land- an area the size of Canada and the US.

Freshwater

The supply of freshwater is finite, but demand is soaring as population grows and use per capita rises. By 2025, when world population is projected to be 8 billion, 48 countries containing 3 billion people will face shortages.

Forests

Nearly half of the world's original forest cover has been lost, and each year another 16 billion hectares are cut, bulldozed, or burned. Forests provide over US$400 billion to the world economy annually and are vital to maintaining healthy ecosystems. Yet, current demand for forest products may exceed the limit of sustainable consumption by 25%.

Biodiversity

The earth's biological diversity is crucial to the continued vitality of agriculture and medicine- and perhaps even to life on earth itself. Yet human activities are pushing many thousands of plant and animal species into extinction. Two of every three species is estimated to be in decline.

Global climate change

The earth's surface is warming due to greenhouse gas emissions, largely from burning fossil fuels. If the global temperature rises as projected, sea levels would rise by several meters, causing widespread flooding. Global warming also could cause droughts and disrupt agriculture.

An Environmental Scorecard

In 1992, concerned about worsening environmental conditions, delegates to the UN Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, stressed the need for action. The Rio " Earth Summit" set specific goals for environmental improvements. Then in 1997 a Special Session of the UN General Assembly – popularly known as the "Rio Plus Five Conference"- meet to assess progress toward these goals.

The conclusions were discouraging. In such sectors as land, biodiversity, fresh water, forest and climate change, the 1997 UN assessment found that conditions either were no better than in 1992 or had worsened. Despite lower poverty rates, the number of poor people had increased – in large part because of rapid population growth in developing countries, as well as uneven development, and increasing concentration of wealth.

Arable land

At the beginning of the 1990s, about 560 million hectares of cropland worldwide were degraded. Soils can become degraded rapidly when they are overworked and thus become more exposed to erosion.

Freshwater

Worldwide, the percentage of the population with access to clean freshwater increases during the 1990s. Nevertheless, due to rapid population growth, currently an estimated 1.2 billion people lack potable water-20% more than in 1990. Also, about 3 billion people lack adequate sanitation facilities compared with 2 billion in 1990.

Forests

Half the world's original forest, cover- over 3 billion hectares- has been lost, largely during the past five decades. Deforestation has accelerated since 1990. For instances, tropical forests declined from 1.7 billion hectares in 1990 to 1.4 billion in 1999.

Biodiversity

Human activities already have pushed many plant and animal species into extinction. While no one knows the exact number, there is wide agreement that the rate of extinction will accelerates as population growth and development put more pressure of prime habitats of other species.

Pollution

Air pollution, already a serious problem in may cities, is becoming worse as urban populations grow and the number of motor vehicle raise. Water pollution is a serious problem almost everywhere. Biologist Peter Vitousek and colleagues have warned that human numbers and actions risk fundamentally disrupting nature's basic cycling of water, nitrogen, phosphorus, and carbon among the ecosystems. Largely by releasing carbon dioxide into the atmosphere and by destroying or altering biological resources, humanity is causing "rapid, novel and substantial " changes to the environment.

Climate change

At the Rio Earth Summit in 1992, whether the global climate was changing was still a matter of debate. Since then, the evidence has mounted. In 1990 atmospheric concentration of carbon dioxide – the main climate-changing gas- were measured at about 355 parts per million. In 1997 concentrations were measured at about 364 parts per million. Since 1950 carbon dioxide emission have increased fourfold.

Poverty

During the 1990s the number of people in poverty increased by about one billion. In 1990 about 2 billion people were subsisting on the equivalent of US$2 day or less. By 2000 that number had raised to about 3 billion- half of the world's population.

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UNIT 2

INTRODUCING EARTH

Life has originated at the earth surface at the interface between land, sea and air. It is essential to understand the nature of this environment and the progressive changes it has produced for several thousand years if we are to study the reason behind the continued existence of the human species.

In general, earth is divided into three zones

a) The core
b) Mantle
c) Crust

Crust is the thin skin of the earth occupying less than 1% of the earth's total mass and only all-out 0.5% of its radius. Its thickness very between continental regions (35km) and oceans (5-10km). The high points of the crust are subjected to the process of weathering and erosion. The debris generated by these destructive process fill the low points of the Crust. Even though this been a continuous process since the formation of the crust between $3.9x10^9$ and $4.5x10^9$ years ago, the earth's surface is not smooth. This is due to the fact that the crust is exposed to land forming process and the force behind is generated within the planet, therefore termed as endogenic. Out of the three layers of earth. Lithosphere comprises the crust and upper part of mantle. Behind this lies the lower part of the mantle, which is a soft region, termed as asthenosphere.

EARTHS ENERGY SOURCES

Sun is the ultimate source of energy for all the inhabitants of earth and the solar radiation is emitted off as a broad continuation throughout the parts of the near ultraviolet visible and infrared region except for a small portion of energy, most of the solar radiation is absorbed in the upper atmosphere itself. The remaining part that reaches the earth is relatively high energy, short wavelength UV and visible solar radiation and is ultimately used as an energy source for plant growth. It is this energy that warms up the earth's surface and contribution to the phase transactions of water. To reach a steady stale, the amount of energy equivalent to that of absorbed must be remitted and it is in the form of law energy, longer wavelength infra red (I R) radiation. However, the remitted radiations do not go to the space immediately. Instead it is absorbed by the atmosphere gases such as CO_2, NH_3 and water thus warming up the earth. Without which the earth would have been in the temperature of -15^0 c.

Radiation and Energy Budget:

Source of energy for the earth is the short wave electromagnetic radiation from the sun. Only 64% of radiation is absorbed by both earth surface and atmosphere while the remainder is reflected back. Of these two, earth absorbs about 73% of the total solar radiation and therefore warms up more.

Apart from absorption and reflection, earth atmosphere system emits long wavelength radiation. Hence the total energy absorbed as radiation from the sun is in balance with the total energy emitted as radiation by earth atmosphere system. Energy budget of the globe can be represented algebraically as

$$K-L=0$$

K- Total solar radiation flux absorbed by earth atmosphere system

L- Total terrestrial radiation flux emitted by earth atmosphere system.

Radiation flux-Energy flow per unit time represented in JS^{-1} –W units.

Matter of climate change comes only when this budget is not in balance (ie) K>L or K<L. The resulted consequence is of the former is warm up and latter is cooling down of earth atmosphere system. This occurs under local conditions. For example the condition at low latitudes can be expressed as K>L, the inverse being at high attitudes K<L. Hence it is clear that the circulatory movement of matter in both the lower atmosphere and oceans push the energy from the equatorial region towards the poles. In this does not happen more nonse will be the temperature condition in lower and higher/altitudes than they are at present (ie) former would be hotter and latter would be cooler.

However the two principle components the earth and atmosphere when considered separately will not fit into the balanced radiation budget. This is because both the components differ between the proportion of absorption and emission of radiation, earth absorbs more radiative energy than it emits while emission is more in case of atmosphere. However this does not influence the global mean surface temperature and they remain essentially constant thus confirming the presence of non-radiative mechanism of energy transfer from earth's surface to the atmosphere. It involves the energy transfer as both sensible and latent heat and this can be expressed as

Q=G+H+LE+P+C
Q= net radiation absorbed or emitted
G= heat flux into the sub surface
H= Sensible heat flux to the air
LE=Latent heat flux
P= energy trapped during photosynthesis
C= absorption of heat by vegetation

It should be noted that the balance between radiative and non radiative energy fluxes is balance even at a local scale and all the terms that make up the above equation are highly dependent on the nature of the surface that determines the rate of absorption and emission which in turn show a significant change in energy input.

HYDROSPHERE

Hydrosphere refers to the waters of the earths' surface. It constitutes about 70% of the surface of the globe as liquid water 10% of land a ice. Out of the total hydrosphere, 97% is salt water and 42% is in the from of ice and glaciers. Remaining 1% is the freshwater left out consumption. Water transition takes place by the processes of evaporation, condensation and run off.

The essence of water cannot restrict to the purpose of consumption alone. Its ulecquitous nature accompanied with remarkable properties ensures its pivotal role in the regulation of climate, cycling of nutrients, several biochemical reaction and the process of weathering. Various form of water is discussed below.

Rainwater

Major portion of the rainwater is generated by evaporation from the oceans (83%). The TDS of the river water is however, $4.8x10^3$ less concentrated than seawater setting of dissolved soils due to the evaporation process in the possible reason behind. Hence clear is the fact that dissolved solids concentrations differ between them but the proportion of different constituent is similar. For in stance, the dissolved solids in both cases are the same predominant sodium and chloride indicating the rain water as a very much diluted sea water aside, the rain water contains dust particles washed gates whose solubility depends on the concentration of atmosphere.

Total dissolved content of rain, river and seawater

Rainwater -7.1 Mg/l Na, K, Mg, Ca, Cc, SO_4 HCO_3
River water – 118.2 Mg/l Na, K, Mg, Ca, Cl, SO_4, HCO_3, SiO_2
Seawater - 34.4Mg/l Na K Mg Ca Cl SO_4 HCO_3

River water

The source of river water is the rain. Soon after, if hits the ground as run OH and percolates there the surrounding rocks, its composition compotes. Naturally with a percent increase in the TDS content, the proportion of its individual allowed constituents also gets altered. Thus mailing it much more concentrated than rainwater below, calcium appears to be the documentation than sodium. However it is different to frame out the nature or river water as theoretically explained here but still based on the weight ratio of Na^+/ Wa^++Ca^{2+} plotted against the logarithm of their total dissolved salt content, the world rivers are categorized center three different pattern

(a) Precipitation dominance

River water surrounded by the highly weathered rocks do not show much variation from the rain water composition. The reason behind this the availability of the material to get etched is lees and the total dissolves salt content is obviously low to give the Na^+ / (Na^++ Ca^{2+}) weight ratio close to unity.

(b) Rock dominance

In content when the drains are basin of the rivers passers activity weathering material it fall under this category. The concentration of TDS content is in intermediate. With Na^+/Na^++Ca^{2+} weight ratio of about 0.55 and below.

Evaporation Precipitation

The arid areas, the rate of evaporation considerably exceeds that of precipitation thus leaving the salt content rich solution. Here the Na+/ Na++ Ca2+ weight ratio is higher

Lake water

Generally the behavior of lakes is determined by the TDS content of the river water that flows in to them. However they are not subjected by frequent changes like rivers. Also the temperature conditions to a great extent influence the nature of lakes. Accordingly they are divided into

(a) Lakes in temperate zones
(b) Lakes in polar and sub polar zones
(c) Lakes in tropical and subtropical zones

Lakes in temperate zones

These lakes exhibit stratified pattern during summer months (i.e.,) a warmer and less dense upper layer called epilimnion; temperature transition middle layer called metal minion and a cool dense lower called hypoliminion. Active photosets there is in the upper zone brings out the depletion of nutrient.

While in the presence of light, bottom dwelling detritivores depletes the available oxygen in the lower layer. During the autumn, cold climate reduces the temperature epilimnion equal to that of hypolimnion. Under these conditions of uniform density throughout the base system, wind induces vertical mixing is highly favored a process called turn over. Thus O_2 and the nutrients are supplied to the lower and upper layer respectively. In winter two distinct layers are formed with water at less than 4^0C above and water at 4^0C below. Hence the water freezes from top to bottom. Once the ice is formed in the upper layer, it retards the cooling process in depths so inhibiting the complete solidification of lake. Oncoming of spring once again warm up the upper layer so as to given an uniform temperature and density from the top to bottom verified mixing for the second time occurs here and the increased temperature in summer brings back the three distinct stratified layers.

Lakes in Polar and Sub Polar Regions

Since the lakes are kept frozen for most of the year, not much stratification is observed in summer but they exhibit turnover during this season.

Sea Water

Seawater receives water, dissolved and particulate solids by the action of rivers, rain, marine volcanoes, ice and underground water flow and they are lossed from the marine environment by evaporation, precipitation and seas spray.

Even though it is reported that the TDS content of seawater is on average $35gl^{-1}$, depending on climate, location and season it varies between 33 and 37 gl^{-1}. The compositions of the seawater rely upon the change in the input of water and solids to that of change in outputs. Suspended solids, as such get deposited as sediments whereas the mechanism by which dissolved solids are removed from seawater requires more explanation. However it is understood that physical, chemical and biological reactions all play a role.

Long Term Climatic Stability

Weather is the term that represents the physical condition (wind, temperature, cloud cover fog and precipitation) of atmosphere, particularly the troposphere at a fixed time and place. But for the assessment purpose, this cannot be accounted. There to acquire a clear picture and to predict the weather changes, long-term view of the weather pattern of a particular locality is taken into consideration. This longer-term view is called climate.

CHANGING ENVIRONMENTAL PROCESSES

Green house is a glass building constructed to regulate the plant growth in temperature countries. Since at allows the short wave length incoming solar radiation to come in but not allow the long wave outgoing terrestrial infra red radiation to escape, the plant growth will not be interrupted due to the lack of temperature. Similar to this, is the earth's atmosphere that traps the solar radiation where the atmosphere gases, CO_2, water and ammonia act as glass windows. This is due to the fact that the atmospheric gases are transparent to sunlight but not to the heat radiation so that the solar heat is trapped and reflected back into the earth, a mechanism popularly known as Green house effect.This becomes problematic when more amount of carbon dioxide gets accumulated in the atmosphere thus leading to global warming. Green house effect may therefore be defined as the progressive warming up of the earth's surface due to blanketing effect of man made CO_2 in the atmosphere.

Adverse effect of deforestation is always given us attention. According to scientists of Brazil, clearing of tropical forests leads to a 7% higher CO_2 emission and in a few regions the rate of increase elevates even to 42%. As per the recent estimates, cutting of trees emits considerable amounts of CO_2 and CH_4 and when the biomass is burnt it releases 2,000,000,000 tones CO_2 into the atmosphere per annum.

Methane

Natural sources generate a methane flux of between $86x10^{12}$ and $29x10^{13}$ mol $ca^{-1.}$ This is generated by the anaerobic microorganisms in wetlands and in the intestines of

ruminant animals. Anthropogenic emissions produces an additional flux between $1.5x10^{13}$ and $3.6x10^{13}$ mol ca^{-1} and to sources are paddy rice production, low temp biomass burning, cattle reaching, waste deposal and fossil fuel extraction.

Soil and atmosphere are the two major sinks of methane (i.e.,) About 2-7% of this gas is trapped by the soil, 6-12% is allowed to escape and oxidized in the stratosphere. Remaining proportion of the methane is removed in the troposphere by a series of chain reactions. One such example is given below

$$CH_4+OH---CH_3+H_2O$$

However due to the anthropogenic intervention, the rate at which the hydroxyl radical's react with methane is decreased (ie) increased emotions of troposphere carbon mono oxide has the ability to consume all out 70% of hydroxyl radicals by the following reaction

$$CO+OH \text{ -----} H+CO_2$$

Much to bother about the methane is that it has a fairly long retention time and therefore gets evenly distributed is concentration in the atmosphere is 1.75ppm but this is increasing every year at the rate of 1-2%. Besides methane, about 600 different airborne hydrocarbons are identified and they include benzene, butanes, ethane, ethyne hexane, pentane propose and toluene. Also isoprene and two pinene are released in substantial amounts the 0^1 variety of biological procedure. All these hydrocarbons are amounted with transport and use of organic solvents.

HYDROCARBONS

Being the compounds of carbon, chlorine and fluorine, they may also contain hydrogen they do not have any natural sources. Only in the year 1930`s, Dupont and general motors corporation collaboratively introduced this as refrigerant un U.S.A CFC-11 CCL_3F and CFC-12($CC1_2F_2$) are the most abundant compounds in this category and their concentration in the atmosphere accounts to 0.280ppb and 0.484ppb respectively. Their characteristic features such are inert, nontoxic; non-flammable and odourless gained more attraction and both compounds well considered as an optional working fluid for refrigerators and ideal for industrial purpose. Well before its introduction, SO_2 or ammonia were the working fluids used in refrigerators and therefore they were lightly expressive to afford as a domestic commodity. But after use of CFC, they became cheap thus accelerate its rate of emission aside they have additional applications such as solvents as blowing agents in the manufacture formed plastics and as problems in aerosol sprays.

With a broad utility for more than 25 years it is not surprising to have a sharpe increase in its emission between 1960 and mid 1970s. The trend continued till 1980's but towards the end of the year, internationally enforced on the rate of these materials has brought down its amount.

The major draw back encounter on the halogenated hydrocarbon is that they uncreative and therefore cannot be subjected to chemical alternations. Also they cannot be destroyed by tropospheric reactions. Hence the atmospheric lifetime of this gas is long that it can stay there for 10 years and some time to even 100 years. Apart from their distribution throughout the troposphere they pass the tropopause to reach stratosphere.

Then they eater in to a sees of photobiotic reaction and thus degrade in a slow manner. The resultant chloride atoms eater in to the capably tic cycles thus splitting ozone molecule that protect the biosphere from harmful ultra violet light. Also the chlorinated hydrocarbons with out fluorine undergo photolysis and release chlorine atoms. Anthepogenic emissions of halons find their application as fire extinguishers and they do not have any natural sources. Instead of chlorine they liberate bromine atoms and they act significantly to increase the rate of chlorine induced ozone depletion. It is reported that a claw conc. of bromine (0.02ppb) may enhance the ozone depletion to above 20%.

Unless national legislations and international agreements give cheek to the emission of this potentially damaging CFCS, severe will be damaged. This is due to the fact that even the total usage of CFC is ceased worldwide, the complete removal of this gas demands another century period.

Major source of green house gases:

Industrial and agricultural operations are two major sources that generate and emit waste gases into the atmosphere. They create a blanket in the atmosphere and prevent the escape of long wavelength infra red radiation reflected break from the earths surface green gorse gases (aster) that contribute more to the global warming are Co2, methane, nitrous oxide, CFC and aerosols.

Carbon di-oxide:

Co_2 constitutes about 362 ppm in the lower layer troposphere in atmosphere. A rapid increase rate of around 0.5% per annum has complied the environmentalist to have aches on its emission. This concern has been sufficient to inspire international agreement in the form of climate change convention, agreed at the earth summit, Riode Janeero, in June, 1992.

Sources : The main source of arm 103 million are

a) Respiration
b) Oxidative delay
c) Combustion
d) Out gassing from oceans.

Photosynthesis and dissolution in seawater the major sinks of this gas. According to us scientists, about 2 billion tones of atom CO_2 are known to dissolve in oceans. This mechanism naturally help in minimizing the green house effect that would have caused by six bullion tones of CO_2, the source being the burning of fascicules soon after its dissolution in surface waves phytoplankton, and marine organisms take them up for photosynthesis. Almost ¾ of the carbon falls on the ocean floor and therefore more the no of life produced by ocean, max will be the Co2 sink. However, the biological productivity of these organisms depends on global warming thus leading to a negative feed back mechanism.

Out of several green house gases Co2 contributes to 55% global warming and industrial emission of CO2 accounts to its major source of emission and for the past 40 years, it has been tripped thus threatening global warming induced climatic change. Next comes the burning of forks fuel in which coal, oil and natural gas contributes to 2.4, 2.8 and 1.3 billion tones respectively.

CONSEQUENCES OF GREEN HOUSE EFFECT

- Melting of ice is at an alarming rate in alpine regions threatening nations like Australia, Switzerland and France. About one third to one half of the ice cover is estimated to have disappeared over the last country.
- As per the climatologists from the university of Delaware (USA), a 2- 4 C increase in temperature will elevate the summer season to two bold there by rising the heat related deaths from 320 to 88.
- As per the recent findings, global warning induced climate changes in our planer are rapid and unpredictable than expected earlier. 20% more storms, 10% more vegetation and early onset of spring are the outcome in the northern hemisphere. At this stage glacial meeting in the anta tie region will be quicker and ultimately result in snow free seasons. However in years to come, continuous rising of temperature leads to draught.

Global warning induced early onset of spring has been found to affect the nesting cycle of birds.

- Algal growth on ice sheets of are tie region is the primary victim due to the shrinking ice. Being the energy producer in arctic food chain they from food to a variety of organism from seals to polar bears. Therefore rising temperature has the possibility to drive these organism extinct in hear future fact is warming regions in the world warming at a rate of 0.75 C per decade for the past thirty years.
- Aside the pronounced climate changes, alteration in the habits, migration and breeding of animals of this region are given lees attention. According to the worldwide fund for nature (WWF), birds, plants and wild life where properly protected would eventually affect human life.
- Global emissions of green house gases have not left behind the coral reefs diversified natural ecosystem. This is because, it is reported that high levels of CO
- May reduce the ability of coral animals to make limestone skeletons that build reefs.

Troposphere Air flow:

Turbulent nature of troposphere is due to the continuous circulation of air. When the air exhibits large-scale movements it is termed primary circulation of the atmosphere fine and defined movements of air constitutes the secondary and tertiary circulation systems and they are usually superimposed on the primary one.

Operation of the three different forces in the horizontal plane influence the primary circulation flow and they are

(a) Pressure gradient force
(b) The frictional force
(c) The carioles force

Pressure gradient force is the primary force that brings out the horizontal airflow while the frictional and carioles force modify its speed and direction. Based on the average wind directions across the surface of the earth, it is possible to discern a definite overall pattern of polar caster lies, mid-latitude western lies and trade winds.

Assessment of average wind direction and envisaging three circulatory cells in each hemisphere can do some other major climatic features. They are

(a) Hadley cell
(b) Ferrell cell and
(c) Polar cell

Hadley Cell Operation

At the equator, the mean surface temperature warms up the air thus causing them to rise and generate a low-pressure zone. This generates a pressure gradient and drives the surface airflow to below equator wards. To conserve the angular momentum and to a lesser extent the carioles force, the direction of the airflow is modified. As a result, trade winds are formed converging on the intertropical convergence zone (ITCZ). Now the aloft air move towards the pole and by radiative cooling it loose energy, becomes dense, falls down and warmed by adiabatic compression. At latitudes of about 30^0N and 30^0S, two areas of high pressure are formed.

Tropical climates

Tropical climates do not hold any discernible winter/summer seasonal change in temperature. They are established between the latitudes of 30^0N and 30^0S. Here Hadley

cells dominate the primary circulation of the atmosphere. The characteristic feature of this locality is the presence of cloud and precipitation at the inter tropical convergence zone (ITCZ) and the dry hot pressure zones created at the pole ward extremes of Hadley cells. Development of two distinct regional tropical climates is the resulted consequence. Areas that come under ITCZ are hot but with high rainfall whereas the outer limbs of Hadley cells are dry hot deserts. Since the ITCZ exhibits seasonal many locations aside, the summer circulation pattern superimposed on Hadley circulation can also brings out rainy season. This occurs in the tropical part of eastern hemisphere, which is characterized by a seasonal reversal in the direction of airflow. Well known is the float that summer wind is the direct cause of differential heating of the land and ocean and when autumn arrives, the thermally direct cell gets weakened due to the decrease in temperature variation between terrestrial and maritime surface temperatures. During the early summer, thermally direct cell becomes reestablished and the cycle continues.

Mid latitude climates

The climates of mid latitudes lies between 30-60^{0}C and 30-55^{0}C and the climatic condition is determined by both latitude and east west location. Because of this western coastal areas are wet than eastern coastal areas and the areas far away from the ocean are still drier. The reason could be the decreasing mean surface temperature with increasing latitude. Also the westerly airflow is the source of wet weather in western coastal. That is they bring down the extra tropical cyclones from the Atlantic and pacific oceans to keep the climate always wet. The condition is maintained throughout the air under the influence of polar front. However near the equator the outer subsiding portions of the Hadley cells modify the west coast mod latitude climate and establish warm dry weather in summer. Hence these areas are characterized by dry warm to hot summers and wet cool winters and the condition being termed as Mediterranean. Pole ward regions are characterized by cold west coast climates since they are out of reach of Hadley cells, they are provided with fairly even distribution of rainfall throughout the year. Towards the interior of the west coasts, maritime influence is less significant and obviously the low precipitation and temperature fluctuation increases to establish interior desert climates. This condition is favoured only in the presence of sufficiently large continent and mountain range extending along north south axis whereas air mass movements from both polar continental and tropical maritime areas influence eastern portion of the continent. High precipitation in this part of the world is due to the moist air blown from tropical maritime area. Land of Southern Hemisphere has the climatic influence similar to that of its northern counter parts.

Polar climates:

Such climates lie between 60^{0}N and 55^{0}S. It is to notify that the average temperature of the warmest month does not exceed 10^{0}C. In most of these regions, the surface area is permanently frozen (permafrost) except for a few summer months. During these seasons, the upper layer may thaw giving way for plants growth. Hence they are said to be aid especially in regions away from the margin of polar area probably the low moisture carrying capacity of the cold air and stable atmosphere conditions covered by polar cell are the two major reasons attributing to the low precipitation. Generally the interior of the northern polar region is calm whereas the interiors of the South Polar Region are highly turbulent due to strong winds of topographic origin.

Climatic System and Climatic Change:

While reviewing the time scale over a period of thousand or several thousands of years it is apparent that the globe has come across high noticeable climatic variations such as alternating cold periods (glacial) and warm periods (interglacial). Beside this, more subtle variations such as little ice age experienced in northern Europe between sixteenth and nineteenth century should also be considered. Hence it is obvious that the climate it not an unchanging phenomenon. Even though the mechanism that favours this climate change is not clear, the nature and extent of the climate change and its dependence on the operation of feed mechanisms cannot be denied. Mechanism that

initiates the climate change is positive and that reduces the size of change is negative. This can be illustrated with an example. Increase solar radiation absorption by the surface would enhance the surface temperature. Now the proportion of snow covered area would decrease since snow is more reflective than land, vegetation on or water, their removal from the surface would further increase the absorption thus mediating the positive feed back.

As per the assessment of climate change in previous years, it cannot be concluded that any future changes would be gradual. This is because significant changes like last ice age is brought down by significant and sudden fluctuations in the temperature regime of North Atlantic region why not the oceanic conveyor belt currently warming up the North Atlantic operate in reverse order to warm up the north pacific!

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