

**EDUCATION
FOR
SUSTAINABLE DEVELOPMENT**

A Source Book for Teachers



**Regional Institute of Education (NCERT)
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PREFACE

Education for Sustainable Development is a visionary approach to education that seeks to help people understand the world in which they live in a better manner, and to face the future with hope and confidence. It addresses the complex and interdependent problems that threaten our future such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, gender inequality, health, conflict and the violation of human rights. Education for sustainable development is conceived as more than a knowledge base related to environment, economy and society which addresses several problems and issues related to development in society. It attempts to motivate people to seek sustainable livelihoods, to participate in a democratic society and live in a sustainable manner. Realizing the importance of preparing the present generations into sustainable livelihood, it is felt essential that the knowledge of sustainable development be integrated in the school subjects. It is also felt that the teachers need to be empowered with sufficient skills and competencies to sensitize the students to the issues and problems of society, environment, health, population, poverty etc.

This source book on Education for sustainable development for teachers of upper primary and secondary level on sustainable development was approved and sanctioned by NCERT under National Population Education Project, MHRD. This source book is integral in its content and processes aiming at promoting the awareness, skills and necessary values. Using the source book, the teachers can meaningfully integrate the concepts of ESD across the curriculum and develop necessary awareness, skills, attitudes and values in learners. The Objectives of developing this source book are as follows.

- To develop a conceptual understanding of the concepts and themes related to sustainable development and how they can be integrated in all subject areas across the school curriculum.
- To develop skills of identifying and mapping the scope for integrating the concepts and issues of sustainable development in the respective school subjects.
- To enhance skills for using a wide range of learner-centered teaching and learning strategies that facilitates the understanding and application abilities, critical thinking, values and citizenship objectives implicit in reorienting education towards sustainable development.
- To develop an appreciation of the scope and purpose of educating for a sustainable future.

The source book on Education for sustainable development is developed into two parts. Part. A provides an understanding of sustainable development and need for education for sustainable development, curricular and learning approaches to education for sustainable development. Part. B deals with the themes of sustainable development which can be integrated in different school subjects through activities, projects, field visits, investigations, case studies etc. Several suggestions and instructional tips are made in the modules with

respect to treatment of the concepts, planning activities and interacting with students on several issues that affect human lives and sustainable development.

The source book was developed with the contributions of eminent academicians from various sources of knowledge fields, such as environmental engineering department, centre for environmental education, Bio technology, Sociology, Economics and Education. Three workshops were organized in order to develop and review this source book. It is hoped that it would be of great use to those teachers who are committed to saving the environment, and care for the needs and lives of future generation. It is hoped that the teachers use the source book effectively to develop awareness, positive attitude and skills in their learners towards sustainable living.

I am immensely thankful to NCERT for funding this source book. I would also like to thank the project Co-ordinator, Prof. Saroj Yadav, DESSH,NCERT, for facilitating the administrative and the financial part of the work , and for her kind cooperation and constant encouragement. I also would like to thank Professor. D.G.Rao, the Principal of the Regional Institute of Education, Mysore, for his cooperation, encouragement, and administrative support through out the work. Lastly, I would like to thank all those experts, who had contributed to this source book. I am exceptionally thankful to Dr. M.J.Ravindranath, Senior Scientist in Centre for Environmental Education, Bangalore, for his guidelines and critical observations during the development of this source book. I would like to thank, especially, my two former Ph.D students, Mr. Biju.K and Dr. Jubilee Padmanaban for their continuous assistance and enthusiasm in bringing out this source book.

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PART A

Chapter One : Sustainable Development and Education for Sustainable Development

1.1. Introduction

All of us are aware of the fact that our earth planet is rich with thousands and thousands of species, and plenty of natural resources. This extraordinary richness of life that surrounds us in the form of diverse arrays of organisms, ecological communities, and natural landscapes sustain human activities such as agriculture, forestry, fisheries etc, which is the basis of our civilization. The natural resources that support our lives have been in existence since billions of years. This biodiversity and mineral rich environment, a product of billion years of evolution, has been rapidly declining in recent years, as a victim of explosion of human population, increasing human needs and demands, and ever expanding technology, industry in the name of development. Because of the environmental problems which are rapid and devastating, the global environment and ecology have become the most demanding subjects of discussion, thereby necessitating proper decisions and actions in the required direction.

As we see, the development has resulted in disparities in terms of socio-economic conditions between rich and poor countries in the world. At the global level, acid rain, desertification, global warming, ozone layer depletion, pollution, radiation and species extinction are some of the most urgent environmental problems. We see that efforts at the global level are concentrated to forge international cooperation in tackling these problems. It is felt worldwide that, human beings are the main concern for sustainable development, entitled to a healthy and productive life in harmony with nature. The essential task of human beings is to eradicate poverty as an indispensable requirement for sustainable development. This is important in order to reduce the disparities in standards of living and to meet the needs of the majority of people of today as well as of future. Therefore, there is a requirement of educating today's man into thinking and living in the culture of sustainability. This chapter discusses the concept of sustainable development, its importance and components, and education for sustainable development. This chapter traces the widening understanding of sustainable development from the last three decades by including international events such

as: the 1987 Brundtland Report, the 1992 Earth Summit in Rio de Janeiro, the 1997 Rio+5 Conference and the 2000 Millennium Summit in New York, and the 2002 World Summit on Sustainable Development in Johannesburg.

This chapter facilitates you to

- Understand the emerging concept and the need for sustainable development
- Explore further to find out the measures adopted for sustainable development in India
- Analyze the value base behind a range of different interpretations of sustainable development;
- Develop your own definition of sustainable development
- See the relationship between the environmental, social, economical, political and cultural conditions in sustainable development
- Explore the ways of promoting the idea of sustainable development among your learners

1.2. From Environmental Education to Education for a Sustainable Development

As pre service teachers, you must have undergone the instruction of environmental education during your teacher education course. Probably, you must have also taught the environmental concepts in different subject areas. All these decades, the environmental concepts and issues were treated under the area 'Environmental Education' which is included in the Higher education courses and in the school education either as a separate subject or as an integrated part of other school subject areas. The objectives of environmental education has been to create awareness about the environment related matters, and largely to focus on man's activities leading to environmental pollution which are of various kinds and to develop proper attitudes and values towards conserving environment.

The World Commission on Environment and Development promoted the concept of 'sustainable development' in the late 1980s. Until then, environment and development were thought of as two distinct actions—the need to promote development on the one hand and the need to protect the environment on the other. At the 1992 Earth Summit in Rio de Janeiro, the environmental side of sustainable development emerged as a main focus. Poverty eradication was also viewed as an important aim. The Rio Declaration and Agenda 21 which were the

main documents to emerge from the Earth Summit, laid emphasis on the importance of protecting the natural environment. They recommended that there is a need for a global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem.

In 2002, a fully developed framework of sustainable development was endorsed at the World Summit on Sustainable Development in Johannesburg. This Political Declaration stated that "sustainable development is built on three interdependent and mutually reinforcing pillars"—economic development, social development and environmental protection—which must be established at local, national, regional and global levels. This new outlook to sustainable development establishes linkages across poverty alleviation, human rights, peace and security, cultural diversity, biodiversity, food security, clean water and sanitation, renewable energy, preservation of the environment and the sustainable use of natural resources. This view of sustainable development seeks to ensure a better quality of life for everyone now and for the generations to come.

1.3 What is Sustainable Development?

Sustainable development is an organizing principle for human life on earth planet. It aims at a desirable future state for human societies in which living conditions and use of resources meet human needs, without destroying the sustainability of natural systems and the environment, so that future generations may also have their needs met. Let us take the example of our families, in order to understand the concept of development better. Most of our Indian parents save some property or the other, either in the form of lands, or construction of houses or cash savings and investments for their children. They plan their living and expenditure carefully and reasonably, so that they lead a good standard life and at the same time save for their children's future. Similarly, it becomes necessary for us -the present generation, to utilize the resources optimally and rationally, so that the future generations would be able to use and enjoy the environment and resources just as we do now.

Sustainable Development is the “development which meets the needs of the present without compromising the ability of future generations to meet their own needs in the limits of a socially and environmentally sustainable manner”.(Brundtland Commission -1987)

The ultimate goal of sustainable development is to improve the quality of life for all members of a community and, indeed, for all citizens of a nation and the world – while ensuring the integrity of the life support systems upon which all life, human and non-human, depends.

(Source: World Commission on Environment and Development (1987) Our Common Future, Oxford University Press, Oxford, p. 43).

There is sometimes confusion about the meanings of ‘sustainable development’ and ‘sustainability’ and the relationship between them. A report on Education for Sustainable Development in New Zealand proposed the following explanation:

Sustainability is the goal of sustainable development – an unending quest to improve the quality of peoples’ lives and surroundings, and to prosper without destroying the life supporting systems on which current and future generations of humans depend. Like other important concepts, such as equity and justice, sustainability can be thought of as both a destination and a journey.

1.4. Four Dimensions of Sustainable Development

The concept of sustainable development has in the past concentrated on three constituent dimensions: *environmental sustainability*, *economic sustainability* and *social sustainability*. However, later the political dimension was also suggested as an important domain. Sustainable development focuses on the principles of social equity and on the ecological constraints posed by the planet to economic and demographic growth. It also visualizes an ecologically literate competent citizens who understand global issues and can bring about cultural change.

The four dimensions, i.e., social, economic, ecological and political of sustainable development are always closely linked with each other. The decisions or action taken in one area always affect the other areas as well. For example, if economic development is to be sustainable, it cannot neglect environmental constraints or be based on the destruction of natural resources; it needs to consider the needs of all species and their rights to enjoy the

quality of life and share of resources: it must consider and support fairness among all people, so that everyone can enjoy the same standard of living and quality of life. Above all it needs to consider the needs of future generations

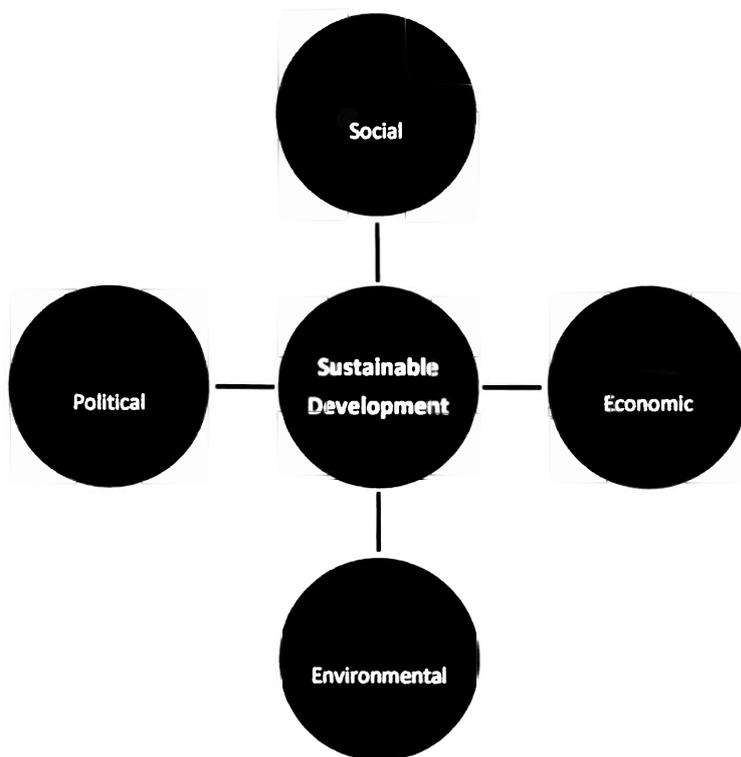


Fig. 1 Components of Sustainable Development

The special contribution of the concept of sustainable development is that it emphasises respect for cultural values and, thus, does not see economic indicators as the sole measure of development. Rather, sustainable development represents the balanced integration of social and environmental objectives with economic development. These three aspects of sustainable development – society, environment and economics – were named as the three pillars of sustainable development at the World Summit on Sustainable Development in Johannesburg in 2002. However, politics and culture is also a key dimension of sustainable development, which influence the interactions of and between the three pillars. They are concerned with the values we cherish, the ways in which we perceive our relationship with others and with the natural world, and with how we make decisions. The values, diversity, knowledge, languages and worldviews associated with culture and politics strongly influence the way issues of sustainable development are decided and, thus, provide it with local relevance.

A core principle behind sustainable development is the idea that economic, social and environmental conditions play a major role. Without a proper ecosystem, it is impossible to maintain a better society and economic development for our own and future generation. Thus environmental dimension is regarded as the ultimate boundary for Sustainable development. The purpose of social dimension is to meet the basic needs of all people without exceeding the boundaries of the ecosystem.

Besides the above, sustainable development establishes linkages across poverty alleviation, human rights, peace and security, cultural diversity, biodiversity, food security, clean water and sanitation, renewable energy, preservation of the environment and the sustainable use of natural resources. This view of sustainable development seeks to ensure a better quality of life for everyone now and for the generations to come. Hence, a fundamental principle in learning for sustainable development is the idea of each individual's involvement, responsibility and commitment to local and global discussions on our common future, which gives democracy a central role.

1.5. World organizations and summits on Sustainable Development and Education for Sustainable Development

The emergence of sustainable development and Education for Sustainable Development can be traced back to 1972 onwards when the United Nations Conference on the Human environment was held in Stockholm. Followed by it many committees and conferences were undertaken. Among them some of the notable ones are given in the following table.

<p>✦ <i>1975: UNESCO sponsored conference in Belgrade, which came out with Belgrade charter</i></p>
<p>✦ <i>1977: the UNESCO in cooperation with UNEP held a conference in Tbilisi which laid down the goals, objectives and guiding principles of EE,</i></p>
<p>✦ <i>1987: the World Commission on Environment and Development published the Brundtland Report which is also known as Our Common future, which introduced the idea of sustainable development in which environmental protection and economic growth are reviewed as independent concepts,</i></p>

<p>✚ 1994: <i>The report, Education for sustainability; An Agenda for action, is produced.</i></p>
<p>✚ 2002: <i>the United Nations Commission on sustainable development held the Johannesburg Summit in Johannesburg which action toward... conserving our natural resources in a world that is growing in population, with ever- increasing demands for food, water, shelter, sanitation, energy, health services and economic security”.</i></p>
<p>✚ 2000: <i>The Johannesburg World Summit on Sustainable Development (WSSD,), proposed the Decade of Education for sustainable Development (DESD), signalling that education and learning lie at the heart of approaches to sustainable development.</i></p>
<p>✚ 2005-2014: <i>This period is considered by WSSD as United Nations Decade for Education for Sustainable Development (UNDESD) and recently the Copenhagen summit in 2009 on climatic change.</i></p>

Table 1.1: World organizations and summits on SD and ESD

Brundtland Report

The term ‘sustainable development’ was popularized by the World Commission on Environment and Development (WCED) in its 1987 report entitled *Our Common Future*. This book is also known as the Brundtland Report, after the Chair of the Commission and former Prime Minister of Norway, Gro Harlem Brundtland. The aim of the World Commission was to find practical ways of addressing the environmental and developmental problems of the world. In particular, it had three general objectives:

- To re-examine the critical environmental and development issues and to formulate realistic proposals for dealing with them;
- To propose new forms of international co-operation on these issues that will influence policies and events in the direction of needed changes; and
- To raise the levels of understanding and commitment to action of individuals, voluntary organisations, businesses, institutes, and governments.

Our Common Future

This was written after three years of public hearings and over five hundred written submissions reported on many of the global realities and recommended urgent action on eight key issues to ensure sustainable development, i.e., it would satisfy the needs of the present without compromising the ability of future generation to meet their own needs. The eight key issues were:

- Population and Human Resources
- Industry
- Food Security
- Species and Ecosystems
- The Urban Challenge
- Managing the Commons
- Energy
- Conflict and Environmental Degradation

These issues have different impacts in different countries especially in the developing countries.

Analyze and Discuss....

- ❖ Which of the above issues pose the greatest challenge to sustainable development in India?
- ❖ Compare the issues that pose the challenge to sustainable development in India and in other developing countries.
- ❖ In which of the school subjects, do you think that the above issues can be discussed?

Agenda 21

The above eight issues along with the other issues were discussed at a major international conference in Rio de Janeiro, Brazil, in June 1992. This conference which was known as the Earth Summit brought together nearly 150 Heads of State where they

negotiated and agreed to a global action plan for sustainable development which they called Agenda 21.

Agenda 21 has been the basis for action by many national and local governments to promote dialogue between government, environmentalists, the private sector and the general community. Based on the agenda 21, many countries had developed programmes for monitoring national progress on sustainable development indicators.

1.6. What is Education for Sustainable Development (ESD)?

Education for Sustainable Development (ESD) is based on ideals and principles that underlie sustainability such as intergenerational equity, gender equity, social tolerance, poverty alleviation, environmental preservation and restoration. This is stated in Rio Declaration which contains 27 principles of sustainability, among which some are as follows:

- People are entitled to a healthy and productive life in harmony with nature.
- The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
- Eradicating poverty and reducing disparities in living standards in different parts of the world are essential to sustainable development (Keating, 1993).

These principles were stated in order to help governments, communities and school systems to identify knowledge, principles, skills and values on which they can create Education for sustainable development or reorient existing education to address sustainability. So we can say that, Education for Sustainable Development is a visionary approach to education that seeks to help people better understand the world in which they live, and to face the future with hope and confidence, knowing that they can play a role in addressing the complex and interdependent problems that threaten our future such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, gender inequality, health, conflict and the violation of human rights.

Based on the discussion on sustainable development in the earlier section, we can say that Education for Sustainable development (ESD) involves integrating knowledge of economic, social and environmental development. It also addresses learning skills, perspectives and values that guide and motivate people to seek sustainable livelihoods.

participate in a democratic society and live in a sustainable manner. ESD involves studying local and when appropriate, global issues.

ESD has five components: Knowledge, skills, perspectives, values and teaching issues which are addressed in a formal curriculum for sustainable development.

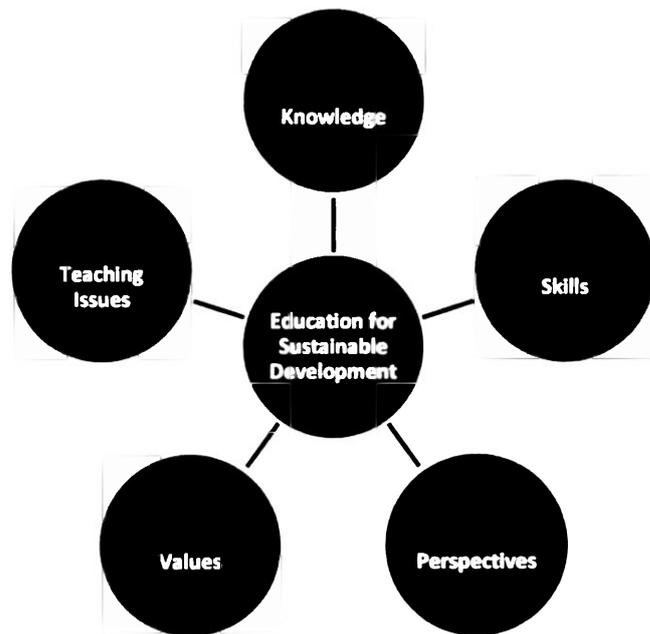


Fig. 2: Components of Education for Sustainable Development

Sustainable development encompasses environment, economics, and society. Therefore, people need basic knowledge about the natural sciences, social sciences, and humanities to understand the principles of sustainable development, how they can be implemented, the values involved, and effect of their implementation. ESD focuses largely on the major social, economic, and environmental issues that threaten the sustainability of the planet. Understanding and addressing these issues is the core of ESD. Besides this, it is important to include locally relevant issues in the programmes related to educating for sustainability. To be successful, ESD must go beyond teaching about these global issues, by providing learners practical skills that would enable them to continue learning even after they leave school, to have a sustainable livelihood, and to live sustainable lives. These skills differ with community conditions which fall into one or more of the three realms of sustainable development - environmental, economic, and social. ESD carries with it perspectives that are important for understanding global issues as well as local issues in a global context. Every issue has a history and a future. Looking into the roots of an issue and forecasting possible

futures based on different contexts and their interrelatedness are part of ESD. Understanding one's own values, the values of the society one live in, and the values of others around the world is a central part of educating for a sustainable future.

The main aim of education for a sustainable development becomes education for global citizenship throughout one's life in order to build a knowledge society in which the local community through participatory process acknowledges the necessary and possible changes. The aims of ESD are as follows:

The aims of Education for sustainable development are to

- Promote understanding of the independence of natural, socio-economic and political systems at local, national and global levels,
- Encourage critical reflection and decision making that is reflected in personal lifestyles,
- Encourage the active participation of citizenry in building sustainable development,
- Develop interactive and participatory skills,
- Develop appropriate environmental understanding based on an understanding of the independence of nature and skills of problem solving.
- Provide opportunities for learners to participate in democratic discussions about what is important to them personally, and for society in the future.
- develop and strengthen the capacity of individuals, groups, communities, organizations and countries to make judgments and choices thus aiming at making our world safer, healthier and more prosperous, thereby improving the quality of life.

ESD also increases the civil capacity by enhancing and improving the workforce, social tolerance, environmental stewardship, participation in community- based decision making which should be enhanced by combining formal, non-formal and informal education. An attitude of concern for the quality of the environment is important to motivate people to develop skills, willingness to take necessary decisions and actions for solving environmental problems.

Educating for this type of change is a challenge to schools, especially integrating it with the other school subjects. The education for sustainable development cannot be treated simply as a matter of knowledge and information transmission, but as a process of actively constructing meanings in social setups, along with development of required skills and values. Knowledge of this kind cannot be considered as separate from the community and from the surrounding territory, but

one should try to jointly build relevant knowledge for that community and that particular context. It is necessary to focus on the problems and issues related to environment and development, by encouraging the students and the community to do research together.

It is a matter of becoming aware of our ways of perceiving our planet and to consider ourselves in relation to the planet in order to strengthen or modify our behaviours and our thoughts in the direction of learning to ‘live the Earth wisely’ (Mortari, 1994).

Learning to think differently also means taking on the responsibility for our thoughts, of the contribution they can make to a future to be built. Thus education becomes an indispensable element for achieving sustainable development. Since ESD is everybody’s concern, the sharing of responsibility for ESD is essential and should take place at all levels. The community, political system, educational system and major organizations working with different developmental aspects should share the responsibility.

To deepen your understanding...

- ❖ Analyse the meanings of Sustainable development in the given web sites and write your own understanding of the concept.
- ❖ Find out the measures adopted for sustainable development in our country.
- ❖ List down your roles and responsibilities in educating your learners on sustainable development.
- ❖ Give some illustrations to show how the societal, environmental, economic, cultural and political factors are important in the sustainable development.
- ❖ In your view, what are the constraints that hinder sustainable development?
- ❖ Investigate why development is more than just economic growth – according to a

World Bank *Development Outreach* report. Refer to
<http://www1.worldbank.org/devoutreach/>

Web links :International Institute for Sustainable Development ; Sustainable Development Gateway ; United Nations Commission for Sustainable Development

Chapter Two : Curricular approaches to Education for Sustainable development

2.1. Introduction

A basic premise of education for sustainability is that just as there is a wholeness and interdependence to life in all its forms, so must there be a unity and wholeness to efforts to understand it and ensure its continuation. This calls for both interdisciplinary inquiry and action. It does not mean that we should put an end to all traditional disciplines which are taught in schools as subjects. A disciplinary focus is often helpful, even necessary, in allowing the depth of inquiry needed for major breakthroughs and discoveries. Education for a sustainable future involves a comprehensive approach to educational reform. It needs to extend beyond the boundaries of individual school subjects and require the attention of teachers, educational administrators, planners and curriculum agencies. Integrating the objectives, concepts and learning experiences of education for a sustainable future into an educational programme, along with the orientation of teachers is an important part of such reform.

This chapter focuses mainly to address the important issues related to education for sustainable development (ESD). The addressed issues are-what are the curricular components of Education for Sustainable Development (ESD), how can it be introduced in the school curriculum, and the objectives of teaching ESD.

Objectives

This chapter facilitates you to

- Understand the different curricular approaches to Education for sustainable development.
- Understand the reason for using integrated approach to ESD in school curriculum
- Analyze the objectives laid down by important world agencies on ESD
- Analyze the broad themes proposed for ESD with a view to integrate them in the school subjects.

- Reflect upon the content that you teach and identify the scope for raising issues related to sustainable development
- Integrate the ESD concepts and skills to be developed in the subjects that you teach

2.2 What are the themes of Education for Sustainable Development?

Education for Sustainable Development should be aimed at empowering learners with the ability and desire to work towards realizing sustainable development locally and globally, which include the awareness and knowledge about the Environmental development (Cognitive); develop willingness, desirable attitude, feelings and values required (Affective); also to act with the essential competence and skills (Action- oriented), which can lead to the critical thinking, commitment, creative problem solving skills and decision making ability including participatory decision making.

You have seen in the earlier chapter, the necessity for educating the community and the younger generation towards sustainable development and the efforts made at the International level. The themes that form the content of the education for sustainable development have also been identified in the International forums that were specified in the earlier chapter. The UNESCO had studied a wide range of some of the emergent issues and identified the following as the most serious concerns:

Serious concerns according to UNESCO

- ✚ The rapid growth of the world's population and its changing distribution
- ✚ The persistence of widespread poverty
- ✚ The growing pressure placed on the natural environment
- ✚ The continuing denial of democracy and human rights and the rise of conflict and violence.
- ✚ The very notion of 'development' itself.

The themes identified by the United Nations Division for Sustainable Development are as follows:

United Nations Divisions for Sustainable Development –Themes

Agriculture, Atmosphere, Biodiversity, Biotechnology, Capacity-building, Climate Change, Consumption and Production Patterns, Demographics, Desertification and Drought, Disaster Reduction and Management, Education and Awareness, Energy, Finance, Forests, Fresh Water, Health, Human Settlements, Indicators, Industry, Information for Decision Making and Participation, Integrated Decision Making, International Law, International Cooperation for Enabling Environment, Institutional Arrangements, Land management, Major Groups, Mountains, National Sustainable Development Strategies, Oceans and Seas, Poverty, Sanitation, Science, SIDS, Sustainable tourism, Technology, Toxic Chemicals, Trade and Environment, Transport. Waste (Hazardous), Waste (Radioactive) and Waste (Solid) and water

Based on the above themes, the content on education for sustainable development is developed to be integrated with the school subjects at upper primary and secondary levels of school education which are discussed in Part B of this source book.

2.3. What are the curricular approaches to Education for Sustainable Development?

There are different approaches to implement the Education for Sustainable Development which are as follows:

- i. The Direct Approach
 - ii. The Indirect Approach
 - iii. The Incidental Approach
 - iv. The Integrated Approach
- i. **The Direct Approach** involves teaching the content of ESD directly using certain methods and techniques. This approach can be used where ESD is introduced as a separate subject among the other school subjects. The drawback of this approach is
- o It tends to become another subject among the existing school subjects which will be tested and evaluated, thus increasing curriculum load on learners.

- It requires a separate teacher to teach the subject which may not be amenable in most of the schools due to several administrative problems
 - It needs to be accommodated into the regular timetable with specified number of hours, which may unnecessarily increase the burden on teachers as well as on learners
 - If ESD is introduced as a separate subject, the treatment of it by teachers would be more of examination driven and a mechanical one. It may not serve the purpose of ESD which is centered around building awareness, attitudinal, value and skills development and other abilities like critical thinking and decision making.
- ii) **The Indirect Approach** involves using the co-curricular activities to teach the content of ESD. Unlike the direct method which is a planned programme intended to develop the necessary awareness, attitude and abilities related to sustainable development, the content of ESD are presented indirectly through the school activities. Here an activity is organised and strategies are used taking the activity as the basis for developing the awareness towards sustainable development. For example, a field trip to a polluted area can raise a few issues related to land and air pollution, the role human beings in causing pollution and the adverse effects of pollution and measures required to reduce pollution and so on. Similarly, panel discussions, Debates and seminars may be organised on the topics leading to sustainable development.
- iii) **The Incidental Approach** implies that whenever an opportunity/instance arises, the teacher can use it as an example to highlight the need for sustainable development. Since this is done when the situation takes place and since the situations of this type are incidental, it is called the Incidental approach. For example, when some children are seen wasting water, that situation may be taken as an example to point out, why we should not waste water, how to use water judiciously and so on. A variety of incidents that might occur in the school or outside the schools may be used for discussion highlighting the need to conserve environment and for sustainable development.
- ii. **The Integrated Approach** implies that the concepts of ESD may be integrated with the school subjects such as Science, and Social Science appropriately. The ESD

concepts can also be integrated in a subject like language under the Prose or the Poetry sections. Sometimes essays are given in languages for language comprehension and analysis purposes. The essays may be selected on the themes related to ESD.

2.4. Why is the Integrated Approach preferred to ESD?

Of all the above curricular approaches to ESD, the integrated approach has been favoured and recommended by the UNESCO and United Nations Divisions for Sustainable Development. No one discipline can or should claim ownership of ESD. In fact, ESD poses such broad and encompassing challenges that it requires contributions from many disciplines. The following table provides a brief outline to show, how different disciplines can be used to teach the concepts of ESD.

School subjects	Contribution to ESD
Mathematics	<ul style="list-style-type: none"> • Helps students understand extremely small numbers (e.g., parts per hundred, thousand, or million), which allows them to interpret pollution data and population data, understand concentration of pollutant in mathematical form and to predict the increase or decrease of pollution in different cities.
Language	<ul style="list-style-type: none"> • Analyze the messages of corporate advertisers and see beyond related to products that are not environmental friendly, analyze the essays and articles on sustainable development. • Reading develops the ability to distinguish between fact and opinion and helps students become critical readers of political campaign literature. • Writing and communication abilities to express their ideas on various topics related to sustainable development.
Social Studies	<ul style="list-style-type: none"> • Helps students to understand the concept of global change, to recognize that change has occurred for centuries. • Helps students to understand ethnocentrism, racism, and gender inequity as well as to recognize how these are expressed in the surrounding community and nations worldwide. • Improves the analytical and interpretative abilities of students

	regarding socio economic conditions and the factors that influence them.
Science	<ul style="list-style-type: none"> • Can bring awareness about environmental conservation, natural resources, biodiversity, global warming etc. • Improves investigatory skills, analytical and inferring abilities.

Table 2.1: Contribution of different disciplines to ESD

Each discipline also has associated pedagogical techniques. The combined pedagogical techniques and strategies of each discipline contribute to an expanded vision of how to teach for creativity, critical thinking, and a desire for life-long learning - all cognitive abilities, attitudes and values that support sustainable societies.

2.5. What are the skills, abilities and values that can be developed through ESD?

Education for Sustainable Development must go beyond developing awareness about the need for sustainable development. It must aim to develop certain practical skills that will enable the students to practically apply their knowledge to real life situations, take proper decisions related to environmental problems, resource management, and act wisely in developmental planning without harming the environment and so on.

The skills and abilities that can be developed through the education for sustainable development are:

- Ability to think critically about value issues,
- The capacity to move from awareness to knowledge to action,
- To work cooperatively with other people,
- Develop the cognitive processes like knowing, inquiring, acting, judging, imagining, connecting, valuing and choosing,
- To develop skills of planning, and decision making in time,
- To learn skills that will help in managing and interacting with the local environment and work towards conserving the resources

Every discipline, every teacher, and every administrator can contribute to sustainability education.

The Earth Charter (1992) has listed some of the values for a sustainable way of life as a common standard which are as follows:

<p>Respect and care for the community of life</p>	<p>Respect Earth and life in all its diversity, Care for the community of life with understanding, compassion, and love, Build democratic societies that are just, participatory, sustainable, and peaceable, Secure Earth's bounty and beauty for present and future generations.</p>
<p>Ecological Integrity</p>	<p>Protect and restore the integrity of Earth's ecological systems, with special concern for biological diversity and the natural processes that sustain life, Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach,</p> <ul style="list-style-type: none"> - Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well-being, Advance the study of ecological sustainability and - Promote the open exchange and wide application of the knowledge acquired.
<p>Social and Economic Justice</p>	<ul style="list-style-type: none"> - Eradicate poverty as an ethical, social, and environmental imperative, - Ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner, - Affirm gender equality and equity as prerequisites to sustainable development - ensure universal access to education, health care, and economic opportunity, - Uphold the right of all, without discrimination, to a natural and social environment supportive of human

	dignity, bodily health, and spiritual well-being, with special attention to the rights of indigenous peoples and minorities,
Promote a culture of tolerance, Democracy, Nonviolence, and Peace	<ul style="list-style-type: none"> - Strengthen democratic institutions at all levels, and - Provide transparency and accountability in governance, inclusive participation in decision making, and access to justice. Integrate into formal education and life-long learning the knowledge, values, and skills needed for a sustainable way of life, - Treat all living beings with respect and consideration

2.6. What are the challenges and barriers to ESD?

There could be many challenges and barriers in implementing ESD. One of the primary challenges would be the lack of awareness on part of the teachers. The teachers should become knowledgeable about sustainable development, and the ways of integrating into the subjects by using effective and innovative teaching methods. The Environmental awareness programme is rarely linked with the school reform programmes in many schools. In many of the ESD programmes, it is seen that the goals are not defined properly. The goals and the programmes should be planned and implemented through student participation process. There is a need for properly trained teachers, administrators, educators, curriculum developers, and evaluators. There is a need to develop a creative, innovative and risk taking climate to make changes, experiment, and to accomplish new educational and sustainability goals.

In order to successfully implement ESD, governments and school districts must plan ahead and develop strategies to address the issues and problems related to environment and sustainable development. The issues should be addressed at every level, especially at the national level, to ensure consistent implementation of ESD across the country.

2.7. What are the specific problems of teachers in implementing ESD?

- An over-loaded curriculum is a concern of many teachers. Increasingly, teachers feel that there is not enough time to cover all the additional material being put into the curriculum.
- There are often questions related to the objectives of ESD and the objectives of other subjects- whether they are different. It is felt that, if there is a difference in objectives, it is likely to increase the curriculum load.

Objectives that is common to ESD and other school subjects

Many educational objectives, especially in the areas of attitudes and skills, are common across most subjects in the school curriculum. Teaching about sustainability emphasizes

- Critical thinking
- Creative thinking,
- Problem solving,
- Decision making,
- Analysis,
- Co-operative learning,
- Leadership, and
- Communication skills.

As a result, it is a very good way of achieving educational objectives without adding to the problem of curriculum overload. Examples of across-the-curriculum objectives that can be served by education for a sustainable future include:

Attitudes and Values

- Care for community
- Respect for evidence and rational argument
- Tolerance and open-mindedness.
- Care for conserving environment and resources
- Valuing the judicious use of resources
- Respect for others' needs and wants.
- Sharing the necessary commodities and resources equally

Skills

- i) **Communication skills:** Example- Expressing views through discussions, presentations, and debates; and arguing clearly and concisely
- ii) **Investigatory skills:** Example - Collecting, classifying, analyzing, interpreting and evaluating information from a variety of sources; and organizing and planning a project.
- iii) **Numeracy skills:** Example-Tabulating, calculating and analyzing data; and interpreting data.
- iv) **Problem solving skills:** Example- Identifying causes and consequences of problems; and forming reasoned opinions and developing balanced judgments.
- v) **Personal social and leadership skills:** Example- Working co-operatively with others; Taking individual and group responsibility; taking initiative, being committed to the task undertaken; Interacting, and participating in the group activities; negotiating the ideas in the groups.

Meaningful learning in SD requires students to integrate ideas from many different perspectives rather than compartmentalize what they learn into discrete 'boxes' of knowledge. As a result, teachers need to be flexible and skilled in accessing and integrating knowledge from different sources and disciplines in facilitating the learning process related to SD.

It is possible for teachers to emphasize interdisciplinary teaching and learning in their own classes, through the topics and examples they choose .However, it is also important that teachers work in a co-coordinated and co-operative way so that students are given the opportunity to integrate knowledge across subjects and across the years of schooling. Here is a case study which shows how the teacher and the students collaboratively work together on a project investigating into traffic problem.

Traffic had been very bad outside a school for a long time. So a teacher and her class of 12-year old students carried out an investigation into the need for a pedestrian crossing to make it safer for people to cross the road. The students first decided to carry out a survey to count the numbers of vehicles travelling in both directions. They calculated the average speed of the vehicles the percentage of those exceeding the speed limit and the

percentage of drivers that would have been unable to stop within a reasonable distance. The students also counted the number of pedestrians crossing and identified peak times. The results of the traffic survey were displayed in the form of bar charts and graphs. The findings were compared with the local authority's guidelines for the provision of pedestrian crossings. The students then wrote a report on the degree of risk involved in crossing the road to reach the school and the best location for the pedestrian crossing. They included data figures and photographs and plans in their reports. The response of the local authority to date has not been encouraging. So the students are now working with the local neighbourhood association to press their case for action.

Source: Adapted from Gough, N. (1992) *Blueprints for Greening Schools*, Gould League, Melbourne, pp. 86.

For a clear understanding and an effective application of integrated approach to ESD, the subjects such as social studies and science are chosen as examples in this chapter. The following table details out the major concepts in the selected units in both the subjects. The sub concepts are also listed under each concept in order to demonstrate the plug points where the ESD concepts can be integrated.

CLASS VII
SOCIAL SCIENCE- OUR ENVIRONMENT
CHAPTER 5
WATER

Concepts	Sub concepts	ESD concepts to be integrated
Water cycle	The process by which water continually changes its form and circulates between oceans, atmosphere and land is known as the water cycle	One of the five elements- earth, fire, air, space and water.
Major sources of water	Earth is like a Terrarium, where the same water that existed centuries ago still exists today. The major sources of fresh water are the rivers, ponds, springs and glaciers.	Modern development and mismanagement of water resulted in huge shortage of water. Shortage of water leads to epidemics, hunger, despair and death.

	The ocean and the seas contain salty water which contains large amounts of dissolved salts- mostly sodium chloride or the common table salt.	
Distribution of water bodies	<p>Three-fourth of the earth surface is covered by water.</p> <p>Distribution of water is Oceans (97.3%) (Saline), Ice-caps (02.0%), Ground water (0.68%), Fresh water lakes and Inland seas (0.009%), salt lakes (0.009%), Atmosphere (0.0019%), Rivers (0.0001%)</p> <p>(Fresh water).</p>	<p>Watershed projects for conserving ground water.</p> <p>Rainwater harvesting and its importance.</p> <p>Activities to prevent run off water.</p> <p>Avoiding concretizing the land to help in easy penetration of water.</p>
Ocean circulation	<p>Ocean water keeps moving continuously and is never still.</p> <p>The movements that occur in oceans can be broadly categorized as: waves, tides and currents.</p>	<p>Oceans are rich in natural wealth</p> <p>Large natural sinks that pollution discharges</p> <p>Plays a key role in the socio economic aspects of a region/country.</p>
Waves	<p>When the water on the surface of the ocean rises and falls alternately, they are called waves.</p> <p>During a storm, the winds blowing at very high speed form huge waves, which cause tremendous destruction.</p> <p>An earthquake, a volcanic eruption or underwater landslides can shift large amounts of ocean water, which result in huge tidal wave called tsunami that may be as high as 15m.</p>	<p>Construction of dams, buildings, destruction of forests and natural land etc. as the cause of earthquake and volcanic eruptions.</p> <p>Reasons for occurrence of Tsunami. Man's influence on environment and the natural</p>

	<p>The largest tsunami ever measured was 150m high. These waves travel at a speed of more than 700 km. per hour.</p> <p>The tsunami of 2004 caused wide spread damage in the coastal areas of India. The Indira point in the Andaman and Nicobar islands got submerged after the tsunami.</p>	<p>response to these.</p> <p>Environmental pollution distribution and dispersion.</p>
Tides	<p>Cause of a Tide</p> <p>The water of the earth closer to the moon gets pulled under the influence of the moon's gravitational force and causes high tide. During the full moon and new moon days, the sun, the moon and the earth are in the same line and the tides are highest. These tides are called spring tides.</p> <p>When the moon is in its first and last quarter, the ocean waters get drawn in diagonally opposite directions by the gravitational pull of sun and earth resulting in low tides. These tides are called neap tides</p>	<p>The rise and fall of water due to tides is being used to generate electricity in some places.</p>
Ocean currents	<p>Ocean currents are streams of water flowing constantly on the ocean surface in definite directions, which may be warm or cold.</p> <p>The warm ocean currents originate near the equator and move towards the poles. The cold currents carry water from polar or higher latitudes to tropical or lower latitudes. The Labrador</p>	<p>Changes in ocean currents due to factors like tsunami which affect the marine life.</p> <p>Impact on dispersion characteristics of air as well as water pollution.</p>

	<p>Ocean current is cold current while the Gulf Stream is a warm current.</p> <p>The ocean current influences the temperature conditions of the area. Warm currents bring about warm temperature over land surface. The areas where the warm and cold currents meet provide the best fishing grounds</p>	<p>Induces change in stability condition of atmosphere.</p>
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SCIENCE CLASS VII
FIBRE TO FABRIC (CHAPTER 3)

Concepts	Sub concepts	ESD concepts to be integrated
Wool and silk fibre	<p>Wool is obtained from the fleece (hair) of sheep or Yak.</p> <p>Silk fibres come from cocoons of the silk moth.</p>	Use of wool in colder parts of the world.
Animal fibres- wool and silk	<p>Wool-</p> <p>It comes from sheep, goat, yak and some other animals.</p> <p>The wool yielding animals bear hair on their body, which trap a lot of air. Air is a poor conductor of heat. So hair keeps these animals warm.</p> <p>The hairy skin of the sheep has two types of fibres-1) the coarse beard hair 2) the fine soft under hair.</p> <p>Selective breeding is done for producing offspring of special characteristics</p>	<p>Growth of farm animals –its importance in eradicating poverty and attaining growth of economy.</p> <p>Does it lead to animal exploitation? Or interdependence between man and animals? (issue)</p> <p>Livestock production</p> <p>Selective breeding for producing disease resistant varieties, high yielding varieties etc.</p>

	<p>Angora wool is obtained from angora goats found in hilly regions as Jammu and Kashmir.</p> <p>Wool is obtained from goat hair.</p> <p>Fur (hair) on the body of camels is also used as wool.</p> <p>Llama and Alpaca found in South America also yield wool.</p>	<p>Why do human beings rear and breed sheep?</p> <p>Does it lead to development? If so, in what sense? Is it possible to move in the direction of satisfying mans economic needs, and at the same time not to exploit the animals?</p>
From fibre to wool	<p>Rearing and breeding of sheep</p> <p>Sheep are herbivores and prefer grass and leaves.</p> <p>Some of the breeds of sheep reared in our country are Lohi, Rampur bushair Nali, Bakharawal, Marwari, and Patanwadi.</p>	<p>What are the breeding and rearing methods used? Ethical issues involved.</p> <p>Ecosystem's symbiotic relationship</p> <p>Socio economic issues- improved commerce of a region.</p>
Processing fibre into wool	<p>Steps involved in processing the wool into fibre.</p>	<p>Satisfy the needs (of fibre) of human beings without destroying or harming the population of sheep.</p>
Silk	<p>Silkworms spin the silk fibres.</p> <p>The rearing of silkworms for obtaining silk is called 'Sericulture'</p>	<p>Sericulture industry and its potential in India</p>
Life history of silk moth	<p>Stages in life history of silk moth and silk rearing</p> <p>India produces plenty of silk on a commercial scale.</p>	<p>Silkworm rearing and its importance in economy of a country.</p> <p>Silk industry</p> <p>Providing employment-economy booster</p> <p>Silk export</p> <p>New technology in sericulture.</p> <p>Is it ethical to rear the silk worms for perpetuating silk industry? Is it development? In</p>

From cocoon to silk		<p>what sense? At cost of what? (issue)</p> <p>For obtaining silk, moths are reared and their cocoons are collected to get silk threads.</p> <p>Process of silk manufacture-environmental pollution.</p>
Rearing silkworms		<p>Rearing of silkworm resulting in killing of pupa inside the cocoon.</p> <p>Conservation of silkworm genetic resources.</p> <p>Development of appropriate technology for silkworm rearing and egg production.</p> <p>For sustainable development of sericulture and progressive increase in productivity.</p>
Processing silk	Steps involved	Issues related to labourers, their exploitation

CHAPTER 18

WASTEWATER MANAGEMENT

Concepts	Sub concepts	ESD concepts to be integrated
	<p>Water which is rich in lather, mixed with oil, black brown water that goes down the drains from sinks, showers, toilets, laundries which are dirty is called waste water.</p>	<p>Waste water as a resource</p> <p>Stagnant wastewater causes different contagious diseases-breeding place of diseases.</p> <p>Cause the replication of mosquitoes in stagnant water.</p>
Water, Our lifeline	<p>Clean water is not available to all.</p> <p>It has been reported that one billion of our fellow human beings have no access to safe drinking water, which cause water related diseases and deaths.</p>	<p>Chemical and microbial contamination of water.</p> <p>Create awareness among public about the steps to be taken for maintaining safe drinking water.</p>

	<p>The increasing scarcity of fresh water is due to population growth, pollution, industrial development, mismanagement and other factors.</p> <p>On March 22, 2005, the General Assembly of the UN proclaimed the period 2005-2015 as the International Decade for Action on 'Water for life'.</p> <p>The decade aims to reduce by half the number of people who do not have access to safe drinking water.</p> <p>Cleaning of water is a process of removing pollutants before it enters a water body or is reused. This process of wastewater treatment is known as 'sewage treatment'.</p>	<p>Over exploitation and pollution of water should be controlled.</p> <p>Need and importance</p> <p>In terms of quantity, quality and sustainability.</p> <p>Public health indicator.</p>
<p>What is sewage</p>	<p>Sewage is wastewater released by homes, industries, hospitals, offices and other users.</p> <p>It also includes rainwater that has run down the street during a storm or heavy rain.</p> <p>Sewage is a liquid waste, which has majority of water with dissolved and suspended impurities called contaminants.</p> <p>Sewage is a complex mixture containing suspended solids, organic and inorganic impurities, nutrients, saprotrophic and disease causing bacteria and other microbes.</p> <p>Organic impurities are human faeces, animal waste, oil, urea (urine), pesticides, herbicides, fruit and vegetable waste etc.</p> <p>Inorganic impurities are nitrates, phosphates, and metals.</p> <p>Nutrients are Phosphorus and Nitrogen.</p>	<p>Proper disposal of wastes for maintaining proper hygiene.</p> <p>Improper disposal of wastes from hospitals, industries etc. into water bodies and its impact on environment.</p> <p>Sewages also mix with rainwater and are carried to other water bodies like river and oceans.</p> <p>Avoid mixing of degradable and non-degradable wastes.</p> <p>Maintain separate bins for degradable and non-degradable wastes.</p> <p>Separate each impurity based on their degrading ability and its proper recycling should be recommended.</p> <p>Protect ones locality from stagnant water.</p> <p>Sewage disposal in highly polluted places.</p> <p>Avoid sewage disposal in areas of human settlements.</p>

	<p>Bacteria are such as which causes Cholera and Typhoid.</p> <p>Other microbes are such as which cause dysentery.</p>	
<p>Water freshens up-an eventful journey</p>	<p>In home or a public building generally one set of pipes brings clean water and another set of pipes takes away wastewater.</p> <p>A network of big and small pipes called sewers, forming the sewerage is present.</p> <p>It carries sewage from the point of being produced to the point of disposal i.e. Treatment plant.</p> <p>Manholes are located at every 50m to 60m in the sewage, at the junction of two or more sewers and at points where there is a change in direction.</p>	<p>Regular checking of sewage pits to prevent the outbreak of contagious diseases.</p> <p>Leakage in sewer network system.</p>
<p>Wastewater treatment plant (WWTP)</p>	<p>Treatment of wastewater involves physical, chemical and biological processes, which remove physical, chemical and biological matter that contaminates the wastewater.</p> <ol style="list-style-type: none"> 1. Wastewater is passed through bar screens. Large objects like rags, sticks, cans, plastic packets, napkins are removed. 2. Water then goes to a grit and sand removal tank. The speed of the incoming wastewater is decreased to allow sand, grit and pebbles to settle down. 3. Water is then allowed to settle in a large tank which is sloped towards the middle. 	<p>Role of technology in wastewater treatment.</p> <p>Convert sewage into usable forms like Biogas.</p> <p>Recovery, recycle and recure technology</p> <p>Water augmentation (particularly the GW)</p> <p>Bio sludge as an organic fertilizer</p>

	<ul style="list-style-type: none"> • Solids like faeces settle at the bottom and are removed with a scraper which is called sludge. • A skimmer removes the floatable solids like oil and grease. • Water so cleared is called clarified water. • The sludge is transferred to a separate tank where it is decomposed by anaerobic bacteria, which produce biogas. <p>4. Air is pumped into the clarified water to help aerobic bacteria to grow and it can consume human waste, food waste, soaps and other unwanted matter remaining in clarified water.</p> <p>Dried sludge is used as manure, returning organic matter and nutrients to the soil.</p> <p>The treated water has a very low level of organic material and suspended matter.</p> <ul style="list-style-type: none"> • It is discharged into a sea, a river or into the ground. • Nature cleans it up • It may be necessary to disinfect water with chemicals like chlorine and ozone before releasing it into the distribution system 	<p>Action point</p> <p>Avoid direct discharge of wastes into water bodies.</p>
<p>Become an active citizen</p>	<p>To be an enlightened citizen, one can approach the municipality or the gram panchayat and insist them to cover the open drains etc.</p>	<p>Participatory behaviour of public to be promoted for cleaning drains, proper plastic disposal etc.</p> <p>Creating awareness, educating people</p>

<p>Better house keeping practices</p>	<p>One of the ways to minimize or eliminate waste is to see what one is releasing down the drain.</p> <p>Cooking oil and fats should not be thrown down the drain as it can harden and block the pipes.</p> <p>Chemicals like paints, solvents, insecticides, motor oils, and medicines should not be thrown down the drain as it may kill microbes that help purify water.</p> <p>Used tealeaves, solid food remains, soft toys, cotton, sanitary towels etc. should be thrown in the dustbin.</p>	<p>Avoid or minimize using plastics. Substitute polythene bags with paper bags, which are eco- friendly.</p> <p>Oils and grease if thrown directly in water bodies can affect the organisms living in water, which will not get enough oxygen.</p> <p>Best management practices</p>
<p>Sanitation and disease</p>	<p>Poor sanitation and contaminated drinking water is the cause of a large number of diseases.</p> <p>A very large fraction of our people defecates in the open, on dry riverbeds, on railway tracks, near fields or directly in water.</p> <p>Untreated human excreta are a health hazard, cause water pollution and soil pollution.</p> <p>It becomes the most common route for water borne diseases like cholera, typhoid, Polio, Meningitis, Hepatitis and Dysentery.</p>	<p>Outbreak of various diseases like Malaria, Chikunguniya, Dengue fever etc due to unhygienic waste disposal and due to stagnant water.</p> <p>Public hygiene concept</p> <p>A talk on spread of dengue fever</p> <p>Proper sanitation system</p>
<p>Alternative arrangements for sewage disposal</p>	<p>To improve sanitation, low cost onsite sewage disposal systems are encouraged. Eg. Septic tanks, chemical toilets, composting pits.</p> <p>Some organizations offer hygienic onsite human waste disposal technology, which do not require scavenging.</p> <ul style="list-style-type: none"> • Excreta from the toilet seats flow through covered drains into a biogas plant. 	<p>Alternative technologies to dispose human wastes on railway tracks like;</p> <ul style="list-style-type: none"> • The latrine automatically closes ones the train comes to a halt. • Avoiding using toilets in the railway stations when train is halted.

Sanitation at public places	<p>Railway stations, bus depots, airports, hospitals are places where large amount of waste is generated.</p> <p>The government has laid down certain standards of sanitation, but unfortunately, they are not strictly enforced.</p>	<p>List of government rules regarding maintenance of sanitation</p> <p>Accumulation of waste at different public places (with illustrations of big cities supported by video clippings) and its consequences-health hazards</p> <p>Requirement of attitudinal change-good citizen</p> <p>Action points</p> <p>Waste must be disposed properly otherwise epidemics may break out.</p> <p>We should not scatter litter anywhere.</p> <p>If there is no dustbin in sight, we should carry the litter home and throw it in the dustbin</p>
		<p>Values</p> <p>We all have role in keeping our environment clean and healthy.</p> <p>One must realize ones responsibility in maintaining water sources in a healthy state.</p> <p>Adopting good sanitation practices should be our way of life.</p> <p>As an agent of change, ones individual initiative will make a great difference.</p> <p>A lot can be done if people work together which has a great power in collective action</p>

What you can do....

Identify the units in the subjects that you teach. Analyze the content and identify the plug points at which the sustainable development concepts could be integrated. Also raise issues related to the concepts that are social, economic and ethical driven. Develop suitable strategies to create conducive learning environment in which children think, analyze, observe the environment around them, reflect on their roles and decide upon their roles in sustaining future.

To deepen your understanding...

- ❖ Find out the curricular approaches followed to implement ESD in other countries.
- ❖ Analyse the objectives of ESD given in this chapter which are laid down by the world committees and organizations. Identify the content given in the themes of ESD that would help in attaining the objectives.
- ❖ Identify the content from the syllabi of upper primary/secondary level which can be used for integrating the themes of ESD proposed.
- ❖ Work out a plan for introducing the ESD integrated curriculum in your school,

Chapter Three :

Learning approaches to Education for Sustainable Development

3.1. Introduction

As we have seen in the earlier chapter, it is not only required to develop proper awareness about the issues and problems related to sustainable development, but also to develop analytical and critical thinking abilities in children related to the issues and matters on sustainable development. The learners should be equipped with skills of handling crisis and solving problems and above all, to make rational decisions. In order to equip the learners with such abilities and skills, proper learning environment need to be created. The learning approaches that include more of learners' involvement, participation, exploring and analyzing the environmental, societal and developmental issues are important. This chapter discusses some of the approaches and methods that can be used to develop awareness about sustainable development and required skills, abilities, attitudes and values in learners.

This chapter facilitates you to

- Understand different learning approaches that can be used to teach education for sustainable development
- Apply the learning approaches appropriately according to the concept and issues of sustainable development
- Organize co-curricular activities on the themes of sustainable development
- Assess the learners' awareness, skills and attitudes on sustainable development continuously.
- Organise field trips on various themes to develop insights into the problems and issues of sustainable development.
- Reflect on your planning, teaching and assessment roles as a teacher of ESD.

3.2. Learning approaches to sustainable development

The learning approaches that are selected for teaching ESD should facilitate the learners in understanding the need for conserving the environment in which we live with all its rich resources for future generations. They should be chosen based on the concepts, attitudes, and skills to be developed. The real life situations and contexts should be chosen as illustrations wherever possible to enable the learners to analyse the problems and arrive at proper solutions. The learners should be encouraged to initiate action on their own. The approaches and the activities suggested in this section are neither exhaustive nor prescriptive. You may design your own set of activities keeping in view the overall objectives of ESD for the grade/class that you are teaching.

i) Experiential learning:

We learn many things through our own experiences. It could either about natural environment or the social environment in which we live. We interact with the environment – natural and social, through observing, communicating, depending on the resources etc. we observe the events, natural phenomena, participate in several social processes. We gain experiences through our observation, interaction, communicating and so on. This experience results in learning which in turn results in development. In the process of experiencing, we also tend to reflect on our experiences. For example, you teach your students everyday with prior planning of what content to teach and how to teach and what learning aids to use etc. After you complete your teaching the class, you tend to re look into your mind about what ever you have done in the class. Sometimes, you feel very satisfied about your teaching. Sometimes, when you play the entire event of teaching in your mind, you tend to see the errors you have committed, things you ought to have done, things which you shouldn't have done etc. This process of looking back into your experience is called reflection. Reflection helps in improving one's own insights, ideas, and critical thinking. Thus we can say that, experiential learning is a process that develops knowledge, skills and attitudes based on consciously thinking about an experience. It involves direct and active personal experience combined with reflection and feedback.

Experiential learning engages students in critical thinking, problem solving and decision making in contexts that are personally relevant to them. This approach to learning also involves making opportunities for debriefing and consolidation of ideas and skills through feedback, reflection, and the application of the ideas and skills to new situations.

Experiential learning is personal and effective in nature, influencing both feelings and emotions as well as enhancing knowledge and skills.

Experiential learning is often thought of as a learning cycle with experience and reflection being the important two phases. The idea of experiential learning as a cycle was suggested by prominent educationalists such as Jean Piaget, John Dewey and David Kolb. David Kolb has provided the cycle of experiential learning which is as follows.

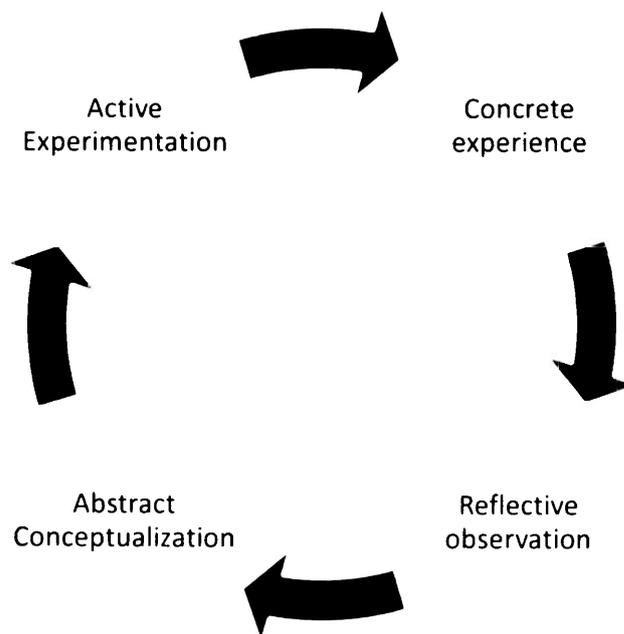


Fig.3 Kolb's Learning cycle

As you see in the above figure, the experiential learning cycle involves four phases:

Concrete Experience

Engaging in an experience in a particular situation and then observing its effects. The instructional activities that support this aspect include small group discussions, simulations, drama and role play techniques, and use of audio and videos, examples and stories. The learners go through the direct experience of the situations created or provided.

Reflective observation (Processing the experience)

This phase involves understanding what we did, thought and felt during the experience. The focus is on attempting to see how things happen, and relying on one's thoughts, feelings and judgement. The learners express their experience and reflections in personal journals and diaries. The other instructional supports include reflective essays, observation reports, thought questions and discussions.

Abstract conceptualization (Generalising)

This phase involves understanding the general principle (called a 'generalisation') of the relationship between the action and its effects. Emphasis is placed on the definition and classification of abstract ideas and concepts aiming at generalized conceptual categories. The instructional activities include constructing meanings, theories, building models and analogies.

Active experimentation (Applying)

This phase involves applying the principle or generalisation to a new situation. Here what ever is learnt or conceptualized in the earlier phase is put into practical approach in real work life contexts. The instructional activities include field work, projects, community work, demonstrations or simulations.

- How do you help students to learn in each of the four phases? What guidelines would you provide at each phase?
- Here is a topic on "waste water management". How will you use experiential learning cycle to teach this topic to students of secondary level?

ii) Case studies:

Case studies are similar to 'environmental encounters'. Real life situations are chosen and the whole class/group of students/school together with their teacher and local experts focus study/activity on a particular situation. The encounter may last for several days or weeks but the basic idea is to focus on a particular issue and explore what additional

knowledge, skills and attitudes may be involved in solving environmental problems. Methods appropriate to the study of the particular issue or case can be done by doing a survey or going on a field visits followed by an in depth analysis of the case involved in the survey or in the field.

Meaning of a case study

A case can be an event, human behaviour, an institution, or about a place-its growth over a period of time etc. It is a method where the pupils explore, investigate, study, interview, analyze, infer and draw conclusions regarding a particular problem or an issue. A variety of tools such as questionnaires, interviews, observations can be used. It can be conducted on any social, economic, environmental and developmental issues related to sustainable development.

Steps involved in a case study

Planning: The students may be helped in identifying a case related to the unit under study. For example, let us take the unit on 'Pollution'. The objectives of conducting the case study related to this may be listed. The group members who are going to be involved in this case study may be identified and the responsibilities may be allocated. The students may be given freedom to form the groups and assigning responsibilities on their own. The teacher may help and guide them if required. The tools and the procedures to be used may also be discussed as a part of planning.

Execution of the case study: According to the plan, the study may be carried out and data may be collected from the required sources and people by using the tools prepared. Sometimes one may come across certain situations or responses which were not anticipated and which were not a part of planning. The students should be guided to consider the information if it is worth and enriching the study.

Examples:

- a) A case study of a local industry: its manufacturing products, the raw materials used, the mechanisms followed to dispose the waste materials, analyze its impact if it is not a safe procedure, interview the members concerned and the management bodies concerned to know their viewpoints and to discuss the alternatives.

- b) A case study of a near by village for its population, area, water and electricity facilities, educational and health facilities, the roads that connect the highway and the other neighbouring towns and rural areas, whether the roads are muddy or constructed properly, the transport facilities, availability of markets, post office etc
- c) Interviewing an old person in the village who had lived in that place for a long time to know the kind of changes that had taken place in the village since his/her young days, whether he/she welcomes the changes that have taken place, if not, why and so on. Trying to know from the interaction, the kinds of things that were available in the past and which are not present now in the village (for example, some plants and animals); what did the village lose or gain in the name of development; or do they require developmental changes in the village, if so, what kind and so on.
- d) Interviews may also be held with the younger generation of the village, women and other important authorities like Panchayat leaders, school teachers etc to study their ideas about their village improvement and as well as to know certain other problems and issues.

The details regarding how to guide the students in conducting a case study is given below.

Example

Planning: Identify the theme on which you want the students to conduct a case study. Divide the class into four groups and brief them about the tasks that they are expected to carry out.

For example, let us take situation (2) that is, a case study of a village.

Group 1: Meet the village Panchayat leaders and collect information regarding the number of population, area, number of people who are literate and illiterate.

Group 2: Meet the old people living in the village and collect information regarding the kind of changes that have taken place and their views

Group 3: Meet the young people living in the village and collect information regarding the developmental changes that have taken place in the village and their views regarding the changes

What guidelines or how would you help students to carry out a case study on the following:

- A case study of Narmada Bachav Andolan movement.
- A case study of shifting the agricultural farms to broaden the roads.

iii) **Problem Solving:**

As you may be aware of, there are many problems and issues related to environment and sustainable development. They may be centered on the social, economic, environmental and political aspects of human living. Creating a learning context that involves an episode, or problem or an issue is the preliminary step in the problem solving approach to sustainable development. Through this approach, the learner learns to apply the solutions to newer situations, critically appraises the situations and attempts to solve the problem through developing a plan of action. This process of teaching and learning has to be combined with the objectives of Education for sustainable development. The process involves:

- Identifying and defining the problem
- Collecting, organizing and analysing the data to relate it to the issues
- Generating and evaluating alternative solutions
- Evaluating the alternatives and selecting the best solutions
- Developing a plan of action
- Implementing the plan
- Evaluating the plan

This strategy may also be combined with the case studies approach. Here is an example to show how a teacher helps the students to solve an environmental problem.

Problem /issue

As a part of the unit 'environmental pollution', the teacher draws attention of the students to the school campus. The students were asked to survey the school campus for its cleanliness. The students on their survey found that the solid waste such as plastic papers, cups and papers were thrown, near the bushes, behind the hostel buildings, staff quarters and classrooms. When the students report what they had observed, the teacher helps them in defining the problem by asking the following questions, and in solving the problem through certain measures.

Step 1 - Identifying and defining the problem

- *What did you observe on the campus? Why do you think that this (waste thrown) is a problem?*
- *What are the causes of the problem?*
- *How do you define the problem?*
- *What are the consequences of the problem for the present?*
- *What would be the consequences for the future, if things were left as they are now?*
- *What are the associated problems? What can we do to sensitize the people living on the campus?*

The teacher may facilitate the discussion with the above questions and let students clarify about their understanding of the problem and the course of action they may take to solve the problem.

Step 2 - Collecting, organizing and analysing the data to relate it to the issues

The data is collected through observation of waste disposal on the campus. The data is also collected through a questionnaire that may be given to the residents of the campus, teachers, administrators and other class students. The questionnaire may include questions like,

- *What are the waste items usually thrown away in homes, hostels and different units on the campus?*
- *What is the quantity of each category thrown as waste?*
- *Can the solid waste be easily sorted out?*
- *How can we sort out the solid waste?*
- *What are the methods that can be used to dispose solid waste?*
- *What are the problems caused due to solid waste?*
- *What can be done with the vegetable waste?*

Step 3 - Generating and evaluating alternative solutions

Analyzing the solutions through discussions

Summarizing the responses

Step 4 - Developing an action plan: Providing bins in front of residential quarters, hostels and other places; providing separate polythene bags for vegetable waste which is collected once in three days by the campus cleaning committee; work out the expenditure

involved in purchasing the bins; form a purchase committee to buy the things required; form a maintenance committee to supervise and monitor cleanliness of the campus

Step 4 - Implementing the action plan:

Step 5 - Evaluating the action plan:

Periodic supervision to see how effectively the plan is working; students go around the campus and observe if the litter is put in the bins provided and the waste is disposed by the campus cleaning committee.

Some Examples

- Arranging visits to a few establishments in the locality like motor repair workshops, kilns, pottery making units, fish and vegetable markets, restaurants and dyeing units and helping learners to find out the types of waste and methods prevalent for its disposal; organising discussions on the information collected to suggest measures for improving the environmental conditions
- Discussing the possibility of finding economical and environment friendly alternatives to deal with the scarcity of resources like fuels in the locality
- Helping learners list different types of industries in the states and collect information about the types of raw materials used, modes of their procurement and disposal of wastes generated; organizing discussions to classify these industries as polluting or environment friendly and suggesting possible ways of reducing pollution caused by these units.

iv) Story telling:

As teachers, you must have experienced how the students love to hear to a story. Story telling is interesting and capable of holding student attention while they learn important concepts, attitudes and skills. Storytelling is currently experiencing a considerable revival of interest. This has led many educators to think about ways in which storytelling can be used to explore important issues and themes. There are many folktales in India about the relationship between the Earth and its human inhabitants since earliest times. For instance, pancha tantras and some of the upanishadic stories and jataka tales are centred on environment. Not only do such

stories offer a source of inspiration, they also contain a potential for understanding many ways in which our ancestors had valued the environment and our earth. Stories provide us with practical insight into approaches to our most persistent environmental difficulties. There are many reasons why stories can be used to develop positive attitudes and values towards sustainable development and environment. Some of the reasons are as follows:

- Stories safeguard and codify information as well as beliefs, and rules for living.
- Stories evoke powerful emotional responses. These emotions help us to clarify the way we feel and can fuel the desire for change.
- Stories always generate communication. Not only does listening to story create a warm bond between us, once the story is finished we often automatically turn to each other to talk and to share our responses. Likewise, a good story invariably evokes the longing to retell it to others.
- Stories can help us work through traumatic and stressful experiences so we might regain feelings of mastery and develop new insights.
- Stories often reflect the viewpoints of indigenous people and so can bring their lessons on sustainability to others.

Read the book *Earth tales: Storytelling in Times of Change*, Alida Gersie (1992) Green Print, London. The book focuses on the stories about the earth, how it was created and the problems that can arise when we forget the importance of living in harmony with it and each other

Identify the stories from Indian mythology, folklore, Panchatantras, jataka tales which highlights the importance of environment and its conservation, and sustainability. Use them effectively and let the students to analyse, conclude and draw inferences. Let them reflect on the message hidden in the story. Inquire about their relevance and applicability to their lives.

vii) Field Trips:

These are undertaken for an extremely wide variety of purposes and may range from a walk to a local field, pond, or a visit to an area lasting for more than a day. The field trips need to be planned and organized effectively with well set objectives or goals. Some of the things that need to be kept in mind while using field trips as an approach to make students aware of sustainable development are as follows;

- i. Plan the goals or objectives of going on a field trip in advance, and let the students know about it.
- ii. A preliminary meeting may be conducted with the students in order to plan what to observe, and study on the field; to prepare interview schedules, questionnaires, if necessary.
- iii. Necessary instructions to the students may be given regarding the place, work to be carried out, meeting the concerned people, recording procedures etc.
- iv. Follow up work after the field work is essential. For example, the things that have been observed, the data gathered, questions or issues emerged, possible solutions to the problems observed.
- v. Obtaining prior permission from the people concerned authorities in charge of the place to be visited etc.
- vi. Questions and discussions to be planned for sensitizing the students towards the issues and problems. Field trips may be planned on some of the following:

Study of eco system, soil and vegetation, lake, streams and estuaries, sea shores, watersheds, patterns of land use etc. Visit to the industries and factories to see how the waste is disposed, and its effects and so on. Field visit to the near by farm and meeting the farmers to interview them on agriculture production, the kinds of crops grown, marketing procedures and so on.

- From the list of topics given for sustainable development, identify those for which field trips can be used as one of the approaches
- Formulate objectives for the topic chosen by you for a field trip. How would

you plan and organize a field trip for the topic chosen? What instructions or guidelines would you provide for the students in preparation to go on a field trip?

viii) **Group methods:**

This approach includes conventional classroom teaching methods together with question - answer and discussions in which the entire class participates. Large classes can be divided into smaller groups to enable better interaction among the participants and to help the teacher provide more attention to the group that needs more. Certain issues or problems for discussion can be given to the students. For example,

- i. How hygienic our city is? What could be done to reduce the traffic jam in the city?
- ii. How to reduce the usage of polythene bags? How to dispose the used polythene products?
- iii. Why do people burn dry twigs and grass during winter and summer? Does it have any benefits or cause pollution to the surroundings?

Activities can be done in the groups. Some of the examples are as follows:

- i) *Laboratory work* - example: analysis and study of specimens, experiments to illustrate pollutants.
- ii) *Students demonstrations* - example: to illustrate water quality, air pollution
- iii) *Discussion groups* - example: to examine a social environmental issue such as radio-active wastes
- iv) *Tutorial groups* - example. to elaborate and discuss further on a particular issue such as land reclamation schemes where additional information is required
- v) *Peer tutoring* - where students help each other to understand a problem

xi) Enquiry learning

Enquiry learning is another learner-centred approach that emphasises higher order thinking skills. It may take several forms, including analysis, problem solving, discovery and creative activities, both in the classroom and the community. In learning sustainable development, the students undergo most of these cognitive processes in order to arrive at conclusions on their own. There are many different approaches to enquiry learning, depending upon the subject area or topic, the background skills of students and the learning objectives of the teacher. One of the enquiry methods is described here with an example.

Mapping Pollution of a coastal area:

This activity is a sample enquiry learning exercise that illustrates the four phases in the enquiry learning process. The topic of the exercise is 'Mapping Pollution of Kovalam (coastal area) in Kerala'. The exercise is presented in two steps.

First, the students may be asked to analyze data on a map, and then to answer questions in their ESD journal on what they found out. The first of these steps corresponds to the first two principles of enquiry learning:

- Learning originates in a challenge/problem and
- Learning involves active investigation.

The exercise is based upon a map of a particular region where a number of important issues are facing local people. The students may be asked to analyze the issues facing people in the region near the coastal area. The second step in this exercise involves the other two principles of enquiry learning. These involve:

- Analysing and synthesising data from the map exercise to make generalisations;
- Interpreting the data by answering the questions such as, how many different kinds of pollution are entering the sea? Which events might have the most effect on (i) the catchment, and (ii) the coast and the sea? Which upstream events affect downstream and coastal environments?

The students may be asked to make generalizations by using their answers to previous questions, and write three general conclusions – or generalizations – based on what they have found out. The students may be asked to reflect on what they have learnt.

x) Community Problem Solving:

This approach provides students with an opportunity to practice the skills that are needed to participate in finding solutions to the local issues that concern them. This helps to develop the important citizenship objectives of learning for a sustainable future. It also helps in value clarification and value analysis with the possible solutions, so that the students can take action to help achieve a sustainable future. A nearby community may be visited, the problems that are related to environment and sustainable development may be identified. This may be done through observation as well as through interviewing the community members. For example, there could be problems like,

- A clean and safe environment
- Problems of getting safe drinking water
- Problems of Electricity supply to all houses
- Problems of affordable health care for everyone
- Non-availability of good school for all children in the community

This approach might begin with a question.

“List five issues or problems you are concerned about in your community”. The students may be asked to explore and identify the problems of the community in which they live in.

There are eight major steps for guiding students through the process of Community Problem Solving:

- Exploring community concerns
- Selecting problems
- Investigating
- Planning actions
- Taking action
- Assessing and developing student skills
- Developing visions of a sustainable future

- Evaluating actions and changes

The first five steps are almost similar to the problem solving approach which has already been discussed in this chapter. As teachers, how do we assess and evaluate the student's skills and abilities in the process of gathering data, moving with the community members, decision making, and implementing actions and so on. Here is a list of skills involved in community problem solving approach which is categorised under four types

Group process skills	Information gathering skills	Analysis and decision making skills	Action and evaluation skills
Taking different roles in a group and becoming a group leader when appropriate Listening to and comprehending ideas Expressing ideas clearly Considering and respecting others Providing constructive feedback to others Exploring group decision-making processes Monitoring 'on-task' behaviour of the group Monitoring the time allocated for tasks	Using the library, including print and electronic resources Designing data gathering strategies for the problem being investigated Using scientific and social science techniques (e.g. water quality testing, social survey) for investigation Identifying relevant agencies, organisations and members of the community Requesting information from sources by writing letters, making telephone inquiries, or using email	Analysing data gathered using scientific and social science techniques Thinking critically and creatively about possible alternatives Considering the values of other people and their own Deciding on a course of action Justifying decisions	Deciding on steps in an action plan Freely choosing to take actions Evaluating whether the changes that were the result of the actions, addressed the problem

Source: Adapted from Bull, J. *et al.* (1988) *Education in Action: A Community Problem Solving Program for Schools*, Thomson-Shore, Dexter, Michigan, pp. 267-269.

xi) Buzz Session:

This approach can be effective when a controversial issue or a problem of current concern arises where students get excited and want to participate. The class could break up into very small groups of 3 or 4 students; have a short 5 minute discussion and then report back to the whole class. Topics that could lend to some controversy such as,

- Should we preserve our forests when there is a shortage of agricultural land;
- is it essential for the a city's image to have a skyline of glass and concrete skyscrapers;
- Is genetic engineering essential?

xii) Simulated games:

A rather informal activity in the classroom in which the players take on roles simulating the real world for example: should a particular island be mined for its mineral or should it be retained for its natural beauty, tourist and recreational potential. Here the actors make decisions according to their assessment of the situation in which they find themselves. They can experience the consequences of their decisions and could have an opportunity to reflect upon the relationship of their role with that of the others and the resulting consequences. The simulated games can be problem-based. It involves multidisciplinary approaches and knowledge and a great deal of information would be required to help one understand the situation. This technique is dynamic and demands a great deal of flexibility in thinking and reacting to other suggestions.

xiii) Role-play:

For a particular situation, hypothetical or real, the participant is expected to assume a new identity and react to the details of the situation. Based on some basic information, the participant acts and reacts according to his role and in the process gains better sights into the situation and human relations. In fact this approach could help to humanize the whole learning and behaviour change process which is an essential component of environmental and sustainable education. Some examples of role play for ESD are:

- A meeting of various representatives on the issue of building a cable-car for Mount Kinabalu;
- A meeting for a land reclamation scheme where a stretch of mangrove forest is to be destroyed;
- Construction of a shopping mall in the city, by cutting trees and removing pavement vendors.

In a role play situation the problem has to be suitable to the maturity and level of understanding of the participants.

Besides the above, there are many other methods that can be used. The activities suggested below are neither exhaustive nor prescriptive. You may design your own set of activities keeping in view the overall objectives of teaching and learning of ESD. Some of them are as follows:

- Organizing discussions and debates on issues of environment like pollution of air, water and soil, depletion of resources, disposal of plastics, and urbanization.
- Guiding learners to collect data from owners/drivers of the private/commercial vehicles through interview-cum-discussion method and to prepare reports. The information may be sought about the maintenance of vehicles, frequency of checking the pollution level, frequency of checking air pressure, - types of horn fitted in the vehicle and frequency of their use and driving speed etc.
- Guiding learners to collect data from different households through interview-cum-discussion method and to discuss and suggest ways and means for saving electricity and fuels. The information may be collected on:
 - types and quantity of fuel used per month in the kitchen
 - amount of electricity used per month or the fuel used for generator or any
 - other sources used for lighting
 - amount of fuel used per month in car, motor cycle, scooter, tractor
 - measures/steps taken for saving fuel and electricity
 - Helping learners find out sources of pollution of water bodies in the locality and to determine the quality of water.

- Guiding learners to make plans for beautification of school campus or a park in the locality, identify suitable plants and trees, undertake plantation and look after them. (This may be introduced as a class/group activity as a part of *van mahotsva* or eco-club programme.)
- Organizing visits to water treatment plants, sewage treatment plants or garbage dumping or vermi composting sites in the locality and helping learners study their working.
- Guiding learners to collect information about global environmental issues and problems and communicate their findings through appropriate modes (like posters, charts, collages, cartoons, handouts, letters, street plays, rallies, campaigns) to all concerned.
- Organizing eco-clubs and activities like debates, quizzes, exhibitions, essay competitions on the themes related to environmental concerns and problems and guiding the learners to synthesize information gathered from books, journals, magazines and internet.
- Panel discussion by experts on important topics or issues related to SD
- Inviting environmentalists, health specialists or experts from different disciplines who can deliver talks on sustainability and environment and health.
- Conducting exhibitions on certain topics like environmental conservation, saving energy and so on.
- Investigatory projects- Assigning projects which are experimental in nature. For example, finding the percentage of salinity in different sources of water, and coming to conclusion about the source of safe drinking water.
- Construction projects- Projects can be given where the students can construct things, like, models. (Rain water harvesting, evolution of man, agricultural models for development, waste water management, recycle of solid waste, making compost pits etc).

Some examples of learning situations where a variety of methods can be employed to enhance teaching and learning in education for sustainable development are given as follows:

1. Learning situations: Use and conservation of natural resources

- i. Simulation games
- ii. Discussion of concepts and practical application
- iii. Outdoor activity/field trip
- iv. Diagram cycles in the environment; examples of food chain/ food web

- v. Invite resource person
- vi. Survey on how waste is disposed
- vii. Relate experiences on use of pesticides in agriculture

2. Learning situation: Environmental Pollution and Control

- i. Class room discussion
- ii. Simulation games and role playing
- iii. Case studies on activities of man in the community
- iv. Field work and study tour
- v. Community programmes to minimize local community problems in the environment
- vi. Enquiry method

3. Learning situation: Environmental pollution - air pollution, water pollution, soil pollution

- i. Students report their experiences and information about air pollution, water pollution and soil pollution
- ii. Examine the degree of air pollution in their neighbouring environment
- iii. Examine the degree of pollution in the sewerage and stream water
- iv. Investigatory approach- collections of water from different sources and examine them in the lab for identifying pollutants by using certain lab tests.
- v. Examine the process of transfer and accumulation of pollutants in the food web

Resources to be used

- Newspapers
- Magazines
- Internet
- Medical practitioners from the community
- Industrialists
- Environmentalists
- Films, charts, and models
- Social workers
- Economists and sociologists
- Resource person from rural development departments.
- Personnel from forest department and agriculture

Teaching-learning needs to be so designed that it facilitates enhancement and concretisation of understanding, refinement of habits, attitudes, values and skills. Besides, linkages between theory and practice need to be strengthened. This would ensure learners' proactive role in addressing environment related problems. The role of a teacher in education for sustainable development is given in the box below.

Role of a Teacher in Education for Sustainable Development

- Providing opportunities for the application of the knowledge gained and the understanding acquired
- Providing opportunities through simple projects for identifying environmental problems which catch their attention.
- Encouraging independent handling of projects and activities
- Providing opportunities for critically analyzing the data and information collected on environmental issues
- Encouraging nature study using the case study approach
- Involving learners in surveys pertaining to environment related problems/phenomena
- Involving learners in community based environment improvement programmes
- Arranging excursions and visits and preparing reports
- Organizing brainstorming sessions to identify areas of action
- Encouraging self-learning through hands-on experiences
- Utilizing group activities for nurturing leadership qualities

3.3. Evaluation

Evaluation of ESD which is integrated into the school curriculum should be more subjected to the formative assessment which is continuous process. The concepts attained through various learning situations and strategies such as projects, activities and so on should be assessed continuously by using rubrics and portfolios. The main purpose of education for sustainable development is to develop awareness, positive attitude, values and skills. The assessment should be centered around these components, rather than a mechanical and ritualistic information oriented tests and exams. Multiple criteria should be adopted for assessing learners' development on above mentioned aspects. Evaluation of conative and

affective aspects of learners could be assessed by using reflective exercises, self and peer assessment. The teachers' assessment can be done through observation of students' participation in individual and group activities, field interactions, projects, co-scholastic activities on ESD, and their involvement in community based projects. A list of assessment techniques and tools that can be used are as follows:

- Short written tests and exercises
- Work sheets
- Rating scales using rubrics
- Anecdotal records
- Self assessment exercises
- Peer assessment
- Observation
- Assessment of seminars, panel discussions projects, field interactions and observations
- Assessment of Group activities and discussions
- Assessment of assignments
- Assessment of models, exhibits and other artifacts
- Maintenance of portfolios on ESD for each student
- Assessment of co-curricular activities-debates, essay and drawing competitions
- Assessment of students' attitudes and values towards sustainable development

What you can do and reflect....

- What learning approaches would you use for topics like “ Air pollution, climate change, conserving natural resources and interrelationship between man and environment”
- What guidelines would you provide to use experiential learning approach to teach any one of the topics mentioned above?
- Find out the audio visual materials that are available to teach the topics on ‘environment’
- How do you visualize your role as a teacher of sustainable development? In your opinion, what are the competencies, attitudes and behavioural aspects that are required of a teacher who teaches ESD?

PART B

As stated earlier, the Part B of this source book consists of the themes of sustainable development that can be integrated with the school curriculum. You might question, why to integrate the concepts of sustainable development, when the text books already consists of topics on environment, pollution and so on. It is not sufficient, if we just expose them to information on environment and pollution. The learners tend to learn the content as a ritual just as they learn the content of other subjects, without developing an awareness and required attitudes. What is needed is to develop critical thinking in learners by raising the issues and problems related to above. The learners should own the responsibility for sustainable future by effective participation in environmental issues. If this is to be achieved, the kind of content to be known, and the modes and approaches involved in the process of knowing would be very different. Therefore, there is a need to understand about the content of sustainable development, so that they can be appropriately applied during curriculum transaction.

Based on the themes proposed by the United nations divisions for sustainable development, the following content had been arrived at which can be taught at upper primary and secondary levels of school education by integrating them with science and social science curriculum.

Content - Education for Sustainable Development

- Population and sustainability
- Human rights, Gender equality and sustainable development
- Poverty alleviation and Sustainable Development
- Sustainable Human settlement and Urbanization
- Intercultural understanding, Peace, and Human security for Sustainable Development
- Bio-diversity and its conservation for sustainable livelihood
- Agriculture- Sustainable food for all
- Energy alternatives for Sustainable Development
- Climate change, Global warming and Air Pollution
- Sustainability of water

The above content is presented in the module form, with the objectives and the issues to be focused. Additional information and illustrations are provided to

strengthen your teaching of sustainable development. Different types of activities have been suggested to engage learners in the process of developing higher order thinking such as, applying knowledge in real life situations, critical thinking, problem solving and analysis. At several points, you have been directed to draw students' attention to real facts and happenings in the surroundings that reflect the need for sustainable development. In addition to the information and the activities provided, you may also extend your search on several themes by visiting the web sites that are listed.

Module One : Population and Sustainability

Introduction

The rapid growth of human population and its changing distribution is the most serious concern of the century. The sustainability of population is the greatest challenge today. Sustainable population is the one which would allow most of the people to live in reasonable comfort and freedom without impairing the ability of the planet to sustain future generations.

This module attempts to help you to focus on the issues related to population and sustainability. The theme provides a scope for understanding Population and its characteristics, Population growth-causes, consequences on quality of life and environmental resources, learning from nature for a sustainable living.

Focus points

Population size and density, population growth, relation between population density and sustainable development, sustainable living.

Objectives

This module facilitates you to

- Integrate the concepts of population and sustainable development in subjects like social science, science and mathematics.
- Develop decision making ability in learners in choosing individual lifestyle for sustainable living.
- Provide situations which help the learners to reason out the causes for population growth.
- Raise issues related to the present situations of population and its consequences on natural resources and development
- Create various activities in which learners are engaged to explore and examine the issues related to population and sustainable development critically.
- Organize co-curricular activities to develop positive attitudes and values towards quality of standard living and sustainable development

Issues to be focused

- What are the causes and consequences of population growth?
- How does the population growth affect the quality of life?
- What do humans learn from nature regarding sustainable living?
- What is the relationship between population and sustainability?

Content & Processes

Population growth has been a serious concern for ages in most of the developing and underdeveloped countries. As the population grows in a region, its needs and wants related to basic needs are also on an increase. The increase in needs and wants places a great demand on the utilization of natural resources which would be unable to cater to the population needs after a period of time. In order to make students to realize that population is one of the major indicators for sustainable development, there is a need to expose them to some of the important characteristics of population and population size across the countries. The following section gives glimpses on some of the important facts and figures.

Characteristics of population

Population has the characteristics- size and density (expand on the meaning of size and density with illustrations). The number of individuals in a population forms its size. The human population of the world was estimated to be 6,812,000,000 as of 1st April 2010 (by United States Census Bureau).

- ❖ Use the following tables to explain the concepts of population size and density.

Table: 1. List of some countries by population

Country	Population (millions)	% of world population	Decadal change (%)
China	1341	19.4%	5.43
India	1210	17.5%	17.64
United States	308	4.5%	7.26
Russia	140	2.0%	-4.29
Japan	128	1.9%	1.1
Bangladesh	164	2.4%	16.76

Nigeria	158	2.3%	26.84
Indonesia	237	3.4%	15.05
Brazil	190	2.8%	9.39
Pakistan	184	2.7%	24.79

China ranks first in size of human population and India is the second largest populated country. World population revealed 2.6 billion in 1950. Today it is 6.9 billion. World population is projected to reach 9.5 billion by the year 2050. The current population itself is 2-3 times the sustainable level as opined by experts.

Density of population is defined as the number of individuals per unit area. Density of population of India is 381 persons per square kilometre. Among the different states in India, West Bengal, Bihar and Kerala have very high density of population. Apart from geographical factors, social, economic and cultural factors influence the distribution of population. The issue to be focussed is the major characteristics of population.

In India, the high density of population in some of the states such as Bihar, Uttar Pradesh, West Bengal, Kerala are of serious concern to the development in these regions. India's total population as on 2011 is 1,21,01,93,422.

Table: 2. Population of some states of India- census 2001

State	Area km ²	Literacy rate	Population		Density	
			2001	2011	2001	2011
Andhra Pradesh	275,045	67.66	76,210,107	84,665,533	277	308
Bihar	94,163	63.82	82,998,509	103,804,637	881	1102
Jammu & Kashmir	222,236	68.74	10,143,700	12,548,926	100	124
Karnataka	191,791	75.60	52,850,562	61,130,704	276	319
Maharashtra	37,713	82.91	96,878,627	112,372,972	315	364
Orissa	155,707	73.45	36,804,660	41,947,358	236	269
Punjab	50,362	76.68	24,358,996	27,704,236	484	550
Rajasthan	342,239	67.06	56,507,188	68,621,012	165	201
Tamil Nadu	130,058	80.33	62,405,679	72,138,958	480	555

Uttar Pradesh	240,928	69.72	166,197,921	199,581,477	690	828
Kerala	38,863	93.91	31,841,374	33,387,677	819	859
West Bengal	88,752	77.08	80,176,197	91,347,736	903	1029
Madhya Pradesh	308,245	70.63	60,348,023	72,597,565	196	236

Table: 3. World Population estimates

UN (Medium variant 2008 rev) and US census Bureau (January 2010) estimates

Year	UN estimate (millions)	Difference	US estimate (millions)	Difference
2000	6115	-	6084	-
2010	6909	794	6831	747
2020	7675	766	7558	727
2030	8309	634	8202	644
2040	8801	492	8749	547
2050	9150	349	9202	453

Table: 4. Population density of some countries

Country	Population	Density (Pop/ km ²)
India	1,198,003,000	352.9
Bangladesh	157,813,124	1069.0
Japan	127,170,110	336.5
Philippines	93,843,460	312.8
South Korea	49,354,980	493.4

After a brief introduction on population and its characteristics with the above illustrated tables divide the class into groups to perform the following tasks.

- a. To collect the population data of all the countries in the world (both earlier and present data) and construct graphs. Let them compare the population size of various countries and draw inferences about their developmental status.

You may raise the following questions to focus on the issue.

- What is the size of the world population today? Is it the same or has it changed? If so how much?

- What would be the population by 2050?
- Which two countries have very high population? Can you guess why? What is their percentage in world population?
- Predict what may happen if the world population were to increase beyond the carrying capacity of the earth?

Have group presentations followed by group discussion.

- b. Introduce the term density. You may perform the following activity to make the concept of density.

Activity: Display 2 sheets of paper A and B of same surface area (of about 1sq ft each). They represent two location on earth A and B. Let some students measure the surface area of sheet A and also B. Let about 15 beads/ seeds be placed on sheet A and similarly 50 beads / seeds on sheet B. Beads/ seeds to represent humans. Pose the question- *In which one the density of population is high?*

Repeat the activity by changing the surface area of sheet B (say 2ft) and pose the same question. Let the students find the density and extend the understanding of it to the density of population.

- c. Provide a situation as given here.

“A house has 3 rooms and a family of 4 members are comfortably living in the house. Suppose another family of 4 members join them to live in the house, the space need to be shared. The house gets over crowded or congested. Allow the students to imagine such a situation and let them discuss the advantages and disadvantages of having to live with more people sharing the house and resources”.

Pose the question ‘*if you are head of the original family living in the house and to take a decision, what decision would you take*’, and why?

- d. Make use of the tables given in this module and present them in the form of charts to the class. Ask students to observe the data given in the tables and compare the population density of different states. Ask the questions such as; *why some states have high population density? Is there any relationship between population density and the literacy rate of a particular state?*

Let the students observe the tables and come to a conclusion which may be discussed.

- e. Allow them to gather more information on the geographical, social, economical and cultural factors which were responsible for the high density of population with illustrations in those states. Let the groups make their presentations.
- f. Provide situations/ contexts such as the following with the question followed.
 - *Some multinational companies are allowed to set up industries in Bangalore. What would happen to the density of population of the region/ state?*
 - *What associated challenges have to be addressed by the government to meet the requirements of the population? List the major ones.*
 - *Is overcrowding a challenge to sustainability?*

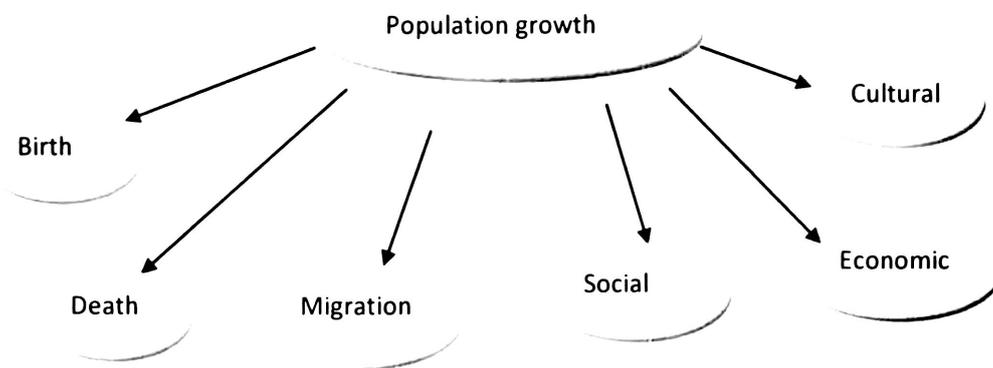


Fig. 4 Factors affecting population growth

Human population increases because of the births and immigration and decreases through deaths and emigration. Currently the human birth rate is three times the death rate.

Birth rate- It is the number of live births for 1000 people in a population in a given year.

Death rate: It is the number of deaths per 1000 people in a population in a given year.

$$\text{Annual rate of population change (\%)} = \frac{\text{Birth rate} - \text{Death rate}}{1000 \text{ Persons}} \times 100$$

In under developed and developing countries, especially in rural areas, birth rate is high due to socio economic and cultural factors. Children are often needed for performing essential tasks and preference is made for male children so that they become the earning members and support the parents in the old age.

In developed countries, the birth rate tends to be lower, especially in urban areas due to the cost of raising and educating children. The educational and employment opportunities are equally available for women.

Human population has also increased due to decline in death rate especially in developing countries due to raise in the standard of living, advanced medical facilities and having better access to basic needs.

- g. When birth rate exceeds death rate population growth occurs. This could be illustrated with the following activity.

Place a transparent glass container (1litre capacity) on the table. This may represent the earth. Provide 3 litres of puffed rice to represent human population. Provide a small cup and a large cup (thrice the size of small cup) to scoop the puffed rice – one cup adding it into the container and the other cup to remove the rice from the container. The activity to be performed by two students. Every time (year) one adds and the other removes the puffed rice from the transparent container on the table.

Let the students observe the activity and answer.

Does the puffed rice gradually increase or decrease in occupying space in the container? If the container were to be the earth and the puffed rice to be the human population what does this change you observe indicate. Explain.

Students may be allowed to repeat the activity with variations and explain their observations with reference to human population and its change

■ Growth rate of population (GRP) indicates the rate at which is population is growing. In estimating GRP, the increase in population is compared with the base population. It can be measured annually or over a decade. Rate of increase of 2 % per annum means that in a given year, there is an increase of 2 persons for every 100 persons in the base population.

■ Indian population increased from 361 million in 1951 to 1210 million in 2011.

- Age composition is an important factor in a given population of a country and it is an important indicator to the development. Age composition refers to the number of people in different age groups in a country. A person's age influences what he needs, buys, does and his capacity to perform. The number of percentage of a population

found within the children. working age and aged groups are notable determinants of the population's social and economic structure.

- Children (below 15 yrs): economically unproductive and need to be provided with food, clothing, education and medical care.
- Working age (15-59 yrs): economically productive and biologically reproductive; they comprise the working population.
- Aged (above 59yrs): can be economically productive though they may have retired. May be working voluntarily, but they are not available for employment through recruitment

India's age composition

- Adults : 58.7%
- Aged: 6.9%
- Children: 34.4%

Dependency ratio

■ The total dependency ratio is worked out by dividing the number of people of age 15-59 into the number of dependent people and multiplying the resulting quotient by 100.

■ DR= $\frac{\text{No. of persons who are active}}{\text{No of persons who are dependent}} \times 100$

No of persons who are dependent

Sex ratio in India

- h. Provide the following information to the students and raise the question "How does the sex ratio of males and females affect the development in a country? Does it have any implication to sustainable development? Let them discuss in their groups and arrive at an answer.

Sex ratio

- Kerala: 1058 females per 1000 males
- Pondicherry: 1001 females per 1000 males
- Delhi: 821 females per 1000 males
- Haryana: 861 females per 1000 males

i. It is also found that the Literacy rate in the country as per the census of 2011 is 74%, of which the literacy rate of males is 82% and females is 65%. *Does this have an implication to increase in the population of our country which in turn affects the sustainable living?* Brains storm this issue among the students.

The important point to be stressed while relating the population and the sustainable development is, the percentage of population that is economically active is an important index of development. The distribution of the population according to different types of occupation is referred to as occupational structure. The classification of occupations in India is as follows:

- 64% of population is engaged in agriculture
- Secondary sector (population engaged in different professions and working in companies and industries) :13%
- Tertiary sector(population of laborers): 20%

The occupational shift is observed recently from agriculture to the other sectors, because of growing industrialization and urbanization.

Health is an important component of population that affects process of development. The following factors are some of the causes for decline in the death rate.

- Death rates declined from 25 per 1000 population in 1951 to 8.1 per 1000 in 2001.
- Life expectancy at birth has increased from 36.7 years in 1951 to 64.6 years in 2001.

- j. With the above data as a background, let the students find out the death rate and life expectancy rates in 2011.

Factors responsible for the decline in the death rate:

2. Improvement in public health
3. Prevention of infectious diseases
4. Application of modern medical practices in diagnosis and treatment of ailments.

Nutrition and sanitation have been the major concern in our country since ages. It is observed that per capita calorie consumption is much below the recommended levels. Malnutrition is still prevalent in most parts of the country. Safe drinking water and basic sanitation amenities are available to only one third of rural population.

- a. *In developed countries the death rate is slowed down. How it has been made possible?* Let the students to react to the issue after gathering information on developed countries.

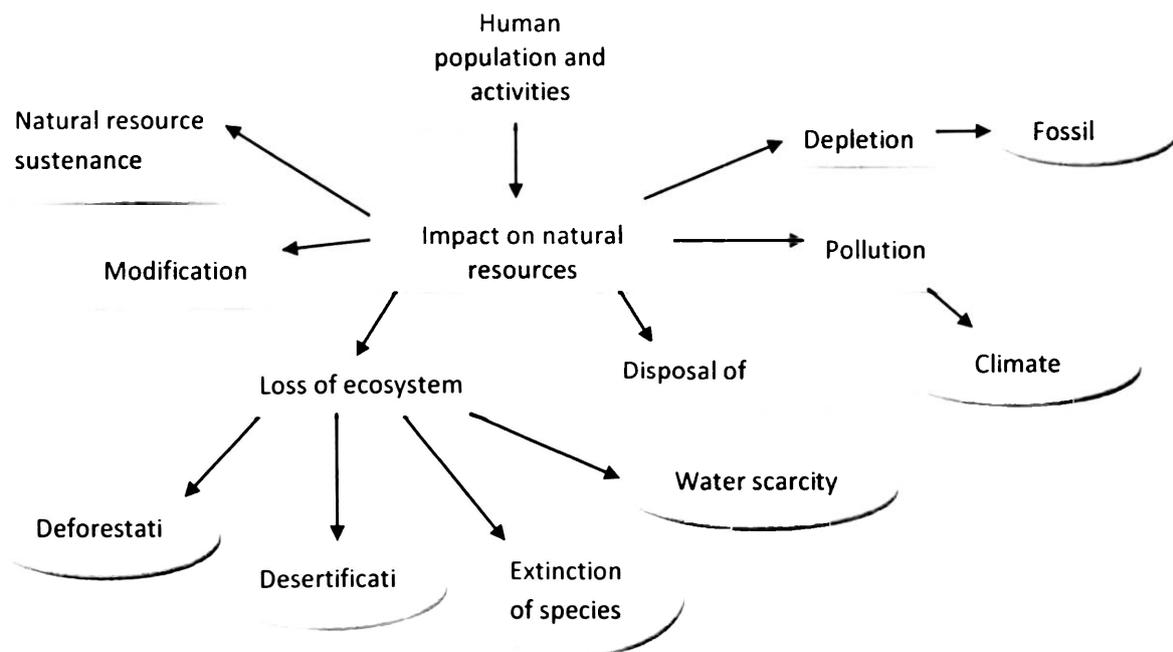


Fig. 5 Human activities- impact on natural resources

The issue to be focussed is the human population –its relation with natural resources and development.

- b. Initiate discussion using newspaper item on climate change/ pollution /water scarcity etc with an issue “*Are we depleting natural resources?*” Let the students discuss and list the impact of human population and its activity on natural resources.
- c. Let the students prepare project reports (using news items/internet/library resources) on the impact of overpopulation on natural resources. Let them present them in the class.
- d. Lastly, let the students list down a few measures they would like to take as individuals to help natural resources to be sustainable/ to treat natural resources in a responsible way for the benefit of future generations.
- e. Let each student list ten items purchased which were needed, and kept in the house and list another 10 items which were purchased just because he/ she wanted them and are needed to be used in the future. Let the groups compare the lists prepared by the members of the group. Discuss and find the sources of items. Let the groups critically think on “*Are the actions of student population leading to overuse/ exploitation of resources*”.

Population growth- causes, consequences and quality of life

The population change/ growth are effected by factors like birth, death and migration. Apart from these- social and economic factors, religious beliefs, tradition and cultural norms also play a role. Population growth brings about a change in the standard of living. In Indian context, poverty alleviation has become a great challenge due to growing population. Food, water, clothing, shelter, health care, sanitation, fuel, electricity, transport, communication are essential for living. Their deprivation affects the quality of life as a consequence of increase in population.

- f. In groups let the students list down the basic requirements for a comfortable living and make charts as given here. Let them also indicate the population growth and its influence on the quality of life.

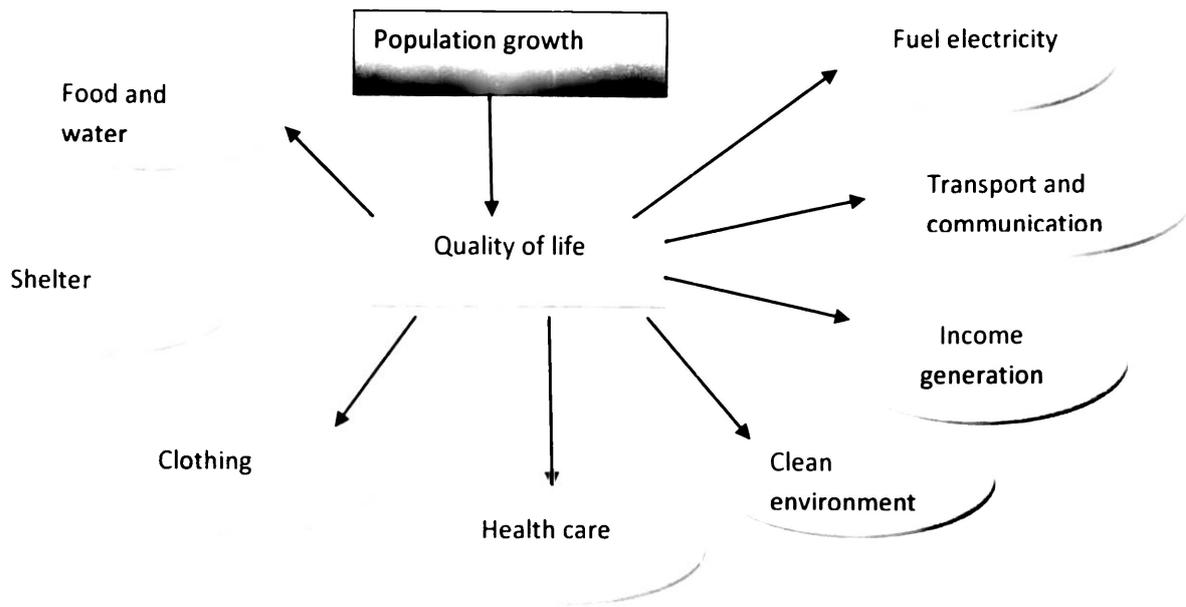


Fig. 6 Population growth and its influence on quality of life

- g. Let the students in groups critically examine the lifestyle of an affluent family and compare it with the lifestyle of an economically deprived family (or the family living in a multi-storey building and another one living in slums). Let them write the merits and demerits of their lifestyle giving reasons (If possible by interviewing them). Pose a question “*If you think that their lifestyle is not of a good quality, suggest measures for improving the same*”.
- h. Conduct debate competitions on population and sustainability. Some of the suggested topics are as follows:
- *Population growth is a boon to humanity*
 - *Population growth improve the standard of living*
 - *How we can preserve the natural treasures for the future generations with the present population size in our country?*

Table 5: Living sustainably- Learn from nature

Nature and its sustainability	Lesson to live sustainably
Ecosystems use renewable solar energy	Depend less on polluting non renewable fossil fuels
Recycle chemicals and hence almost no water in nature	Prevent and reduce wastes and recycle and reuse resources
Biodiversity adapts to changing environmental conditions and helps to maintain and sustain ecosystems	Conserve biodiversity and protect ecosystems
Nature limits population growth and resource consumption	Reduce births to control population and reduce consumption of resources

- i. Encourage students to work in groups and list the basic needs for living of plants and animals. Let them select a natural ecosystem and study the living conditions of plants and animals and report. Provide them with questions to study how the nature sustains itself, like
 - *What is the source of energy for plants? Does it pollute the environment?*
 - *How do plants/ animals get their food?*
 - *How do the plants and animals interact? What happens to their wastes?*
 - *How is their population maintained?*
 - *What if over population or overcrowding of any species occur?*
 - *How do the organisms adapt to changing environmental conditions?*
 - *Do humans have any lessons from nature for living for present as well as future (or for sustainability of population?)*

- j. Arrange competitions/ extracurricular activities on population and sustainability.
 - Poster with slogan contest
 - Quiz
 - Essay writing
 - Debate
 - Short skit.

Reflect on....

- Was it possible to integrate the concepts given in the subjects that I teach?
- Was it possible to conduct the activities and create the situations as suggested? How well you could do them?
- Do you think that you could have used alternative activities than suggested? If so what are they?
- What are the constraints faced by you while integrating the concepts given here?
- What are the ways planned by you to overcome the constraints and improve upon your role as a facilitator in bringing about an awareness about sustainable development among learners?

Module Two : Human rights, Gender equality and sustainable development

Introduction

This module on “Human rights and sustainable development” aims at helping you to make your students understand about the relationship between human rights and sustainable development. It also focuses specifically on gender equality which in the present context refers to a state of affairs in which women and men enjoy the same opportunities in all walks of life. It also means the presence of a gender perspective in decision-making of all kinds and those women’s interests are given the same consideration as men’s in terms of rights and the allocation of re-sources. This module attempts to help you to focus on the issues related to human rights, gender issues, and the reasons on discrimination, the need to emphasize on women empowerment and empowerment of all people belonging to different sectors of the society and their role in sustainability of future.

Focus points:

Importance of human rights, Human rights and peaceful co existence; Role of women in societal life; Reasons for discrimination: Women’s equality- empowerment and rights; Role of Gender equality in sustainable development and progress of a region ; Cultural / religious barriers / beliefs towards gender equality (Social evils); Special privileges for deprived people; communal riots w communal riots war- causes and effects; Disarmament and promotion of human rights; Rights of the child; Cultural diversity and human rights; Government and human rights; Protection of human rights- judiciary, NHRC, media, institutions, NGOs Violation of human rights; Media and human rights; Senior citizens and differently abled people: right to education, health, sanitation and work; Right to information- use and abuse; Intrinsic and instrumental values of human rights to create sustainable human development; Fulfilment of human rights through development programmes, poverty alleviation.

Objectives: This module facilitates you to

- To integrate the concepts related to the need for human rights, human relationship and their relationship to peaceful coexistence in social science, and other subjects wherever found relevant.
- To sensitize the learners about the discrimination against women, their status in education, employment, family etc.
- To create situations and activities in order to help the learners to critically analyze the socio economic issues related to human rights
- To make learners to identify the factors of communal riots, and violence in society.
- To develop an awareness about the need to provide special privileges to the socio economic backward groups
- To develop an understanding of the need to protect cultural diversity
- To understand the role of media in promoting human rights
- To sensitize learners about the child's rights
- To provide instances of violation of rights of the child.
- To develop an understanding of the responsibilities of government and people in promoting human rights
- To appreciate empowerment of women and its impact on improving life conditions

Issues to be focussed:

- Why are human rights important?
- How can exercise of human rights result in peace?
- What is the status of women/ girls in education, employment, home, society etc?
- In what different ways are women discriminated in the society? Is this discrimination right? How can we overcome the discrimination?
- Why is it necessary to provide special privileges to the under privileged/ specially-able- people?
- Why does violation of human rights lead to dissatisfaction among people?
- How can the exercise of human rights promote the preservation of cultural diversity?
- Why is the practice of anti- social activities considered as violation of human rights?
- How does fulfillment of human rights promote constitutional obligations of sustainability?

- How do media influence the development of awareness among people about human rights?
- In what ways are the rights of the child violated at house/ school/ society?
- How can school promote rights of the child?
- In what ways can children get their rights protected?
- Why is war considered as violation of human rights?
- How can disarmament promote human rights?
- How does development programme of poverty alleviation create sustainable human development?
- What are the responsibilities of government and people in promoting human rights?

Content and processes:

Human rights are moral principles that set out certain standards of human behaviour, and are regularly protected as legal rights in national and international law. They are "commonly understood as inalienable fundamental rights to which a person is inherently entitled simply because she or he is a human being." Human rights are thus conceived as universal and egalitarian.

The *Universal Declaration of Human Rights* (UDHR) is a declaration adopted by the United Nations General Assembly on 10 December 1948 at the Palais de Chaillot, Paris. The Declaration arose directly from the experience of the Second World War and represents the first global expression of rights to which all human beings are inherently entitled. The Declaration consists of thirty articles which have been elaborated in subsequent international treaties, regional human rights instruments, national constitutions, and other laws. The International Bill of Human Rights consists of the *Universal Declaration of Human Rights*, the International Covenant on Economic, Social and Cultural Rights, and the International Covenant on Civil and Political Rights and its two Optional Protocols. In 1966 the General Assembly adopted the two detailed Covenants, which complete the International Bill of Human Rights; and in 1976, after the Covenants had been ratified by a sufficient number of individual nations, the Bill took on the force of international law.

The following are the rights in Indian context:

Introduction to Human Rights

- Constitutional provisions
- Universal Declaration on Human Rights, 1948
- International Covenants regarding Human Rights

Human Rights Institutions in India

- Protection of Human Rights Act, 1993
- Composition and functioning of NHRC/SHRCs/ NCPCR

Rights of other vulnerable groups

- Bonded Labour Issues & the Bonded Labour System (Abolition) Act, 1976
- Child Labour Issues & Child Labour (Prohibition and Regulation) Act, 1986
- SC/ST issues & Scheduled Caste and Scheduled Tribe (Prevention of Atrocities) Act, 1989,
- Civil Liberties Act, 1988
- The Forest Rights Act, 2006

Rights of Women

- UN Convention on the Elimination of All Forms of Discrimination against Women, 1979 and its optional protocols
- Protection of Women from Domestic Violence Act, 2005
- Female feticide and Pre conception and Pre- natal diagnostic techniques (Prohibition of sex selection) Act, 2003
- Sexual Harassment of Women at Workplace and Complaints Mechanism
- Women trafficking
- Violence against women
- Issues relating to women of disadvantaged sections like SC/ST or persons with disability
- Reproductive and Maternal health
- Nutritional deficiencies among women
- Education and Employment issues

Rights of Child

- UN Convention on the rights of the child and its optional protocols (Right to survival and development, Right to participation , Right to protection)
- Right to Free and Compulsory Education Act, 2009
- Child Labour Issues & Child Labour (Prohibition and Regulation) Act, 1986
- The Juvenile Justice (Care and Protection of Children) Act, 2000
- The Protection of Children from Sexual Offences (POCSO) Act, 2012

Apart from the National Human Rights Commission (NHRC), the other institutions that help in safeguarding the human rights are given in table below

Sl.No.	Name of the body/ institution	Scope	Aims	Themes
1.	State Human Rights Commission	State	Protection of human rights , prevention of human rights violations, awareness generation on human rights	Human Rights covering custodial deaths, police excesses, fake encounters, women and children' rights , Dalit's rights, minority communities, disability, bonded labour, armed forces, para military forces etc. in the state
2.	National Commission for Women (Chairman as ex-officio member of NHRC)	National	Addressing the issues of women rights violation and advising the government on policy matters related to women	Women's rights
3.	National Commission for Minorities (Chairman as ex-officio member of NHRC)	National	Protection of minorities rights	Minorities rights
4.	National Commission for SC/ST (Chairman as ex-officio member of NHRC). These are two separate commissions: one for SC and another for ST.	National	Protection of SC/ST rights	SC/ST rights
5.	National Commission for Protection of Child Rights	National	Protection of child rights and best interest of Children	Child rights
6.	Disability Commissioner	National	Protecting the rights of Disabled persons	Looks into complaints with respect to disabled persons

(Adopted from IGNOU – Protection of human rights)

An awareness of human rights can be developed through activities, real life situations, case studies, posing problems and so on. Co-curricular activities may be organized in which topics related to human rights for debate and essay competitions and exhibitions may be given. The issues related to human rights may be appropriately integrated in subjects like social studies, languages, science art education and so on. Some of the issues followed by activities of various kinds are given below.

a) Need for human rights, and its relationship to human relationship

A brainstorming session may be conducted on the need for human rights. Teacher will initiate the session; write the points given by the students on the blackboard. Observe the points given by the students and make the students find relationship between human rights and human relationships (you can quote the example of film “Bombay” which finally strengthened the relationship between two religions)

b) Human rights, peaceful co existence, socio economic issues, cause and effects of communal riots

A drama may be planned by the students with your help, which has a theme of interdependence of two castes of people- a high and a low caste. A rural situation where a low caste person is not allowed to enjoy his/ her human rights- dignity, labour, use of public property etc. this results in dissatisfaction and communal riots. The life of both the groups of people high- low becomes miserable. After allowing a low caste people to enjoy their human rights- both the groups peacefully live together. After dramatization of the above scenes, a discussion may be generated, wherein the various aspects of drama are critically viewed. Students should be allowed to express their views freely.

c) Socio economic issues, causes and effects of communal riots

A collage on communal riots may be prepared by the students and displayed in the class. The collage will have information about the place, effects of communal riots that took place in different parts of our country/ world. A heated discussion can take place in the class on the observed visual(s). If possible a clipping of a movie/ documentary on communal riots may be viewed and discussion also can follow.

d) *Disarmament, need for disarmament*

A person from the defence may be invited to school to talk on 'disarmament'. Later students can interview the person and collect the information which will help them to arrive at need for disarmament. If there are family members of the wounded or dead in the border wars, or communal riots, they may also be interviewed to understand their difficulties. If there are army/ defence hospitals, students may visit it.

e) *Privileges for backward groups*

Students may be taken on a visit to the houses of people who are socially/ economically backward or underprivileged. Allow the students in teams to visit different households and gather information on their status, need for help from outsiders (Government, NGO's etc.), and types of help needed and how it can bring change in their life. The collected information has to be consolidated depending on the nature of information and guide students to arrive at findings. The findings may be presented in the class followed by discussions.

Students can also be asked to collect information regarding special privileges given by the government to special groups of people. Government programmes can also be listed out and try to find the extent to which the objectives of those programmes have been achieved.

f) *Protection of cultural diversity*

Students may be divided into different groups- region wise like north, south, east, west, central and island groups of our country or based on aspect of culture like dance, literature, songs, food, festival etc. and collect information, pictures, models and so on, depicting the cultural diversity and similarity. Let the students present before the class the collected information in different forms followed by an exhibition in the school. Make students understand the richness of the diversity and need to protect the diversity. Have a brainstorming session on ways of protecting cultural diversity.

g) *Media and Human rights*

Students may be informed well in advance to collect information on cases wherein media has played role in protection of human rights- through personal experience, newspapers, elders, movies, TV etc. Every student may be given opportunity to share their experiences. Different experiences may be consolidated. Students may also be asked to

prepare a collage from newspaper, magazine, and cut-outs to further strengthen their role in protection of human rights.

h) *Rights of the child- violation, promotion*

Ask the students to prepare an interview schedule. Let it cover the various aspects/ dimensions of violation of rights of the child- by teacher, parents, peers, neighbours etc. at home, school, neighbourhood etc. Every student may be asked to interview 5- 10 children of their school and other schools or out of school children. Let them report their process and findings of the interview and a discussion may be held in the class based on the report.

Students may be asked to play the role of teacher, parent, peer etc. and act out how they violate and promote rights of the child.

i) *Government, NGOs and Human rights*

Ask the students to collect information about Government programmes for poverty alleviation, crisis prevention, equal opportunity etc. Each of the programmes can be analysed in the class and examine how they fulfil the spirit of human rights. Teacher may take up issues related to mining, construction of dams, installation of atomic power stations, widening of roads etc. A detailed discussion can be held on their effect on sustainability and how it results in violation of human rights. A few local NGO's may be referred in the class and a relationship may be inferred between their functions and protection of human rights. Regarding protection of human rights by government and NGO's- discussion may be held on benefits/ privileges given to senior citizens/ differently abled people. Intervention of government/ NGO's in bringing peace in a disturbed society has to be highlighted.

k) *Right to shelter:*

Case study 1 -

One of our rights is Right to have a decent shelter. The Stephen court building one of the oldest buildings in Kolkata provided shelter to a large number of families. People lived in their houses. On 24th March 2010, last two floors of the building were damaged due to fire and the people were vacated from the whole building. They were asked not to enter into the building until further orders from the government. It was also in the news that the building is very old, it may be demolished.

Now discuss in small groups

- *Doesn't the boy have a right to shelter?*
- *Why does he ask to save the houses?*
- *What difficulties do you think, the people of the building will face, if it is demolished?*
- *How can they have a safe shelter?*

Present the outcome of the discussion in the class. Try to collect some more information and pictures on people's right to shelter.

All of us have a right to live in our residence and right to work. People might have lived in the houses for generations together working on their land as farmers. If the house and the land are to be used in the interest of the public, then the owners of the land will be vacated by the government. *What about the future of these land losers? What has been done to safeguard their right/ interest?* The case studies have been narrated below. Read and discuss them in the class.

Case study 2:

In view of the development of the state, Government of Karnataka acquired land from the farmers and permitted the industries to come up on those lands. As farming was the only source of income to these families, the farmers were put to lot of difficulty. Sensing the poor condition of the land-losing farmers, the government of Karnataka proposed to reserve 5% of seats in ITI colleges for children of land losing farmers and even it ensured that the steps would be taken to provide employment to those children in the industries that are going to come up on those lands (Star of Mysore, 24.03.10)

Discussion questions:

- *Is the government right in taking away the land of the farmers? Why?*
- *How do you react to the government's action in providing employment to the children of the farmers?*

Case study 3:

Tehu is one of the biggest dams coming up in Uttaranchal. Lakhs of families had to leave their loving homes and lose their land for the sake of construction of dam which would serve several purposes in years to come. After continued fight with the government, people were shifted to a dry, uneven rocky region where it is difficult to people to lead a normal life. They

lack all the basic facilities. Suppose you were in the place of the sufferers how would you have felt?

Discussion questions:

- *Why do you think government is right in the construction of dam?*
- *What should the government do for having displaced the families?*
- *Are people enjoying their right to basic amenities?*
- *How can they sustain their lives?*

One of the fundamental rights is right to education and culture. It is the duty of the government to provide equal opportunity to all in enjoying this right. Let us examine one of the actions of government of Karnataka. The Government of Karnataka is planning to allot 100 acres of land covered by trees for Music varsity in the village of Varakodu. It will be named after a well known musician of Karnataka- Dr. Gangubai Hanagal.

- *Is the government helping people to preserve their culture?*
- *Is it right in allotting the tree filled land to a music university?*
- *What alternative do you suggest that would preserve culture and protect forest cover?(for discussion in class)*

Gender equality

Partnerships and equality between men and women are the basis of strong families and viable societies in a rapidly changing world. Yet women have been consistently excluded from decision-making across history and societies. Participation, decision-making and management roles of women are critical to sustainable development processes and governance at local, national and international levels, where they can be effective agents of change.

Surveys in developed countries have found that women, owing to lifestyle and consumption patterns, seem to be more concerned about the environment and have a greater sense of responsibility towards achieving sustainable development. There are indications that women tend to hold themselves more accountable as consumers, are more likely to recycle, and use public transportation more often than men.

Some 1.6 billion people in the world live “off the grid”, with no access to electricity. Energy poverty, particularly in rural areas, is a major challenge in every dimension of people’s lives. For example, more than 3 billion people rely on open fires and traditional

cooking stoves utilizing bio fuels, with the responsibility for collecting the requisite firewood falling primarily on women and children, who may spend several hours per day fulfilling their households' energy needs. Investments in clean and affordable energy, such as solar power, not only contribute to freeing up the time needed by women and girls to pursue education and income-generating activities, but also promote the achievement of the Millennium Development Goals and help address the challenge of climate change.

Women's and girls' access to education, training and capacity development holds the key to their empowerment and improved livelihoods. Targeted public support can ensure that women and girls have equal opportunities in education and training.

Sustainable development is possible by sustainable infrastructures such as energy, water and sanitation. Women participation in economic activities will help in improving these infrastructures to their community at large.

i) Status of women, discrimination against women

Let the students find the status of women in education, family, society/ job or any other through survey in their locality. In order to do this, let them be divided into groups, prepare a questionnaire related to their area of study (theme), visit women in their locality and collect information, analyse and interpret the data. Let them write a short report with the findings and make a presentation. You can raise questions such as "why the status of women are different in different localities, families etc? Do the family structure, education status and the socio economic back ground play a role in determining the status of women? Let the students discuss these questions with the experience of survey findings.

Pose the following questions for group discussion.

- *How are your sisters and brothers treated in your homes? Or in your relatives' home?*
- *Is there any difference shown by the parents or elders in treating boys and girls equally?*
- *Have you at any time thought about this discrimination? Do you feel it is right? If not, what are your reasons? What are the occasions or instances when the girls are discriminated?*

- *Have you observed girls and boys being discriminated in schools, in society? What are your views about it?*
 - *What are your solutions to resolve the problems of discrimination? How do you see your role in the above?*
- Ask students in groups to find out from various sources (newspaper, internet, interacting with local government officials) about different programmes initiated by government to improve women's life conditions. Let them also interact with local women and interview the impact of those initiatives in their life.

It is common observation that women, family and child care have very strong link in developing countries. Their contribution for family (preparation of food, taking care of the children, collecting water, house cleaning, collecting fuel for cooking etc.) are not generally considered with economic value.

Divide your students in group and let them discuss and make presentation of their views.



(The Hindu, Delhi, March 10, 2010)

- In Indian society, women earn through agricultural labour, producing goods in their homes (making bamboo baskets, broom sticks, agarpathi, beedi), housemaids, rag pickers, and as coolies in construction of buildings. But their hard work is paid in meagre amount which does not allow them to improve their standard of life. The gender discrimination can be seen in overexploiting women. Discuss in small groups and enact a role play.



(The Hindu, Delhi, February 16, 2010)

- Women's role in decision making is one of the most important questions for consideration in the movement for their empowerment. The 73rd and 74th

Amendments (1992) to the Indian Constitution have served as a major breakthrough towards ensuring women's equal access and increased participation in political power structures. This Amendment provided for reservation of one third of seats for women at level of local governance in urban areas. After 1993, women's participation in local governments increased quite radically, with the enactment of the legislation providing 33 percent reservation of seats for women in local bodies. There are about 1 million elected women representatives in Panchayats and Municipal Bodies in India.

Divide your students in groups and let each group meet the elected women representatives at various levels (Panchayat, municipal, legislative) in their locality and interview them on their participation and its impact on health, education, child care and status of women.

- Divide students in group and ask them to visit their locality in interact with women of Educated and employed, Educated and not working, Working but not educated, House makers and others

The students may be asked to gather information on:

- their participation in decision making in their family
- contribution to their children's education
- economic stability of the family
- family health
- status in the society
- and other factors

Ask students to prepare a chart indicating the percentage of equality provided in different social classes (Rich, upper middle class, middle class, poor).

- Initiate a brainstorm session in your class and ask boys and girls to express their aspiration what they want to become in future. Encourage students
 - To see is there any pattern emerging in their choice?
 - To discuss why do they think certain profession / job male or female oriented / dominated
 - Is there any social / cultural influence of preferring particular profession / job?
 - To discuss about what are the probable solutions to break this barrier.

Let them present their views.

- Organize a debate on gender equality. Make groups of boys and girls.
- Organize a debate on “*Women’s empowerment leading to sustainable development*”

Reflect on....

- **In which subjects were you able to integrate the concepts given in this module?**
- **How well could you integrate the concepts? Were you satisfied with the students’ understanding, involvement and analysis of the issues posed?**
- **How you would like to improve on the concept integration and planning of the activities for future classes?**
- **Compare your views on human rights and gender equality before and after implementing the strategies and activities given here. Is there any change or improvement in your views? Were you motivated to know more about human rights and gender equality?**

Reference:

Protection of Human rights, retrieved from

http://nhrc.nic.in/ignou/EUnit2/Unit_2.pdf

http://en.wikipedia.org/wiki/Universal_Declaration_of_Human_Rights

<http://www.un.org/womenwatch/daw/csw/csw55/panels/Panel4-E.pdf>

Module Three :

Poverty Alleviation and Sustainable Development

Introduction

Widespread poverty is a grave problem and poverty alleviation has been a key component in development strategies over the past 50 years. There are several measures and developmental projects and schemes implemented in the country to remove poverty. However, in spite of some progress in addressing poverty, the problem remains. History has led to vast inequalities, leaving almost three-fourths of the world's people living in less-developed countries and one-fifth below the poverty line. Almost half the world's population currently lives on less than two dollars a day. In recent years, tackling such widespread poverty appears once more to have become a priority issue for many aid agencies. Our common future can only be achieved with a better understanding of our common concerns and shared responsibilities related to eradicating poverty and illiteracy and improve the economical status and the standards of living of all human beings.

Focus points

Poverty in developing and developed countries, factors responsible for poverty, poverty and its impact on development, possible solutions

Objectives

This module facilitates you to

- Integrate the concepts and the issues related to poverty in the relevant topics in subjects like social science.
- Select appropriate learning experiences to develop an understanding of poverty and its related issues in learners
- Enable learners to analyse the impact of poverty on the development of a country
- Enable learners to interpret the data on poverty and suggest solutions
- Provide situations to enable learners to analyse the various causes of poverty that hinder sustainable development

- Enable learners to analyse the ways and means by which we can reduce poverty.

Issues to be focussed

- Why poverty is a main hindrance towards a country's progress?
- How to Reduce poverty for attaining sustainable development?
- What are the causes and consequences of poverty which have to be minimised?
- What is the status of developing countries in utilization of natural resources when compared to the developed countries?

Content and Processes

Meaning of Poverty

Poverty is the scarcity, dearth, or the state of one who lacks a certain amount of material possessions or money.

Absolute poverty or destitution refers to the deprivation of basic human needs, which commonly includes food, water, sanitation, clothing, shelter, health care and education.

Relative poverty is defined contextually as economic inequality in the location or society in which people live. Some of the definitions of poverty are as follows.

- 1) **United Nations:** Fundamentally poverty is the inability of getting choices and opportunities a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family not having a school or clinic to go to; not having the land on which to grow one's food or a job to earn one's living not having access to credit. It means insecurity powerlessness and exclusion of individuals' households and communities. It means susceptibility to violence and it often implies living in marginal or fragile environments without access to clean water or sanitation.
- 2) **World Bank:** Poverty is deprivation in well-being low incomes and the inability to acquire the basic goods and services necessary for survival with dignity. Poverty also encompasses low levels of health and education poor access to clean water and sanitation inadequate physical security, lack of voice and insufficient capacity and opportunity to better one's life.
- 3) **Copenhagen Declaration:** *Absolute poverty* is a condition characterized by severe deprivation of basic human needs including food safe drinking water sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to social services. The term 'absolute poverty' is sometimes synonymously referred to as 'extreme poverty.'

Poverty in India:

At the beginning of the new millennium, 260 million people in the country did not have incomes to access a consumption basket which defines the poverty line. Of these, 75 per cent were in the rural areas. India is home to 22 per cent of the world's poor. Such a high incidence of poverty is a matter of concern in view of the fact that poverty eradication has been one of the major objectives of the development planning process. Indeed, poverty is a global issue. Its eradication is considered integral to humanity's quest for sustainable development. Reduction of poverty in India is, therefore, vital for the attainment of international goals.

Poverty relief, Poverty alleviation, Poverty reduction and Poverty eradication:

These terms are often used interchangeably, which can lead to some confusion. Let us see what these terms mean.

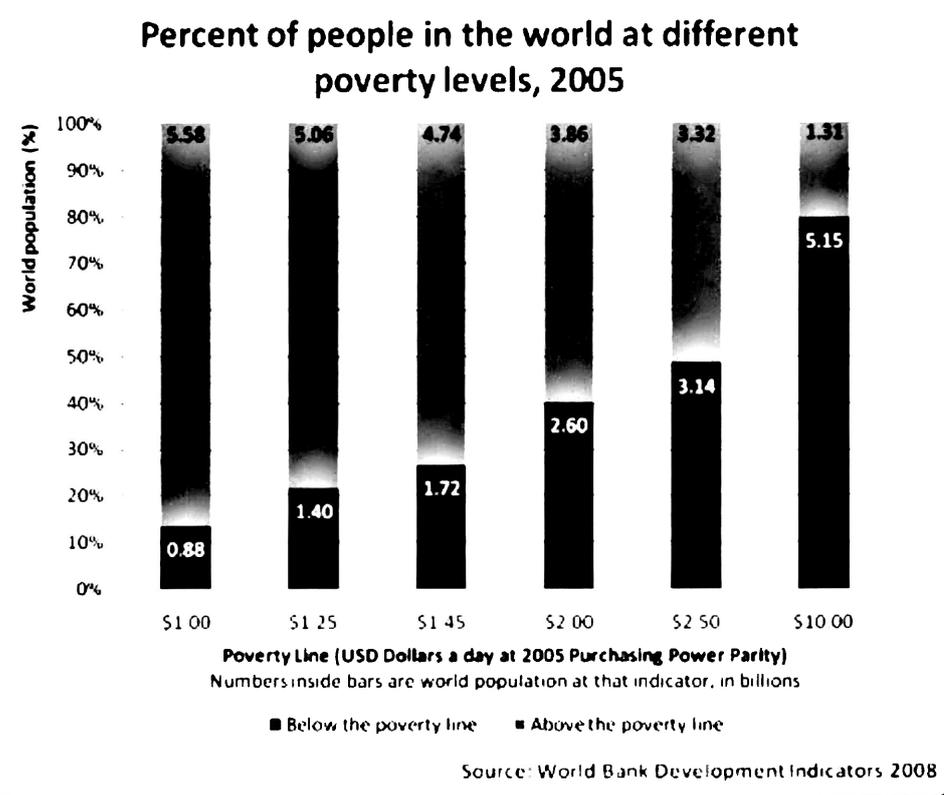
Poverty relief refers to policies and interventions that seek to give short term assistance to a person who are living in poverty, and is usually linked to some external shock that pushes people into a more severe state of vulnerability than before. It is accordingly often seen as —emergency relief. Examples of these programmes include the Department of Social Development's short term -Social Relief of Distress Grant, as well as food parcels and drought or flood relief. These policies are not intended primarily to be developmental, but to give aid to address immediate needs.

Poverty alleviation also aims to reduce the negative impact of poverty on the lives of poor people, but in a more sustained and permanent way than poverty relief programmes. It includes the state's social grant programmes which alleviate the impact of poverty for many people. Poverty alleviation programmes tend to have longer term goals and are in general more developmental than Poverty Relief programmes. Thus the state's social grant policies both provide immediate relief for poor people, but have also been found to provide a developmental stimulus by empowering people to look for jobs who live in households in which members (children, disabled persons or old age persons) receive social grants, or start their own small businesses and of course strive to ensure that children are able to receive sufficient nutrition to enable them to grow up healthier.

Poverty reduction usually refers to strategies and policies that reduce the number or percentage of people living in poverty or the severity of the impact of poverty on the lives of poor people.

Poverty eradication means ending the existence of poverty. The state has committed itself to the eradication of poverty in South Africa, and as a half way marks, to halving the rate of people living in poverty by 2014.

Almost half the world – over three billion people – live on less than \$2.50 a day.



At least 80% of humanity lives on less than \$10 a day. ¹

- a) You may prepare the above graph in a chart and ask the students to interpret the graph on the percent of people in the world at different poverty levels.

Causes

Agricultural wage earners, small and marginal farmers and casual workers engaged in non-agricultural activities, constitute the bulk of the rural poor. Small land holdings and their low productivity are the cause of poverty among households dependent on land-based activities for their livelihood. Poor educational base and lack of other vocational skills also perpetuate poverty. Due to the poor physical and social capital base, a large proportion of the people are forced to seek employment in vocations with extremely low levels of productivity and wages.

- Ask students to conduct a survey in their locality to find out the number of families coming under Below Poverty Line (BPL) and Above Poverty Line (APL). They can be asked to collect the data of the same of about 10 years back. They can plot a graph with the data. Compare them and analyse whether there has been any decrease or

increase in the number of BPL families. Discuss in groups and find out the possible reasons.

- You may prepare a worksheet showing the following graph and ask students to discuss in groups about the percentage of population below the poverty line in Urban and Rural India from 1973 to 2000. Let them discuss on the following points.

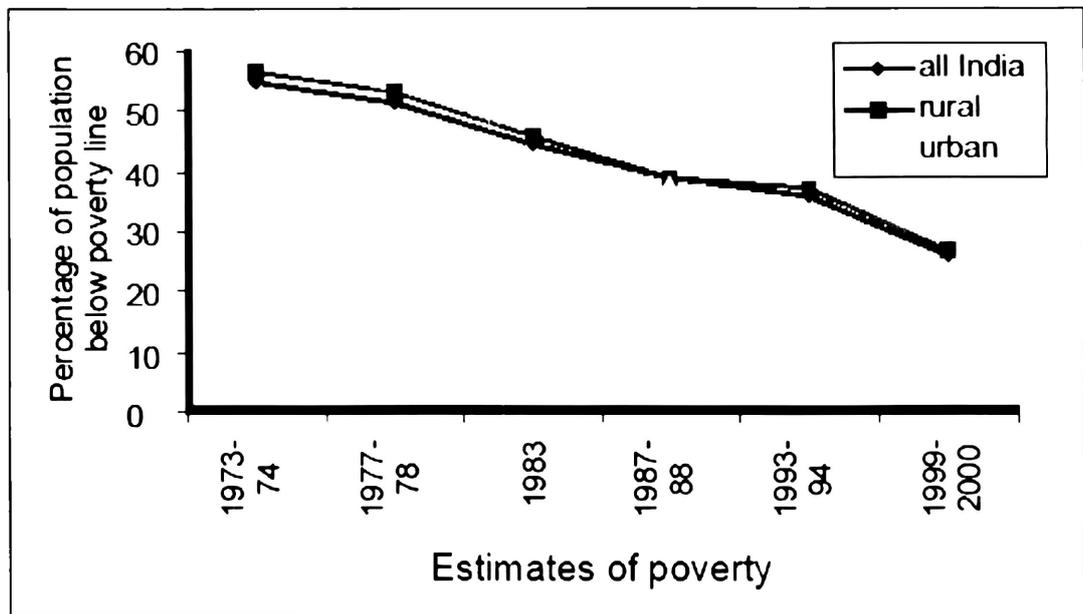


Fig.7 Estimates of Poverty

- There is a decline in the percentage of Below poverty line people from 1970 to 2000? What could be the possible reasons for it?
 - Suggest some ways by which we can reduce the rural poverty?
 - How do poverty hinder sustainable development?
- You may make students to divide into groups and discuss the following questions
 - 13% of humans earn just \$1.00 in a day. What ways do you suggest for them to have a better earning?
 - What is your interpretation about people of Below Poverty Line in the graph on poverty levels?
 - Do you think that this poverty may hinder sustainable development? How?

Avenues to overcome poverty

Poverty alleviation has been one of the guiding principles of the planning process in India. The role of economic growth in providing more employment avenues to the population has been clearly recognized. The growth-oriented approach has been reinforced by focusing on specific sectors which provide greater opportunities to the people to participate in the growth process. The various dimensions of poverty relating to health, education and other basic services have been progressively internalized in the planning process. Central and state governments have considerably enhanced allocations for the provision of education, health, sanitation and other facilities which promote capacity-building and well-being of the poor. Investments in agriculture, area development programmes and afforestation provide avenues for employment and income. Special programmes have been taken up for the welfare of scheduled castes (SCs) and scheduled tribes (STs), the disabled and other vulnerable groups.

The success of the anti-poverty strategy can be gauged from the decline in poverty levels from 37.27 per cent in 1993-94 to 27.09 per cent in 1999-2000 in the rural areas. In absolute terms, the number of rural poor fell below the 200 million mark for the first time since 1973-74. However, this achievement falls short of the Ninth Plan projections. At the beginning of the Plan, it was projected that, with a growth target of 6.5 per cent per annum during the Plan period, only 18.61 per cent of the population would be below the poverty line by 2001

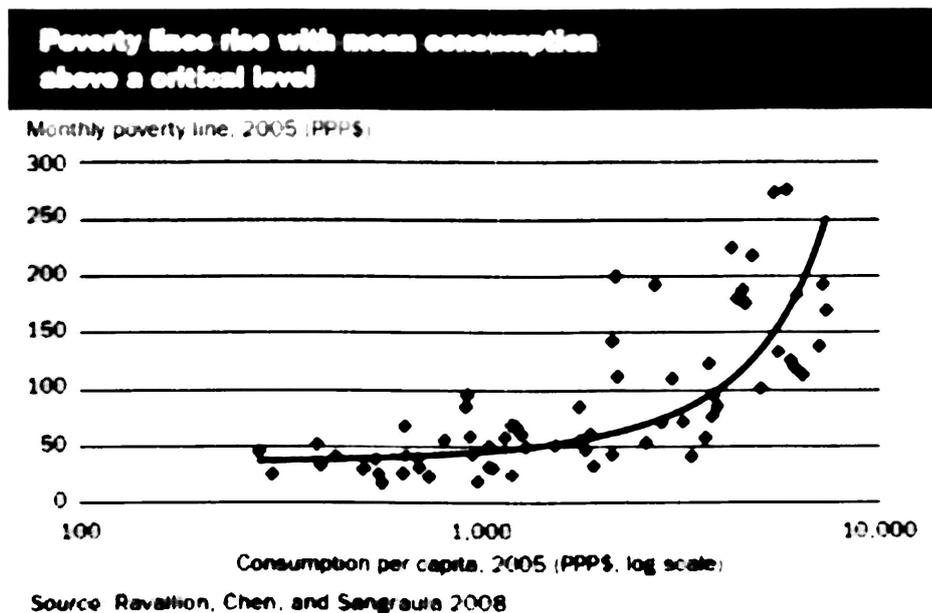
Anti-poverty programmes in the Ninth plan

- 1) Integrated Rural Development Programme/ Swarnajayanti Gram Swarozgar Yojana
- 2) Wage Employment Programmes
- 3) Jawahar Rozgar Yojana/Jawahar Gram Samridhi Yojana
- 4) Employment Assurance Scheme
- 5) Food for Work Programme
- 6) Sampoorna Gramin Rozgar Yojana (SGRY)
- 7) Rural Housing
- 8) Social Security Programmes
- 9) Land Reforms

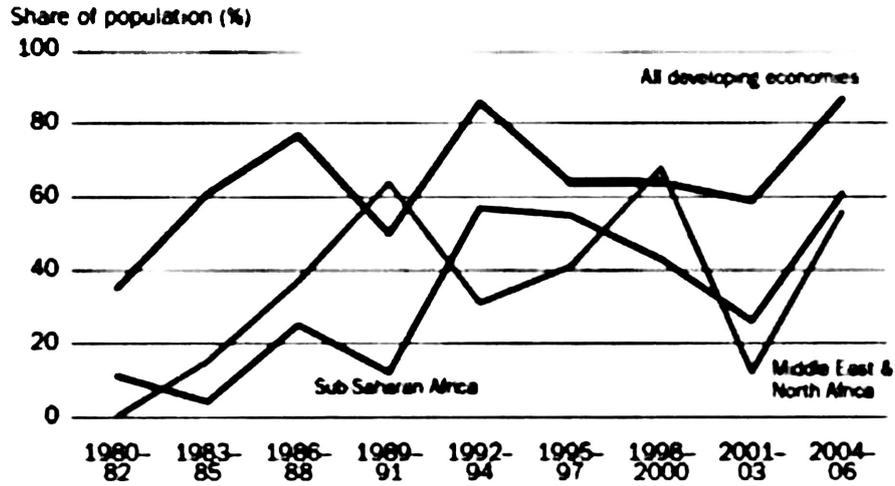
Since, poverty is one of the major hinderance towards sustainable development, there is a need to reduce poverty in the present world. Looking into the causes and consequences of poverty, the following activities helps to enable your students to know about the poverty level of the world and how it comes in the way of sustainable development. Few of the suggested activities may be used in order to create an awareness in the learners.

- Conduct an elocution on the topic: **“When a city develops, a slum also develops along with it”**
- You may ask students to interview some elderly person in their family or their neighbourhood to know about the cost of essential commodities in their childhood days. This may be compared with the present rates. Students may be asked to reflect on how poverty is related with rising rates of these commodities.

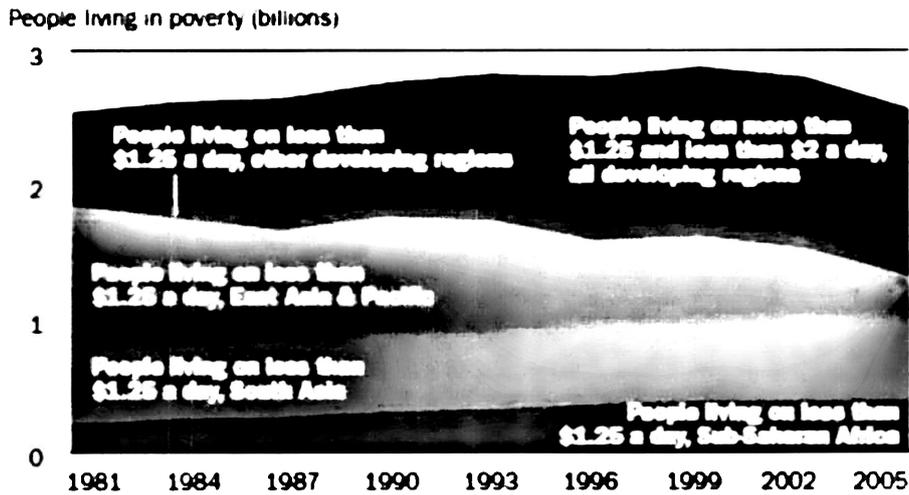
The following graphs can also be made use of to initiate a discussion that ‘do poverty lines also raise with mean consumption above a critical level’.



People represented by income or expenditure surveys



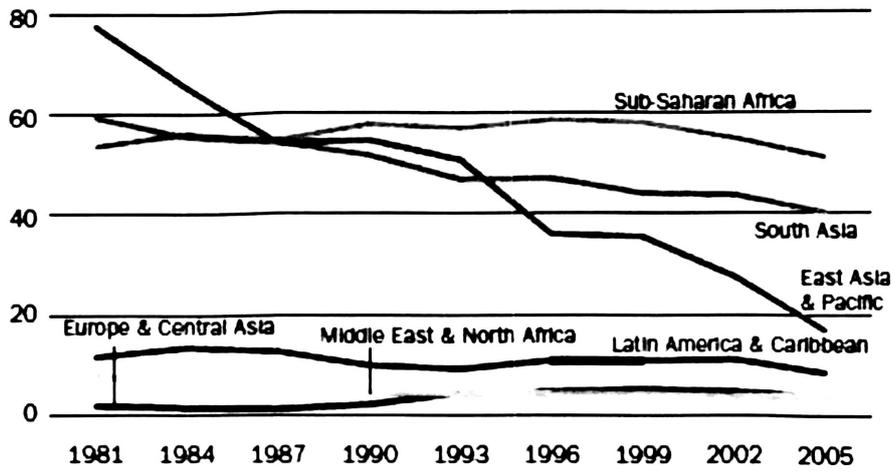
The number of people living on less than \$2 a day has changed little since 1981



Source: PovcalNet, World Bank.

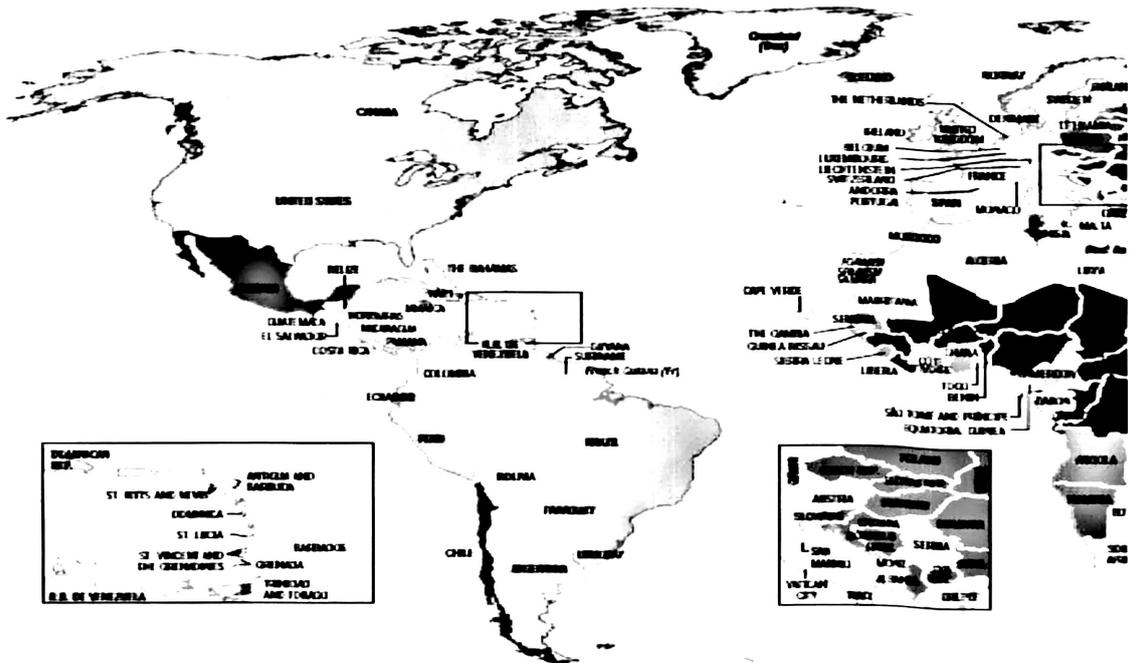
Poverty rates have begun to fall

Share of population living on less than \$1.25 a day (%)

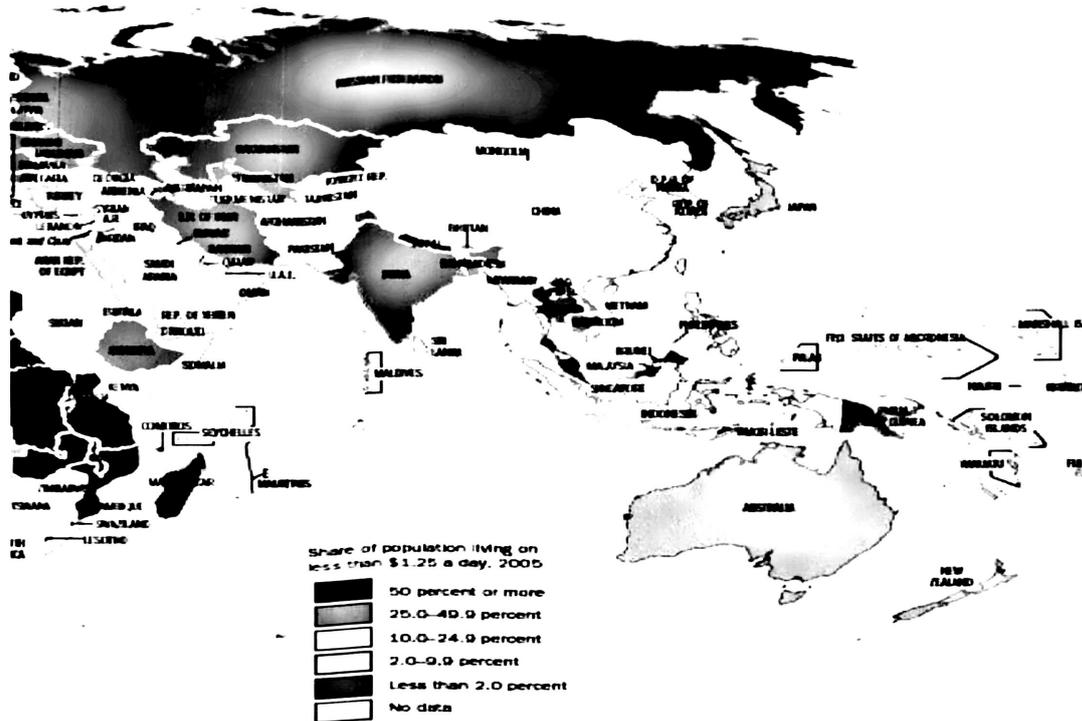


Source: PovcalNet, World Bank.

People living in extreme poverty



People living in extreme poverty



- Almost half the world — over 3 billion people — live on less than \$2.50 a day.
- The GDP (Gross Domestic Product) of the 41 Heavily Indebted Poor Countries (567 million people) is less than the wealth of the world's 7 richest people combined.
- Nearly a billion people entered the 21st century unable to read a book or sign their names.
- Less than one per cent of what the world spent every year on weapons was needed to put every child into school by the year 2000 and yet it didn't happen.
- 1 billion children live in poverty (1 in 2 children in the world). 640 million live without adequate shelter, 400 million have no access to safe water, and 270 million have no access to health services. 10.6 million died in 2003 before they reached the age of 5 (or roughly 29,000 children per day).

- Show pictures on slum areas of Mumbai, Chennai and Kolkata. Ask them to list down the problems of people living in those areas.
- Draw the attention of students to the daily news coverage on people living below poverty line. Let the students list down the consequences of poverty, like, ill health, malnutrition in children, illiteracy, beggary, petty crimes and so on.
- Relate poverty with illiteracy by giving examples and real life anecdotes.
- Ask students to find out the measures taken by the Government to help poor people in terms of supplying free ration, building shelter and providing free education, medical services and so on.
- Make students realize how important it is not to waste food, and other resources, when so many people do not have enough to eat and live properly.
- Arrange for a talk on “Mother Theresa” and her invaluable service to poor and sick people. Ask students to reflect on the poverty situation in their local areas and write down in their dairies. Ask them to write down, the actions or measures they would take at their level to help the poor and needy people. (for example, collecting clothes from neighbourhood and food grains to give it to the poor; providing the poor and the sick people with blankets and woollen clothes for winter; getting them employed wherever it is possible)

Use the following links for more information on poverty.

<http://www.nda.org.za/>

<http://planningcommission.nic.in>

Reflect on....

- The methods you have adopted to bring an awareness and sensitivity about poverty in India in students.
- Students’ receptivity to the topic and their attitudes and values towards helping the poor
- The sufficiency of the content to generate critical thinking, analysis and empathy on part of learners

Module Four :

Sustainable Human Settlements and Urbanization

Introduction

We have seen in our experience, how a rural area over a period of time, has grown into a small town, and later transformed into an urban area totally, where many business centres are opened, transport facilities are increased, and industries and factories have been opened. This development in a particular area opens up opportunities for employment due to which many people tend to migrate from other places and settle down in the place where they find occupations. This transformation and human settlements opens up many issues of sustainable development. This module attempts to provide basic understanding of human settlement, urbanization, health promotion and transport with the activities for learners to probe and develop insights into the issues associated.

Focus Points:

Human settlements, Urbanisation, Rural Development, Transport and Health promotion.

Objectives:

This module facilitates you to

- Integrate the concepts in subjects like social science and science at appropriate places.
- Plan activities and situations for learners to observe and understand the life conditions and aspirations of rural, urban and urban slum area in terms of facilities (transport, water and air quality, job opportunity etc.) available to them
- Enable learners to analyse the impact of pollutants and change of life style on health of people living in urban and rural area
- Enable learners to understand the factors affecting rural development

Issues to be focused:

- What are the reasons for human beings moving towards urban areas?
- How to improve the life conditions of urban slum and rural areas?

- What are the implications of urban waste on environmental degradation?
- How an unplanned urbanization has an effect over the health aspects of people living there?
- How can we address the problems of health?
- What are the initiatives to be taken to improve the health conditions at urban and rural areas?

Content and Processes:

Human settlements are the places where human beings build their homes. The fabric of human settlements consists of physical elements and services. The physical elements provide the material support to the services. The physical elements are comprised of shelter and Infrastructure. Shelter is the superstructures of different shapes, size, type and materials erected by mankind. It provides security and protection from weather, enemies' etc. and privacy for his singularity within a community. Infrastructure is the complex networks designed to deliver to people goods, energy or information. Services cover those required by a community for fulfillment of its functions as a social body. These include education, health, culture, welfare, recreation and nutrition.

Human settlements is the totality of the human community whether city, town or village- with all the social, material, organizational, spiritual and cultural elements that sustain it. (The United Nations Conference on Human Settlements held at Vancouver in 1976)

Urbanization is an index of transformation from traditional rural economies to modern industrial one. Even though India is among the countries of low level of urbanization in the past century, a number of urban agglomeration /town have grown from 1827 in 1901 to 5161 in 2001. Number of population residing in urban areas has increased from 2.99 crores in 1901 to 30.69 crores in 2001. It is about 30% of population was living in urban areas as per 2001 census. Over the years there has been continuous concentration of population in class I towns and metro and megacities (Classification is given in the table given below).

Type of town	Population
Megapolis (megacities)	More than 80,00,000 (80 lakhs)
Metropolis (metro cities)	More than 10,00,000 (10 lakhs)
Class I (city)	1,00,000 or more
Class II	50,000-99,999
Class III	20,000-49,999
Class IV	10,000-19,999
Class V	5,000-9,999
Class VI	Less than 5000

(Source: *The Green Reader-1999, Centre for Environment Education*)

Census year	No. of towns	Urban Population (in million)	Percent Urban to total population	Number of towns						Percentage of urban population					
				Class I	Class II	Class III	Class IV	Class V	Class VI	Class I	Class II	Class III	Class IV	Class V	Class VI
1901	1827	25.85	10.84	24	43	130	391	744	479	26	11.29	15.64	20.83	20.14	6.1
1911	1815	25.94	10.29	23	40	135	364	707	485	27.48	10.51	16.4	19.73	19.31	6.57
1921	1949	28.08	11.18	29	45	145	370	734	571	29.7	10.39	15.92	18.29	18.62	7.03
1931	2072	33.45	11.99	35	56	183	434	800	509	31.2	11.65	16.8	18	17.14	5.21
1941	2250	44.15	13.86	49	74	242	498	920	407	38.23	11.42	16.35	15.78	15.08	3.14
1951	2843	62.44	17.29	76	91	327	608	1124	569	44.63	9.96	15.72	13.63	12.97	3.09
1961	2365	78.93	17.97	102	129	437	719	711	172	51.42	11.23	16.94	12.77	6.87	0.83
1971	2590	109.11	19.91	148	173	558	827	623	147	57.24	10.92	16.01	10.94	4.45	0.44
1981	3378	159.46	23.34	218	270	743	1059	758	253	60.37	11.63	14.35	9.54	3.58	0.5
1991	3768	217.17	25.72	300	345	947	1167	740	197	65.2	10.95	13.19	7.77	2.6	0.29
2001	5134	285.35	27.78	433	493	1383	1561	1040	224	62.23	12.03	14.75	7.94	2.77	0.28

Source: Census of India (1981, 1991, 2001 and 2011)

On the contrary the concentration of population in medium and small towns either fluctuated or declined. The increase in number of urban centers from lower population size categories to class I cities has resulted top heavy structure of urban population in India. India's urbanization is often termed as *over urbanization* and *pseudo-urbanization*. The big cities attained inordinately large population size, leading to virtual collapse in the urban

services resulted in basic problems in the field of housing, water, infrastructure, quality of life etc.

Pseudo-urbanization is a product of demographic explosion and poverty induced rural-urban migration. It is expected that between 2000 and 2100, the percentage of people living in the world's urban areas is expected to increase from 47% to 80-90%. It is high time to initiate redirection of investment to develop strong economic base for small and medium city neglected so far so that migration flows are redirected to small and medium cities. The following activities may be conducted in order to enable the learners to understand the concepts of urbanization and the relationship of it with development, to critically analyze and examine the issues associated with urbanization and human settlements.

- Ask the students to find out from their grandparents or parents about where they lived in olden days, what are the changes occurred over a period of time in terms of their place of living and facilities. Once the students have the information, ask them to share that information through brainstorming session and through road maps to show the changes in their locality.
- Initiate discussion in the classroom by asking the students whether they changed their place of living or any other person in their neighbourhood changed their place of living. Let them identify the reasons for it. Students attention may be brought to the issue of living among nomadic tribes, seasonal urban migrants and others and condition of living thereof.
- Students may be asked to select specific areas (around 1 sq. km) mentioned below and collect information related to number of families, family size, employment, education, number of rooms in the house, cars, mobiles etc.
 - Their locality
 - Compare their locality with other areas such as rural, urban, urban slum and preparing report on it.
- Divide the class into small groups of 7 to 8 students in a group. Ask each of the group to visit different locality (rural, urban and urban slum) to observe the facilities available like schools, hospital, sanitation, waste management, clean water, electricity, entertainment, job opportunity etc.
- Ask students to go on field trip to visit the place where urban migrants stay and interact with them and collect the following information.

Place from where they came & why?	Education	What was their work before coming here	Monthly income in their place	Expenses for a month in their place	Present Job nature (name of work)	Skilled or unskilled in their present work	Monthly income	Monthly income Expenses for a month

Ask the student to think about those unskilled migrants: (a) what would have happened if those people were given education and skills in the previous place itself? (b) What would happen if those people are given education and skills now?

- Ashok is the son of a farm labourer from an interior rural village which is 5 km away from the main road. He is studying in a school in the nearby village which is 1 km away from his home. Sunil is from a metro city. As his parents work in government office, he studies in a public school. Manoj is the son of a rickshaw puller living in an urban slum and he studies in municipal school. Neeraj is from a village which is close to the town and his father works as a teacher. All the four are 7th standard students and meet in tourist spot. They share where they have come from and their experiences. Ask your students to do a role play on these four characters and express what they aspire on the following dimensions.

Dimension	Ashok	Sunil	Manoj	Neeraj
What you want to become?				
What kind of place do you want to live in?				
What kinds of facilities are required in your home?				
What kind of facilities is required for your transportation?				
What are the problems do you experience in your living place?				

- Gradually in cities and towns transportation is becoming unmanageable due to increasing number of cars and private vehicles. Ask the students whether they think improving public transport system may solve the problem. What about individual aspiration to own a car? Allow them to discuss in groups and make their suggestions. Show a picture of the kind given below, and ask students to give their views and opinions on it.



(Traffic on a road in Delhi. The Hindu, November 25, 2009)

- The increase of population in urban areas lead to greater pressure on transportation and poor public transport facility leads to chaos both in urban and rural areas. The two pictures given below show poor public transport in rural and urban areas. Ask students to consider themselves as an expert team who is planning for improvement of public transport system. Through discussion, observation and interviews with public and concerned authorities let them plan a transport system to suggest the government.



From internet (source url to be identified)

The great railway bazaar



IS BISHI WATCHING? Passengers from aboard an over-crowded
 bogi ahead of the Rail Budget PHOTO: NEUPATI / NEPALSO PAAL

(The Hindu, Feb 24, 2010)

- Generally in metropolitan cities water is supplied to houses through pipes. But in slum areas families share common tap. Ask students to prepare a report in small groups through discussion, *if the metropolitan cities plan to install water meters for tax collection, what will be the implication to the different groups (individual houses, apartments, slum areas etc)?* Students' attention may also be brought to what implication it will make to them if it applies to them.
- The life conditions of migrants labourers / workers (construction, waste collection etc) in urban and metropolitan area are very miserable. They are deprived of permanent and quality accommodation due to their migration, and they are unable to receive basic government facilities like goods on subsidized cost, and remain out-of-coverage of basic health, education and development services.
 Divide the class into small groups of 4 to 5 students in a group and ask them imagine the problem (if they were not exposed to such situation) and discuss this problem in detail and develop a plan / strategy to address it
- The extreme pollution by direct flow of industrial and domestic wastewater through canals and drains, dumping of non-biodegradable waste into rivers and rapid development works related to construction of roads and bridges of human activities cause threat to other animals and birds habitation as well as their extinction. The table

below gives the details of bird census of year 2009 and 2010 of Okhla Bird Sanctuary located in Yamuna river basin at Delhi.

- **Note:** You can choose data on 4 to 5 birds at a time and present it to students for analysis and inference.

Table 6: Number of migratory birds

Name of the Bird	Number of migratory birds observed in 2009	Number of migratory birds observed in 2010
Bar-headed geese	212	112
Gadwal	302	72
Northern Shoveler	854	484
Northern pintail	272	172
Common coot	355	231
Mixed flock of brown-headed and black-headed gull	877	345
Eurasian widgeon	18	15
Grey leg geese	416	411
Eurasian spoonbills	16	6
Common teal	184	78
Common pochard	320	28
Tufted pochard	236	4
Greater flamingos (local bird)	Large numbers	20 (tracked later)

- Let the students visualize the health facilities available to the 3 set of people given below:
 - Urban slum
 - Migrant labour living in an urban area
 - People living in rural / remote areas
- Divide the class into small groups, and assign the following tasks
 - Learners may be encouraged to spell out possible difficulties faced by the people in those areas
 - Possible strategies / solutions to address the difficulties

- Let learners imagine that they are living in a city. Let them list down the things they wanted to use, and how much they consume when resources are limited. ; describe how they cope with non-availability; what changes in their life activities / habits (individually and collectively) can reduce the pressure on resources / deterioration in the city.
- Divide your students into 3-4 groups, each group may play the roles of Gram Panchayat members and discuss on different developmental issues at panchayat level.
- Ask learners to imagine that their village has better internet connectivity. Let the students list the activities where different occupational groups of the village can engage using internet to improve their economic condition, through interacting members of each of the occupational group.

The child mortality and malnutrition is a serious concern of India. One of the UNICEF reports states that around 50% children in India are malnourished. As per National Family Health Survey (NFHS 3, 2005-06) 48 percent (61 million) children fall under of chronic under nutrition



The similarity between stunted and underweight growth and appalling rates of malnourishment is not peculiar to India. The reality is a global concern. Malnutrition rates that do not reflect the economic growth of a country in India. Photo: A. S. Reddy.

(The Hindu, Feb 4, 2010)



A SIGHT OF MALNOURISHED CHILDREN, according to India's third National Family Health Survey of 2005-06, 70 per cent of children between 12 months and 24 months are malnourished. PHOTO BY A. S. REDDY

(The Hindu, December 10, 2009)

- Divide your students in group and assign the following tasks:
 - (a) Discuss in group and enlist the characteristics of healthy and malnourished child

- (b) Visit to the locality where school is located and identify number of children appear to be malnourished
- (c) Ask students to prepare charts, posters and poems to eradicate malnutrition in their locality and organise programme for local community where students can display / express their ideas to educate the community about healthy food habit.
- The following tasks may be assigned in groups.
 - (a) Visit to the local village / community and interact with farmers on
 - i. What do they feel about their occupation?
 - ii. What is their reflection on farming activity in the past, present and how do they visualise in future?
 - iii. What are their preferences / opinions on their children continuing farming as an occupation?
 - iv. In case, they don't want their children to continue the farming as an occupation, what are the reasons for that?
 - v. What is their aspiration about their children occupation / profession?
 - (b) Visit to the local village / community and interact with agricultural labourers
 - i. What do they feel about their work?
 - ii. What is their reflection on their work in the past, present and how do they visualise in future?
 - iii. Are they engaged in any other job other than agricultural work? What are the reasons for it?
 - iv. What is their aspiration about their children occupation / profession?
 - (c) Let the students observe and list down different economic activities engaged in their village / locality and number of people involved in each of those activities; Interact with the elders who are living in the village and interview them about the changes in the different economic activities over a period of time
- In a brainstorming session list down the food items consumed by learners and its frequency (some food items are given here)

S.No	Name of the food item	Number of times taken in a week
1	Roti	
2	Boiled rice	
3	Dal	
4	Kichidi	

5	Maggi	
6	Noodles	
7	Fried rice	

(Note: Try to see any fast food consumed by learners and include into the list)

Divide your class into two groups and let one group of learners focus on the benefits of consuming each food item and the other group focus on the problems.

You may raise the following questions. Let students debate

- (i) Why do they prefer to have fast food?
- (ii) What is their opinion on nutrition content in fast food?
- (iii) Is consuming more food ensure nutrition requirement?

Ask your students to plan of balanced diet based on local food habit and availability.

The recent study published in Lancet journal indicates that smaller increase of overweight in India (obesity rates for women rose from 10.6 per cent to 12.6 per cent between 1998-99 and 2005-06). But the increase was steepest in urban areas in the west of the continent — nearly 40% in the early 2000s — almost doubling in less than 10 years. “Though it quoted smaller increase in India...the prevalence of obesity ranges between 30 and 50 per cent in Delhi, Jaipur and Chennai and more often in women, resulting in multiple cardiovascular risk factors,”

According to Lancet, unhealthy diet is pushing obesity rates in developing countries closer to those of wealthier countries such as the European Union and the US.

(November 12, 2012, Indian Express, New Delhi)

<http://www.indianexpress.com/news/Obesity-on-the-rise-in-India-says-Lancet/710062>

- Divide the students into small groups and assign the following tasks:
 - a) Collect the information on change of food style from newspaper, internet, library and other sources and discuss what are the healthy and unhealthy food styles emerging in Indian society
 - b) Collect information on school children’s physical activities

S.No	Name of the Physical Activity / Exercise	Number of students who play / do			Time duration
		regularly	occasionally	rarely	
1	Volley ball				
2	Foot ball				
3	Tennis				
4	Kabadi				
5	Running				
6	Walking				

- Raise the questions on following themes to sensitize the students the necessity of playing and physical activity for better health.
 - Amount of time spent in physical activities vs. appetite
 - Amount of time spent in physical activities vs. frequency of getting health related problems etc
 -

Skill development of individual members of the society helps in economic productivity as well as individual capacity of earning which enhances the quality of life and lead to the sustainable development. Skill development in rural, hilly and remote areas can contribute to improve productivity and working conditions in the agricultural sector as well as enabling rural workers, particularly young people, to access emerging employment opportunities beyond the agricultural sector. If good quality of skill development programmes organised in rural areas to enable rural workers to acquire and upgrade technologies; increase agricultural production; expand access to market and engage in farm activities which can generate supplemental income. But, infrastructure and programmes for skill development are scarce in rural, hilly and remote areas and thus the problem of access to training is most acute in these areas

(Source: National Skill development policy, 2009).

Divide your students into groups and following tasks may be carried out.

- a. Visit to the agricultural university / horticultural farms and interact with the officials about new skills or upgraded technology for different crops production
- b. Interview with farmers / farm labourers on did they received any kind of training or awareness programme by government officials on new techniques of farming, off-farm activities etc. through national employment programmes, such as National Rural Employment Guarantee Scheme (NREGS).
- c. Let them discuss in group and suggest some plan to improve the situation based on their understanding which they acquired through these interactions.

Rural development can be achieved by establishing better infrastructure such as water Sanitation, housing, road, drainage system facilities to the community. It is observed that in India more than 60% of population do not have sanitation drainage facilities.

Divide your class into groups and ask them to

- d. Visit nearby village, town / city and make a survey on the facilities such as sanitation, water supply, drainage, road, health facilities etc.
 - e. Discuss the information which they collected through survey with a focus on 'difference between village and town' - how and why?
 - f. Prepare a report on their visit and provide some solutions to address the problem and present it in the whole class.
- Divide the students into groups and ask them to
 - Visit the nearby village and interview the different occupational groups
 - What is their reaction on migrating to urban area if they have chance / opportunity?
 - What are the reasons?
 - What if they were provided with the best infrastructure, services, market support to agro-businesses and having better employment opportunities by industries in their / neighbouring village itself, would they still prefer to migrate?

Let the groups present their findings in the classroom and discussion may be initiated.

In addition to the above, the following activities/assignments may be given

- Make a table with two columns to show the advantages and disadvantages of urban and rural life
- Prepare a plan for the waste management in your school
- Make a collage using the waste materials that cause pollution depicting the problems of urbanisation
- Find songs in your folklore/ culture describing the harmony of human life with nature. Use these songs as a medium to promote the same idea
- Visit a nearby town and make a list of the sources of noise pollution, sources of litter and the wastes thrown around
- Organise a debate on the issue of widening the national highways and felling of trees on either side of them for the same reason
- Organise a seminar on topics like green city, cleaner and healthier surroundings etc.
- Visit to a construction site. Ask the students to observe and note down how the topography of the landscape is being transformed
- A group of students may visit a few senior citizens living in urban area and discuss how things have been changed over a period of 25 years and make a presentation in the class
- Students can make a brief case study on a piece of cultivable land that is being developed for construction of buildings and its impact on the surrounding area-
- Group discussion- Divide the class into four or five groups. The groups may be asked to discuss the following questions in the urban context
 - Industrialisation
 - Construction work
 - Increasing transportation
 - Modernisation
 - Modern lifestyles
- Brainstorming session on “Human activities - responsible for environmental degradation and suggestions for sustainable urban development”.

For you to think and act...

- Identify the subject and the units in which the concepts discussed here can be integrated.
- What are the concepts related to human settlements that you would be able to integrate?
- What are the co-curricular activities that can be organized to sensitize the students about urbanization and the problems related to it.

Reflect on...

- ❖ Were you able to integrate the concepts of human settlement and sustainable development effectively in the units identified?
- ❖ What were your experiences during the process of developing an awareness related to the above in learners?
- ❖ What were the activities and the strategies you were able to organize for learners? Did you feel a sense of achievement that you were able to develop an awareness and critical thinking in students?
- ❖ What were the attitudes and values that you were able to observe in your learners as an outcome?

Module Five: Intercultural Understanding, Peace and Human security for sustainable development

Introduction

As we all know, our country is rich with so many cultures, languages and traditions. This cultural diversity provides opportunities for education and sustainable human development. In its rich diversity, culture has intrinsic value for development, social cohesion and peace. Cultural diversity is a driving force of development, not only in respect of economic growth, but also as a means of leading intellectual, emotional, moral and spiritual life. Cultural diversity is an asset that is indispensable for poverty reduction and the achievement of sustainable development. Peace and security are fundamental to human dignity and development. Education for sustainable development plays a key role in promoting values for peace. This module presents the need of intercultural understanding with cultural diversity, peace and human security for sustainable development.

Focus points

Intercultural understanding, cultural diversity, peace and human security

Objectives

This module facilitates you to

- Integrate the concepts of intercultural understanding, need for peace and human security appropriately in the school subjects.
- Organize co-curricular activities to promote the awareness of intercultural understanding.
- Enable learners to appreciate cultural diversity in India

- Enable learners to collect, analyze and disseminate examples of “good practices” which demonstrate how Cultural Diversity and Intercultural Dialogue can be part and parcel of ESD
- Enable learners to analyse the importance of peace and human security
- Provide appropriate learning experiences for learners to participate effectively in activities inculcating intercultural understanding
- Enable learners to analyse the problems related to human security and peace in the society.
- Enable learners to evaluate the role of technology in preserving and demolishing the culture

Issues to be focussed

- Why do we need to have an understanding about intercultural understanding?
- How is respecting the cultural diversity related to peace and human security?
- What is the relevance of peace and human security in the present world context?
- What are the different ways by which we understand and appreciate the cultural diversity in India?
- What are the main reasons for the indigenous knowledge getting deteriorated day by day
- What is the influence of technology on culture?

Content and Processes

Over the past few decades, the processes of economic globalization, combined with rapid advances in ICT and more rapid forms of transport, have brought us closer together, thereby increasing interconnectedness. Such close links and communication between peoples and cultures could potentially bring greater understanding, international cooperation and knowledge exchange, greater levels of interdependence, harmony and improved human relations. Unfortunately, we see that there is an increase in racial, social and religious tensions, increasing intra-state and inter-religious conflicts, discrimination and intolerance,

threatening peace, human rights and security. The present situation of this kind in our country points out to the need for intercultural understanding that promote peace and sustainable development which can be attained through raising an awareness about in masses, either informal or formal education. There is a need to understand the meaning of culture and diversity of cultural practices in our country. It becomes important to engage individuals and organizations in becoming part of a global network for culture, dialogue and sustainability. Let us look into the meaning of culture in order to address the other factors through education.

Understanding Culture

UNESCO's Universal Declaration on Cultural Diversity (2001) defines culture as "the spiritual, material, intellectual and emotional features of a social group" including the values, beliefs, attitudes, behaviours, customs, traditions, practices, identity, lifestyle, language and religious faith of diverse peoples.

As you have experienced, culture is reflected in our language and colloquial expressions, dress, food, laws, heritage, history, technology, and the values or attitudes that are reflected in our conversations and relationships. It is also expressed in the arts, music, dance, theatre, architecture, literature and in the festivals we celebrate. We see different forms of dance and music in different part of India, which reflects the culture and uniqueness of that place. Many of these determine the face of sustainability in each society, and therefore also form the basis for the content of a curriculum in intercultural understanding. Culture is not only reflected in different languages, art forms and practices, but also in our ways of doing, being and living together.

To integrate Intercultural Understanding in the school curriculum, a broad definition of culture is adopted which includes the whole experience of life in all its dimensions, as follows: (source: *Education for Intercultural understanding, UNESCO*)

Physical – cultural practices and what people *do*

Intellectual – traditional knowledge and diverse ways of *knowing*

Emotional – diverse ways of expressing emotions (e.g. love, compassion, joy, sorrow)

Spiritual or religious – beliefs, practices,

Aesthetic – art, music, dance, concept of beauty, etc.

Linguistic – languages spoken

Social – social issues faced by diverse cultures, equity/inequity, human rights, disadvantage, discrimination, experience of social conflict and harmony

Political – diverse political systems

Historical – the history of cultures, migration, colonization, experiences of disadvantage and marginalization, war, conflict and peaceful co-existence power relations - disadvantage, injustice, minorities, marginalisation moral/ethical – differences and similarities in values across cultures.

In the past, it may not have been as important to foster intercultural understanding to the students, as they were surrounded by their culture in every aspect of their lives. Cultural values at home, in the community, in places of worship and at school were consistent. The kinds of things used in daily life, the values and practices were determined in the culture of a specific society. In this situation, the children were secure and confident of their culture due to limited exposure to cultural difference. The situation is very different today, as children are exposed to other cultures constantly within their own community and through the presence of the media and so on. There are many things adopted from other cultures, for example, conducting marriage ceremony, food habits, dressing etc. We also see how media influences our ways of thinking on many matters. The flow of changes has also become rapid due to globalization. This situation necessitates the need for education in intercultural understanding to strengthen one's own culture and to gain deeper understanding of others. The school education can play an important role in bringing about this awareness and positive attitude and values required for intercultural understanding.

In the present NCERT Social Science textbook, these concepts can be integrated meaningfully along with suitable activities and illustrations to create awareness on sustainable development. A few activities and learning experiences are provided here to facilitate you to promote intercultural understanding, and sustainable development.

- Ask students about the different cultural festivals, folklores etc. of India. They may be asked to prepare a chart /collage as follows, which projects different cultural forms of India.



Students may be asked to discuss on the following:

- What are the different cultural diversities we find in India?
How can we preserve these traditional cultures?
- Which among these cultural activities help in sustainable development?
- Provide some articles on Indigenous practices for students to read. A discussion may be initiated on how this indigenous knowledge is helping in sustainable development.
- Following is an article on the Convention on Biological Diversity. Students may be asked to read it and reflect on why traditional knowledge has to be preserved and the importance of such an article.

Article 8(j) - Traditional Knowledge, Innovations and Practices

Introduction

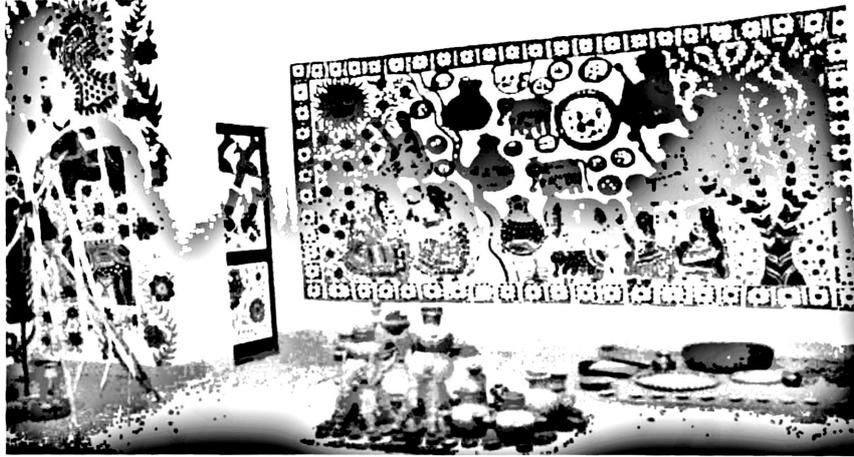
Article 8(j) states

Each contracting Party shall, as far as possible and as appropriate:

Subject to national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge innovations and practices.

The students may be asked to talk to their parents and grand parents about some of the traditional practices and knowledge which they have had during their younger days and which are no more in existence now. In certain families, old artefacts, antiques including palm leaves on which things written in olden days may be available. In certain families, books related to herbs and medicines used during olden days may be available. Ask students to collect information about them, if possible, bring their pictures to the class in order to have a discussion. Highlight on the importance of treasuring indigenous knowledge.

- A field visit may be planned to a museum of Tribal heritage. Ask students to observe the various tribal customs and traditions and make a report of the cultural diversities they have observed.



- Ask students to discuss about the different customs that they follow in their homes. Let them share their knowledge and discuss as to how far these customs are helping towards sustainable development.
- A photography (or Poster) exhibition may be organised on different cultural diversities found in their locality or in different parts of India. Present the pictures like the following and ask students to identify what they are, and to which State they belong to.



- Give a project to the students - to conduct an interview with an elderly person/ grandparents about the ways they celebrated different festivals in their childhood. The information obtained may be analysed and the reports may be presented in the class. Let the discussion focus on the cultural practices related festivals and whether they help in sustainability. For example, use of crackers during diwali celebration may be taken as an issue-whether it helps in sustainability of environment.
- A discussion may be initiated on the various terrorist attacks that the students have heard about and also on the impact and consequence of it on peace and human security.



- Let the students collect the newspaper items reporting about communal riots based on religious and language issues and discuss in the class. Highlight the importance of secularism in our country. Focus on the importance of appreciating the diversity of cultures, languages, rather than people differentiating them with hostility and negative attitude.
- Arrange for an exhibition of culture, where different artefacts, pictures and various art forms, monuments and architecture of different historical places, food items of different places, variety of costumes and dresses of different parts of the country, ancient scripts and so on are displayed. The objective of the exhibition should be to bring people of different places and culture together; expose students to rich cultural heritage of our country.
- Arrange for celebration of various State festivals in the school in which all students participate. Let the students take up the responsibility of getting together in planning for the festivals.

- Focus on the point that how inter cultural understanding can promote peace and security in the country and thereby help in the sustainable development.

References:

UNESCO, Peace and human security -

<http://www.unesco.org/en/esd/themes/peace-and-human-security/>

UNESCO Cultural diversity

[http://portal.unesco.org/culture/en/ev.php-](http://portal.unesco.org/culture/en/ev.php-URL_ID=34321&URL_DO=DO_TOPIC&URL_SECTION=201.html#topPage)

[URL_ID=34321&URL_DO=DO_TOPIC&URL_SECTION=201.html#topPage](http://portal.unesco.org/culture/en/ev.php-URL_ID=34321&URL_DO=DO_TOPIC&URL_SECTION=201.html#topPage)

UNESCO, Convention on Biodiversity –

<http://www.cbd.int/traditional/>

Module Six :

Bio-Diversity and its conservation for sustainable livelihood

Introduction:

Bio-Diversity means a variety of species of all living plants, animals and microbes living in the natural habitats. Our biosphere has immense diversity (heterogeneity exists, which we can call, species bio-diversity. Without losing the resources, managing the existing natural resources in sustained manner is called sustainable livelihood. This module focuses on the bio diversity conservation and human interference as a biotic factor.

Focus Points

- Need for Biodiversity conservation.
- Forest resources conservation approaches.
- Human forest relationship.
- Human impact on forest (Anthropogenic activities)
- Mapping of particular environment for bio-diversity rich Zones.

Objectives: This module facilitates you to

- Integrate the concepts of bio diversity and its importance in the relevant units in subjects like science, social science and languages.
- Enable the learners to understand the importance of bio-diversity as a resource to be conserved
- Develop an awareness in learners about Endangered, Extinct, Rare, threatened, Common, Gregorian and Vulnerable distribution of species as per UNDP
- Illustrate through various examples about the impact of human colonization and its effects on the diversity of species.
- Help the learners to analyse the judicious management practices and strategies for conserving biodiversity
- Relate the cause that lead to extinction of species
- Develop positive attitudes and values in learners towards conserving biodiversity.
- Suggest measures to conserve biodiversity.

- Enable learners to critically examine the issues and concerns related to maintaining the eco balance.

Issues to be focused

- Why forests are getting depleted?
- Why do we need forests?
- Who are the custodians these forests?
- What are the threats to the Bio-diversity?

Content and Processes

The world's forest provides an array of goods and services critical to economic development and human well being. Forests produce tangible and intangible products. Forests also perform a range of environmental functions that protect and maintain ecosystems at local, regional and global levels. These services are important not only to proper ecosystems functioning, but also for agricultural productivity, species diversity and absorption of carbon -dioxide that would otherwise trap, solar heat in atmosphere, that lead to global warming. The Green House gas emissions have become a critical concern in today's world. The world organizations, and many environmental organisations and research centres have raised an alarm about the deteriorating condition of the earth planet and called for saving it not only in the present, but also for sustainability of future. We also see that a number of plant and animal species have become extinct over a period of time. Use the table given below to show the destruction of biodiversity in India.

India: A land of Diversity and Destruction		
Biodiversity element (indicative examples)	Range native to India	Destroyed/ under threat
Eco systems Forests	200 types, scrub to rain forest	Approx.50% wiped out over last century
Wet lands	8 types seasonal flood plains to lakes	One-third drained out,70% polluted
Agro-ecosystems	20 agro-ecological zones	Mass homogenisation across the plains
Coasts	Several types of beach, mangrove, coral reef systems	40% of mangroves wiped out, major portion of coral reefs bleached or silted
Wild species	47,000 plant and 89,000 animal species	
Flowering plants	17,500 species	At least 20 extinct; 10% threatened
Mammals	390 species	2 or 3 extinct; 20% threatened
Birds	1232 species	2 extinct; 5 to 10% threatened
Insects	57,000 species	No estimate
Domesticated	167 crop and 10 livestock species; tens of thousands of varieties	
Goats	20 breeds	50% threatened
	40 breeds	30% threatened
Sheep	18 breeds	100% threatened
Poultry	Thousands of varieties of several hundred species	No estimate; but probably in thousands
Crops		

Source: Ashish Kothari based on information from zoological survey of India, botanical survey of India, national bureau of Plant genetic resources

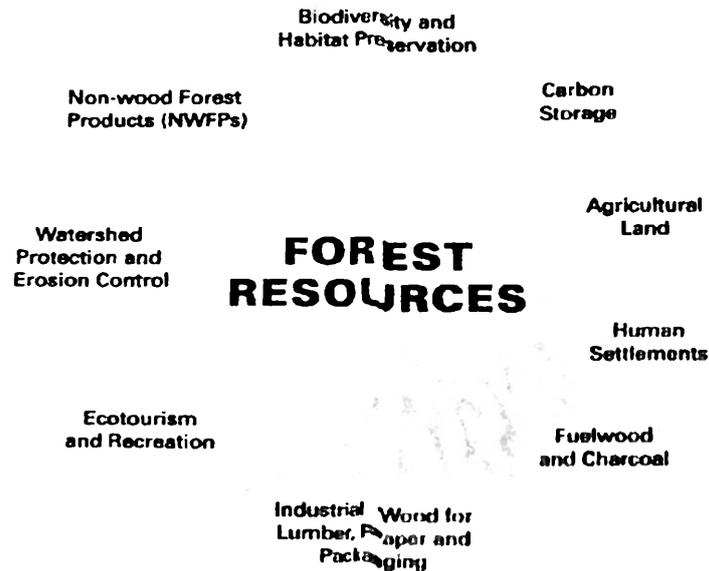
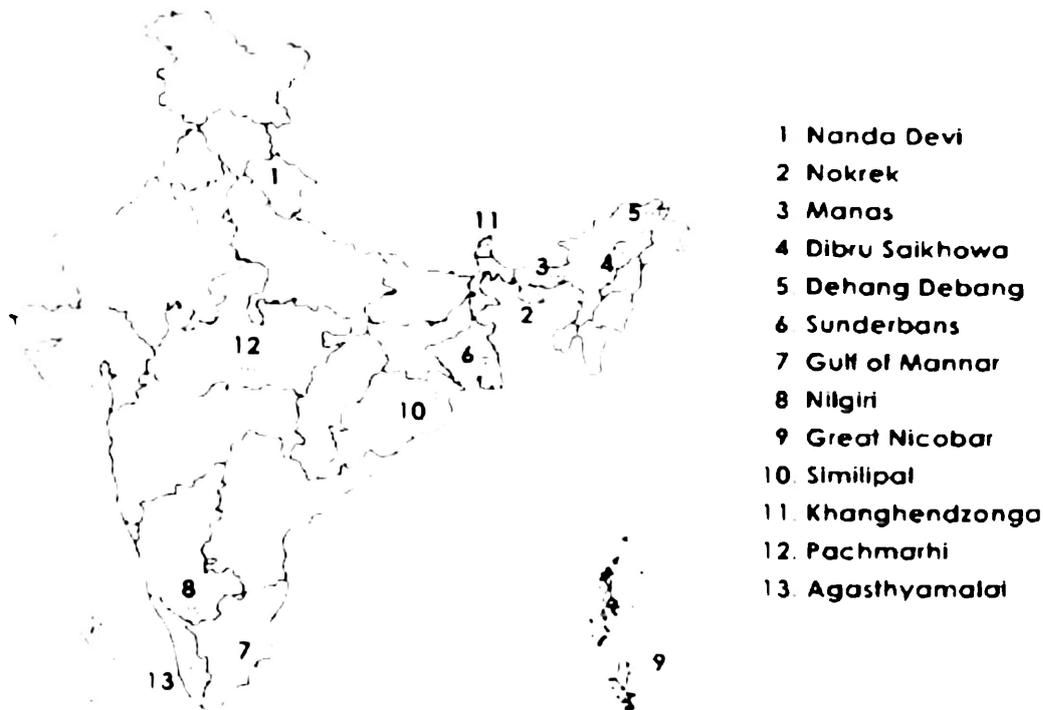


Fig. 8 Forest Resources

- Initiate a discussion about forest by raising a question such as why forest and forest products are required.
- Students may be asked to observe their home and list down the number of forest products being used in their homes. This may be followed by a brainstorming session on how to reduce the pressure on forest products and its importance of conservation. The picture given here may be used to initiate discussion on forest resources, and their consumption by human beings. Let them discuss about how human settlements has reduced the forest coverage

Certain questions like, “why certain spots are considered as bio- reserves and what is the role of bio-reserves in conservation of biodiversity?” may be asked to generate discussion and to gather information by students.

- Ask the students to identify the forests in India which are declared as reserve forests and map the bio-reserves and National parks of India.



- Provide articles regarding some of the projects for protecting wild life such as tiger project, elephant project etc. students may be asked to reflect on why these animals are being protected and how can we prevent the killing of such animals and what are the laws prevalent that are aiming at protection of wildlife.

Project Tiger, launched in 1972 has been proclaimed as a successful intervention for conserving the tiger population. There were 1827 tigers in 1972 the same has gone up to 3642 in 2001-02 when the tiger census was last conducted.

Project Elephant, launched in 1992 helps protect wild elephants from poaching and scientific management of elephant habitats. There are 24 elephant reserves in the country as on 31.03.2004. A programme called 'Monitoring of Illegal Killing of Elephants (MIKE)' launched in 2003-04 for effective prevention of poaching.

- Make use of the given pictures to create awareness in students about the threats to Tiger reserves of India.



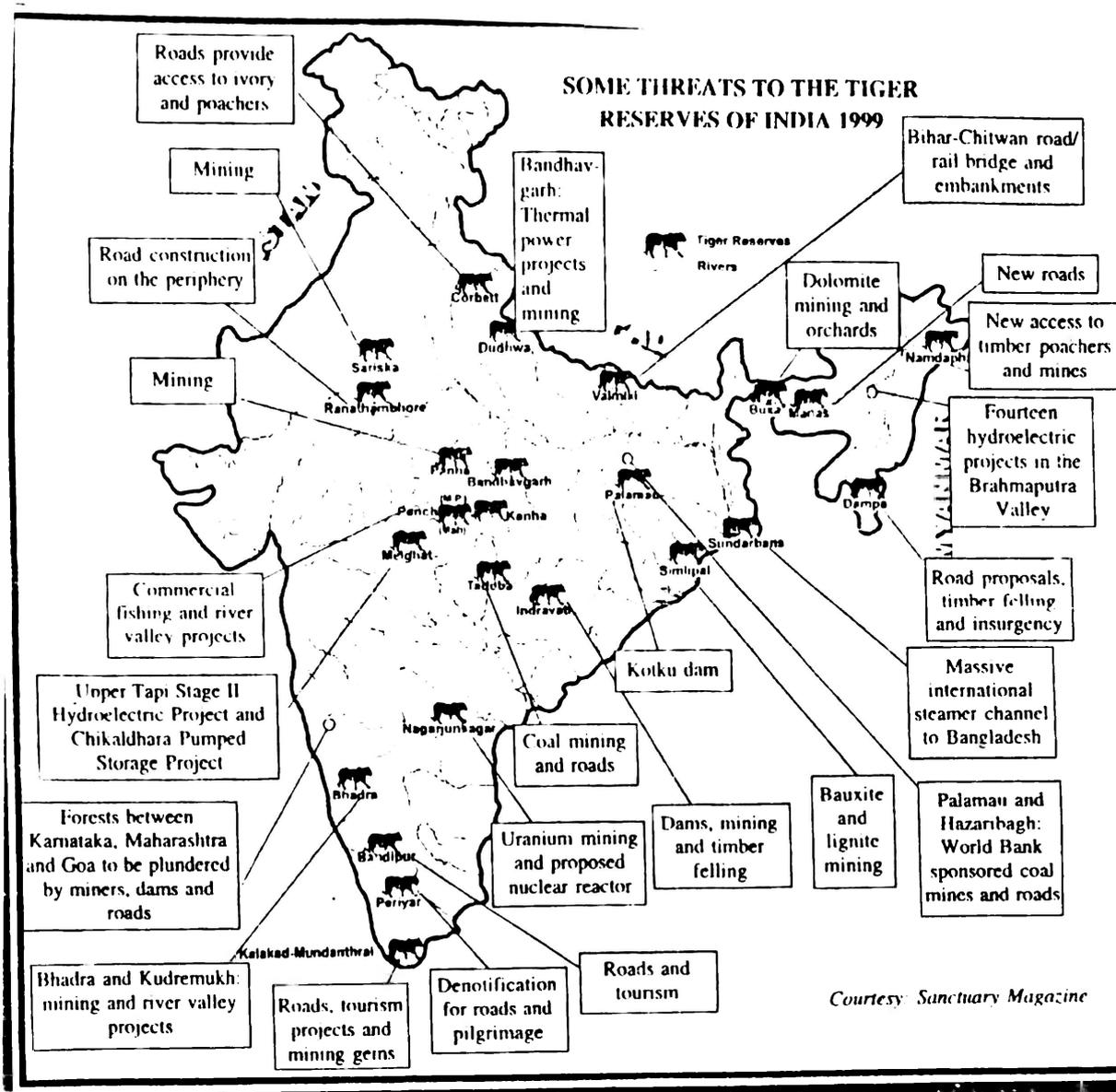
Ministry of Environment and Forests
Government of India
<http://envfor.nic.in>

Let's join hands to conserve wildlife



Ministry of Environment and Forests
Government of India
<http://envfor.nic.in>

Let's join hands to conserve Wild Life



- Making use of the information given in the table above, initiate a discussion focusing on the elements of biodiversity which are destroyed and are under threat. Let them arrive at some suggestions for protecting them.
 - Raise the following question to initiate discussion among students:
 - i) Why wetlands are important?
 - ii) Some of the flowering plants, mammals and birds are under threat. Find out the names of such plants, mammals and birds.
 - iii) Ask the students to discuss with their parents or elderly people in their family about the plants, animals and birds that were existing during their childhood days but not seen at present.

- Initiate the students to list out different life forms that are seen in their surroundings. Ask them to collect the different types of plants, leaves, seeds, and insects and so on. Ask one of the students to read the following article in the classroom followed by a discussion focusing on the following points:
 - Who are the custodians of this diversity?
 - What rights do they have on forests?
 - Can one justify in asking the tribal people to move out of their forest territory?
 - What role is played by the tribal people in protecting the forest? Illustrate with real life examples.



R. Prasanna Venkatesh/Wilderfile

Of Adivasi rights

The destruction of biological and cultural diversity across the world has led to an increasing realisation that traditional cultures, in particular indigenous and tribal peoples, may well provide answers for the future.

This feeling was clearly manifested in a national workshop on "Biodiversity and Adivasi/Indigenous Peoples", in New Delhi between January 29 and 31 this year. It was organised by the All India Coordinating Forum of Adivasi/Indigenous Peoples, in association with Kalpavriksh, and the ongoing National Biodiversity Strategy and Action Plan (NBSAP) process.

About 85 representatives of adivasi/indigenous communities, and support organisations, from all the regions of India, came to the following major conclusions:

- ✦ Adivasi peoples are severely threatened by the forces of globalisation, especially by their usurpation of adivasi lands and resources, often with the aid of the government. "Development" projects in "national and public interest" destroy livelihoods and biodiversity, and adivasis resolve to struggle against such projects. In this context, adivasis strongly warn the Government against recent moves to amend the Fifth Schedule of the Constitution, and denotify parts of Schedule areas to hand over lands to foreign capital and their agents.
- ✦ Adivasi/Indigenous peoples strongly reject the notion of intellectual property rights, including patents, on life forms, and on knowledge relating to biodiversity. All such knowledge must be in the public domain, and indigenous knowledge must be protected through appropriate community rights systems.

Left: Many tribals are forced by circumstances to find work as migrant labour because of lack of access to retributive justice.



Ushah Lakshmi

A specialist thematic working group is formulating an action plan on securing livelihoods through biodiversity conservation and use, and various agencies at local and State levels are preparing detailed, micro-level plans for the same. A recent workshop on adivasis and biodiversity, brought together 85 adivasis and supporters to discuss these issues. The results of all these exercises will feed into the national action plan, and hopefully influence governmental policy to be more sensitive to biodiversity-based livelihoods.



Far left: Ratsamma Oluole from Deccan Andhra: women's empowerment is the key to integrating conservation and livelihoods.

Left: Strong people's mobilisation based on livelihood links to the forest, has saved large patches such as this one in Mendha (Lekha), Maharashtra.

Biodiversity conservation – a way of life for the Irulas

The Irulas are a semi-nomadic tribe of hunter-gatherers in Tamil Nadu known for their skills of catching snakes and treating snakebites. High dependence on biodiversity for survival has made them acutely sensitive to their local environment, making conservation a way of life.

In the words of Irula women and men, "On entering a forest, we first look for medicinal plants as they are our means of sustenance. We then look for snakes... and then other animals (rats, rabbits, mongoose, cats, etc.) that we can catch for food and money. We use 36 different plants for treating snakebites. We identify them by keenly observing the animals, such as the mongoose, that use them. Similarly, we identify snake species and their burrows from their tracks, droppings and skins.

"We only hunt older rats and rabbits and while collecting termites, always leave some in each mound for them to re-grow. Similarly, we never remove all the roots of a plant while collecting roots and even replant the tops of the ones we remove.

"The medicinal properties of some plants have received so much publicity that they have become endangered. To protect such plants we have codified their use in our folk songs and we even spread myths about their being useless!

"While moving through our forests for hunting and gathering for a livelihood, we also carry seeds from one forest into another. Yet, we have to hunt stealthily since the law does not allow it."

As recorded by Manju Raju

- Initiate the students to list out different life forms that are seen in their surroundings. Ask them to collect the different types of plants, leaves, seeds and insects and so on. This can be an outdoor activity to observe the biodiversity. Provide them with a format like the following to do the outdoor project.

DIVERSITY

Objectives

- To study the plant diversity of an area
- To compare the diversity and density of plants between areas

Introduction

Plants occupy almost every kind of habitat. The variety within the plant kingdom is immense. The total number of plant species in an area/ecosystem refers to its plant diversity. The number of individuals of a particular species refers to the density of that species in that ecosystem. Diversity and density depend on various environmental factors. Human activities influence the diversity and density of plants in an area. In all habitats a web of inter-relationships connects plants and animals to each other.

Smaller representative areas are considered as samples, since it would be impractical to work larger areas. Though there are many sampling methods available, the 'plot method' would be suitable to study the diversity and density of plants. A plot is an area with a definite dimension and shape. Though a plot of any shape can be laid, it is convenient to choose a quadrangle. However, squares and rectangles are easy to measure and replicate. The boundaries of the plot can be defined using a string held in the corners by pegs. The area of the plot may vary according to convenience but maintain a uniform size for a specific type of vegetation such as trees, shrubs, etc. Many plots for a given type of vegetation need to be laid for a better enumeration. A minimum of 15% of the chosen area is to be covered for a statistically agreeable sample. It is not advisable to draw conclusions from a single plot.

Requirements Pegs, string, measuring tape, and writing materials.

Activity

1. Identify the area to be studied. For e.g., garden, park, roadside, play ground, agricultural areas like farms, plantations, etc.
2. Lay a plot using measuring tape, pegs and string
3. List the number of individuals of each species in the form of a table. An example is shown

Note

- Large plots have to be laid, if enumerating trees(say, 25m X 25m); while smaller ones will suffice for shrubs(say, 5m X 5m) and further smaller ones for herbs (say, 1m X 1m)

- Initiate a discussion on topic Deforestation and its pros and cons with a focus on Habitat loss that leads to species decline and also on the relationship between Human population Growth and species Decline.

- Each year an estimated 27,000 species of animals, plants, fungi, and micro organisms become extinct.
- Human migrations lead to pollution, deplete the atmospheric ozone shield, and leads species extinction, UV radiation which can change the DNA of any organism etc.
- The steady increase in human populations have an adverse effect on forest, which is natural resources: leads to extinction of some species which are widely consumed by mankind.

- Initiate the students to conduct an experiment in order to know why butterflies are to be protected. Ask them to observe where the butterfly is going and how frequently it visits the plants: Record how many plants it visits. This may be followed by a discussion on how cross pollination of plants is helping in maintaining biodiversity. A discussion related to dispersal of seeds, shape of seeds and mode of spreading of seeds in nature may also be carried out.
- Students may be asked to share their experience of visiting a Glass house. This may be followed by a presentation on how the green house effect happens.

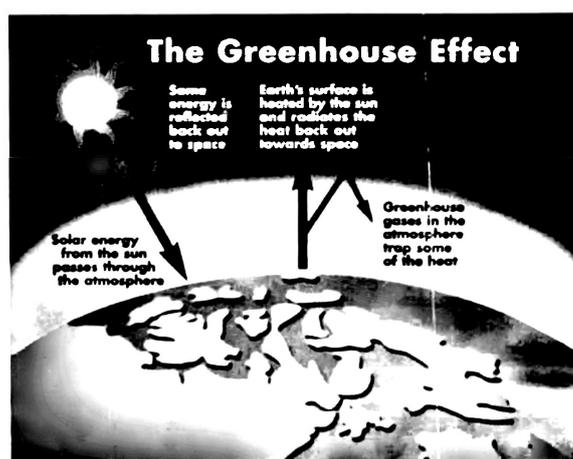


Fig.9 The Green House effect

- Students may be asked to prepare a concept map/ mind map about the factors that lead to global warming along with the measures that can be adopted by them to reduce the emission of green house gases. A sample of a concept map is given below.

111. Understanding Forest Loss

In its essence, deforestation results from choices that people and their institutions make about the use of land in order to survive, to improve livelihood and to profit. These choices are affected by many factors – demographic, economic, political, cultural and environmental – that vary widely in different times and places. Isolating population's role within this ensemble is difficult because all of them influence and are influenced by each other. As a result, clear, consistent and quantifiable connections between population dynamics and forest loss rarely emerge from scientific examination. However, once the multiple benefits of acting on population emerge – clearly especially those that individuals and families gain from better access to health care and education – the need to quantify the precise relationship of the population forest connection becomes less relevant. **If population policies are valuable on the merits of their individual and community benefits, and if one of their side benefits is a higher probability of**

abundant forests in future generations, then the argument for linking the two issues is strong.

Human beings do three things to trees in a forest: cut them, clear them off the land and burn them. To better understand why and to what extent each of these actions results in forest loss, it helps to distinguish between forces operating on different levels. The scientific literature divides these forces into two groups: *direct* and *underlying* causes. Direct causes are those activities that result in forest clearance. These include logging, mining, road building and farming. Attempts to identify who is most responsible for actually causing forest loss – loggers, farmers, ranchers or fuelwood collectors, for example – often produce little more than finger-pointing. Human beings can hardly be blamed for acting in their self-interest if their behavior is legal and not willfully destructive of the livelihood and property of others. A question deserving more attention is: Why is the loss of forests so much more pervasive and

ecologically hazardous today than historically? To address that question, it is more productive to consider the systemic forces driving the process of forest degradation and loss – in effect to ask what is causing deforestation rather than who is causing it.

FIGURE 8 Major Factors in Forest Loss

Underlying Causes	Direct Causes
Population change • growth • density • migration	Agricultural clearing of forests • subsistence agriculture • commercial farming • cattle ranching
Economic growth • rising income • dietary change • housing preference	Industrial logging
Poverty	Infrastructure and industrial development • roads • dams • mining • housing
Market failures • inadequate property rights • inappropriate valuation of forest goods and services	Fuelwood and charcoal production
Policy failures • price and taxation policies (e.g., subsidies, tariffs and trade restrictions) • population resettlement programs • corruption	

World Bank

Environmental Agencies / Organizations: Working towards conservation environment and forests.

International bodies:

WWF	World Wide Fund for nature
UNEP	United Nations environmental protection programme
IUCN	International Union for Conservation of Nature and Natural resources.
IMCO	International Marine Consultative organization
UNESCO	United Nations Educational, Scientific and Cultural organization (UNESCO)
MAB	Man and Biosphere programme.
UNCSD	The United Nations Commission on sustainable development.

- Ask the students to read the given news cuttings in the classroom, and let them discuss the factors influencing the forest loss. Let them also identify the human activities responsible for forest
- A video clipping about Mangrove may be shown in the classroom. Ask the students to discuss on the impact of loss of mangrove. A video clipping on the Tsunami in 2004

may also be shown and ask them to reflect on how can mangroves help in preventing such natural disasters?

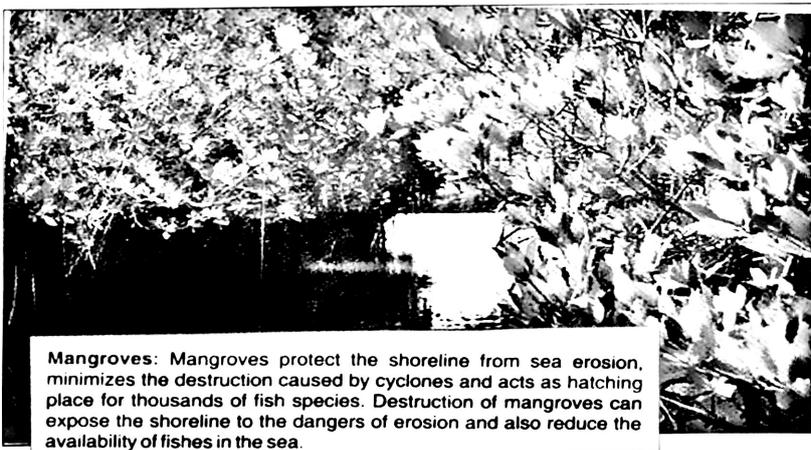
- Ask the students to give some suggestions to reduce the usage of paper. Let them come up with some suggestion to recycle the waste paper. Let them list down 'how they would reduce wastage of paper'.
- Ask the students to find out why do the shop vendors collect old news papers from homes and what do they do with that.

Give a project to make a list of endangered animals, plant in India or bring some information on vulnerable plant species which are of medicinal importance in India.

Case study 1:

In the state of Madhya Pradesh forests, the tribal's major economy is based on the Beedi leaf collection (Tendu leaves) (Botanical name- Diospyrus melanoxylon- Ebenaceae). If we do not protect the plant species, it not only cause imbalance to the ecology, but also affect the economy of the community. (Similarly Teak wood (Tectona grandis- Verbanaceae) for further information refer to Population and Environment- Impacts in the developing world, an information kit containing questions and answers, abstracts of recent scientific papers, charts, official statements and a resource kit).

- Followed by this, you can initiate a discussion on Biological species pressure/ species exploitation. Raise questions as follows:



- What are the ways to restore such plants from getting depleted?

- Suggest some eco friendly ways by which one can improve the economy as well as the environmental diversity.

Case study II:

In 1973, a scientist (naturalist) discovered that all the trees of a particular kind in Mauritius were over 300 years old. About 13 in number, they were all dying. Though they bore fruits and nuts, none of their nuts were germinating. The scientist then happened to recall that about 300 years ago the last dodo was killed there. The scientist deduced that the nuts would not germinate unless they were first eaten by a dodo and had passed through its gut. Stones in the dodo's crop (a pouch in its gut) may have helped grind up the nuts, softening the seed-coat, so that the seedling could grow. The dodos were extinct, and no other bird on Mauritius was able to crush the hard nuts of what the scientist called the dodonut tree. The scientist knew that turkey, a kind of bird found in the American continent had a crop (gut) similar to that of the dodo. When turkeys were brought from America, and they were fed the nuts from the dodo nut tree, the seeds in the turkeys' droppings were seen to germinate. Thus, turkeys had to be introduced in Mauritius for the dodo nut trees to be saved from extinction.

Based on the above you may raise the following questions:

- What does this story warn you about?
- What adaptive advantage might the tree have in bearing nuts with hard seed-coats?
- Many Indian trees have hard seeds. The Indian Laburnum *amaltas* is one such tree. Find out the conditions under which it grows best and the time taken for its seeds to germinate. Do you know of any other tree with a hard seed-coat?
- The dodo and the tree were 'made for each other' species: one was a plant and the other an animal. Let them discuss the inter relationship between animals and plants.

Case study III:

In 1813, bird expert John James saw a single flock of passenger pigeon that he estimated was 16 kilometre (10 miles) wide and hundreds of kilometre long and contained perhaps a billion birds. The flock took three days to fly past him and was so dense that it darkened the skies. By 1914, the passenger pigeon had disappeared forever. How could a species that was once the most common bird in North America (and probably the world) become extinct in only a few decades? The extinction of this species largely resulted from uncontrolled commercial hunting and loss of bird's habitat and food supply as forests were cleared to make room for farms and cities. Beginning in 1858, passenger pigeon hunting became a big business. In 1878, one professional pigeon trapper made \$60,000 by killing 3 million birds at their nesting grounds near Petoskey, Michigan. On early 1880's few thousand birds remained. At that point, recovery of the species was doomed because the female laid only one egg per nest each year. On March 1900, a young boy in Ohio shot the last known wild passenger pigeon. The last passenger pigeon on earth, a hen named Martha died in Cincinnati zoo in 1914. Her stuffed body is now at the National Museum of natural history in Washington, D.C. (Miller)

Based on the above you may raise the following questions:

- Why should we care about protecting wild species?
- Which human activities endanger wildlife?
- How can we help prevent premature extinction of species?
- Discuss your reaction to the following statement: '*Eventually all species become extinct. Thus, it does not really matter that the passenger pigeon is extinct and that the whooping crane and the world's remaining tigers are endangered mostly because of human activities*'.

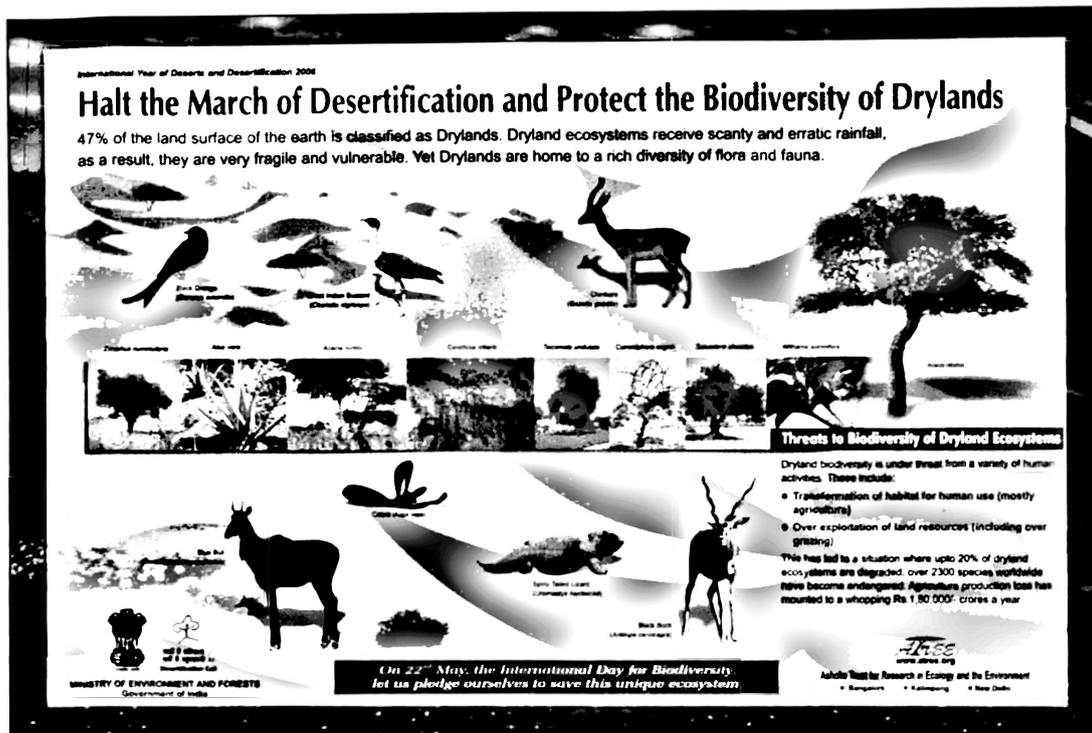
Case study IV

A Disturbing message from the birds

Human activities are causing serious declines in the populations of many bird species. Approximately 70% of the world's 9,800 known bird species are declining in numbers, and roughly one of every six bird species is threatened with extinction, mostly because of habitat loss and fragmentation. Birds are excellent environmental indicators because they live in every climate and biome, respond quickly to environmental changes in their habitats and are easy to track and count. They also play important ecological roles- control of rodents and insects, pollinate variety of flowering plants, spread plants throughout their habitat, scavenge dead animals etc. (Miller)

Based on the above you may raise the following questions:

- What can one do to the environment to prevent pollution thereby to protect the endangered species?
- What will you do if you observe that some of the bird species in your locality is getting reduced in number?
- Show the pictures (posters) like the one that is given below to the students, and ask them to prepare such posters depicting the importance of biodiversity conservation.



- What are the cultural practices of the tribals living in forest regions to conserve trees and animals? This may be given as a project to the students. They may be instructed to visit a nearby forest and find out the details.
- Raise a question for discussion, "How is conserving biodiversity help in sustainable development?" Highlight on the following points during the discussion.
 - ❖ The unsustainable use of our natural resources, combined with the needs of a growing global population, is seriously jeopardizing the health of our ecosystems, resulting in the loss of biodiversity.
 - ❖ Today, approximately 17,000 species are in danger of extinction. As biodiversity declines, so too does the resilience of our ecosystems. Scientists estimate that 60% of the Earth's ecosystems have reduced their capacity to deliver the vital ecosystem services on which we all depend. Loss of biodiversity also leads to loss of cultural diversity.

According to the Millennium Ecosystem Assessment released in March 2005 there has been a substantial and largely irreversible loss in the diversity of life on Earth due to human action. Among the outstanding problems is the dire state of many of the world's fish stocks, the vulnerability of the 2 billion people living in dry regions to the loss of ecosystem services and the growing threat to ecosystems from climate change and nutrient pollution

- Conservation of biological diversity is the subject of Chapter 15 of Agenda 21 which was adopted by the United Nations Conference on Environment and Development in 1992 in Rio de Janeiro.
- In 2002, the World Summit on Sustainable Development, in Johannesburg, addressed biological diversity in Chapter IV, paragraph 44, of the Johannesburg Plan of Implementation. The Johannesburg Summit also endorsed the target to achieve, by 2010, a significant reduction of the current rate of biodiversity loss at global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on earth.

- ❖ The biological diversity, as well as the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity has a critical role in maintaining ecosystems that provide essential services, for sustainable development and human well-being.
- ❖ The severity of the global loss of biodiversity and the degradation of ecosystems undermine global development, affecting food security and nutrition, the provision of and access to water and the health of the rural poor and of people worldwide, including present and future generations. This highlights the importance of the conservation of biodiversity, enhancing habitat connectivity and building ecosystem resilience.
- ❖ The traditional knowledge, innovations and practices of indigenous peoples and local communities make an important contribution to the conservation and sustainable use of biodiversity, and their wider application can support social well-being and sustainable livelihoods. It is important to recognize that the indigenous peoples like the tribal communities living in the forests and local communities are often the most directly dependent on the biodiversity and eco systems and thus are often the most immediately affected by their loss and degradation.

Reflect on...

- ✚ What are the subjects and the units in which the concepts of this module could be integrated?
- ✚ What are the transactional strategies that can be used besides the activities mentioned in this module to develop awareness in students?
- ✚ Could you use the activities suggested in this module? What are the outcomes that you were able to observe in students as the result of activities given?
- ✚ Could you drive the point “How saving bio diversity is very important for sustainable development “in students? What were the problems or difficulties faced by you during the process?
- ✚ Were you able to answer student’s questions or queries regarding biodiversity? What were the questions that you were not able to answer?
- ✚ What is your sense of accomplishment in creating awareness about biodiversity and sustainable development? Were you able to develop required attitudes and values? If so, how do you ensure of these?
- ✚ What are the visits that you had planned for students with respect to biodiversity? What were the experiences of students? What were your experiences of guiding the students?

Module Seven : Agriculture: Sustainable food for all

Introduction

India is an agricultural country, where 70% of the population is directly or indirectly associated with farming. Agriculture is a regulated production of food for consumption by human as well as other domesticated organisms. Animal heads were part and parcel of Indian agriculture and women were responsible for conservation and preservation of native seeds through rituals and native techniques. Agriculture has changed dramatically over a period of time. Food and fibre productivity has soared due to new technologies, mechanization, increased chemical use, specialization, and government policies that favoured maximizing production and reducing food prices. Although these developments have had many positive effects and reduced many risks in farming, they also have resulted in significant problems such as topsoil depletion, groundwater contamination, air pollution, greenhouse gas emissions, the decline of family farms, neglect of the living and working conditions of farm labourers, new threats to human health and safety due to the spread of new pathogens, economic concentration in food and agricultural industries, and disintegration of rural communities.

This module focuses on integrating the concepts of sustainable agriculture, like cultivation of food crops, making use of several local resources, making cultivation and consumption sustainable by organic compost and organic farming methods.

Focus points

Agriculture and its practices; suitable agricultural practices; food and nutrition; cultivation of food crops and sustainability of food

Objectives

This module facilitates you to

- Integrate the concepts of sustainability of food appropriately in social science and science subjects

- Plan activities and projects for learners which enable them to learn about the importance of agriculture
- Focus on agriculture as a sustainable practice
- Enable learners to identify the relationship between nutrition and health
- Enable learners to identify different types and methods for cultivation of food crops, vegetables and fruits
- Enable the learners to understand the significance of mixed farming and crop rotation
- Guide the learners in understanding various factors that are important crop production.
- Explain the importance of various soil inputs (compost, vermicompost used in agriculture) with evidences
- Enable learners to realize the effects of pest- repellents (Sprays, traps, Integrated pest management and Ecological pest management) pesticides and foliar sprays
- Assist students in exploring different methods of crop harvesting and storage, irrigation practices
- Enable learners to analyse the importance of recycling of agro waste
- Assist learners in exploring various methods of conversion and usage of different end products in agriculture
- Guide learners to identify and list down various medicinal herbs with their herbal remedies and traditional knowledge
- Focus on organic /bio farming

Issues to be focused

- Why do we need intercrops especially in horticulture?
- Why is green manure important?
- Role of women village economy

- Why traditional knowledge of medicinal plants is neglected today? What do we do to revive the practice?
- . Why does the Government continue to allow the use of carcinogenic pesticides in farming?
- Do we produce enough food to feed world's people?
- How serious is malnutrition, especially for children?
- Are the traditional sustainable methods effective in raising crops?
- Can we continue expanding the green revolution?
- Can we grow more food in urban areas?
- Do government policies affect production of crops?
- How can we design and shift to more sustainable agricultural systems?
- India being a country with rich biodiversity, would genetically modified organisms be a threat to our biodiversity?
- How safe is genetically modified plants and poultry for consumption?
- Why do people depend on exported variety of fruits and vegetables rather than depending on fruits and vegetables that are grown in our own compound?

Content and processes

Sustainable agriculture integrates three main goals – environmental health, economic profitability, and social equity. It rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Social, economic, and environmental sustainability are closely intertwined and necessary components for a truly sustainable agriculture. For example, farmers faced with poverty are often forced to mine natural resources like soil fertility to make ends meet, even though environmental degradation may hurt their livelihoods in the long run. Only by creating policies that integrate social, environmental, and economic interests can societies promote more sustainable agricultural systems.

There is a need for a balanced relationship between the natural and human resources in order to attain economic gain. The human resources includes consideration of social responsibilities such as working and living conditions of labourers, the needs of rural communities, and consumer health and safety both in the present and the future. The land and natural resources involves maintaining or enhancing the quality of these resources and using them in ways that allow them to be regenerated for the future. Sustainability considerations must also address concerns about animal welfare in farm enterprises that include livestock.

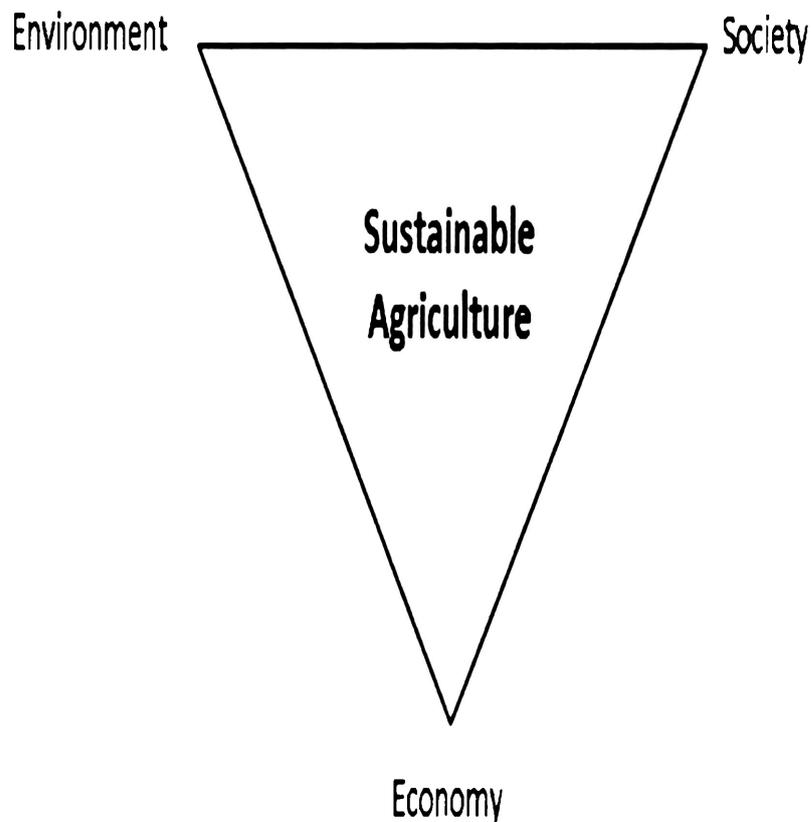


Fig. 12 Three dimensions of sustainable agriculture

The major problems confronting Indian agriculture are those of population pressure, small holdings, depleted soils, lack of modern technology and poor facilities for storage.

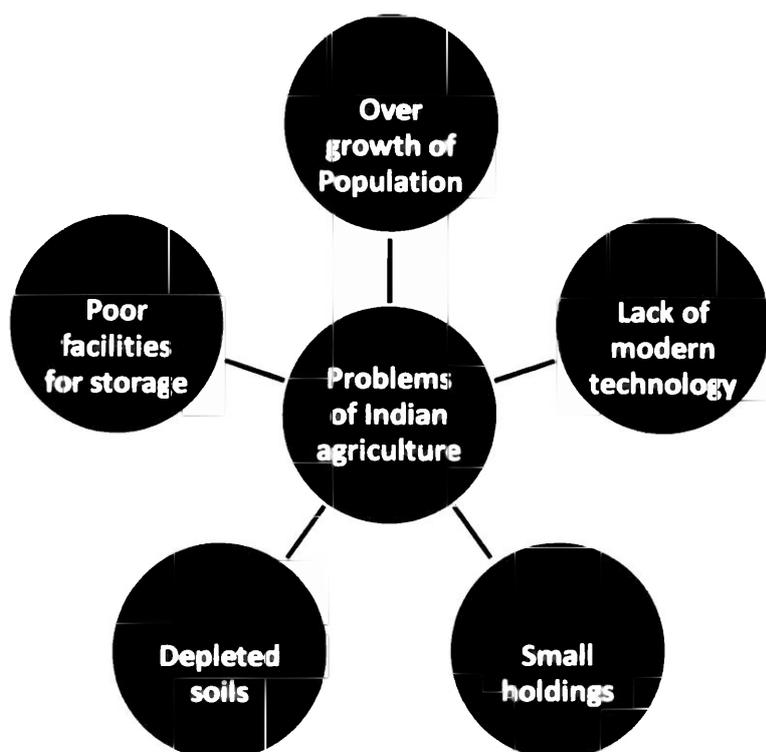


Fig. 13 Problems of Indian agriculture

(a) Population problems

India has a huge population of over one billion and it is increasing at a very fast rate. According to 2001 census figures the overall density of population is 324 persons per sq. km. This is likely to increase further in future. This has created great demand for land. Every bit of land has been brought under the plough. Even the hill slopes have been cut into terraces for cultivation.

- Students may be asked to observe how there is a demand for sites to build houses in their locality, and how trees and forest land have been cleared to erect buildings, malls and houses.

(b) Small and Fragmented Land Holdings:

The pressure of increasing population and the practice of dividing land equally among the heirs has caused excessive sub divisions of farm holdings. Consequently, the holdings are small and fragmented. The small size of holdings makes farming activity uneconomical and leads to social tension, violence and discontentment.

- Of late, we see that most of the farmers selling away their lands. Students may be asked to find out the causes by interviewing some of the farmers nearby.

(c) Inadequate Irrigation Facilities:

By and large the irrigation facilities available in India are far from adequate. So for half of the total area under food crops has been brought under irrigation and the remaining half is left to the mercy of monsoon rains which are erratic in time and space.

- We see many farmers families settled in towns and cities. What are the reasons for their migration? Is the lack of monsoon rains in certain regions the major cause for selling away the lands and migrating to the nearby towns and cities in search of jobs? Ask students to carry out a project- interviewing the migrated farmers to know the causes for selling away their lands to settle down in cities.

(d) Depleted Soils:

Indian soils have been used for growing crops for thousands of years which have resulted in the depletion of soil fertility. With deforestation the sources of maintaining natural fertility of soil has been drying out. Lack of material resources and ignorance of scientific knowledge have further depleted the soils of the natural fertility. Earlier only animal waste was enough to maintain soil fertility.

- Students may be asked to interview the farmers to find out the measures adopted by them to increase the fertility of the soil; what do farmers do in case of monsoon failure and how do they cope with the economic loss etc.

(e) Storage of food grains:

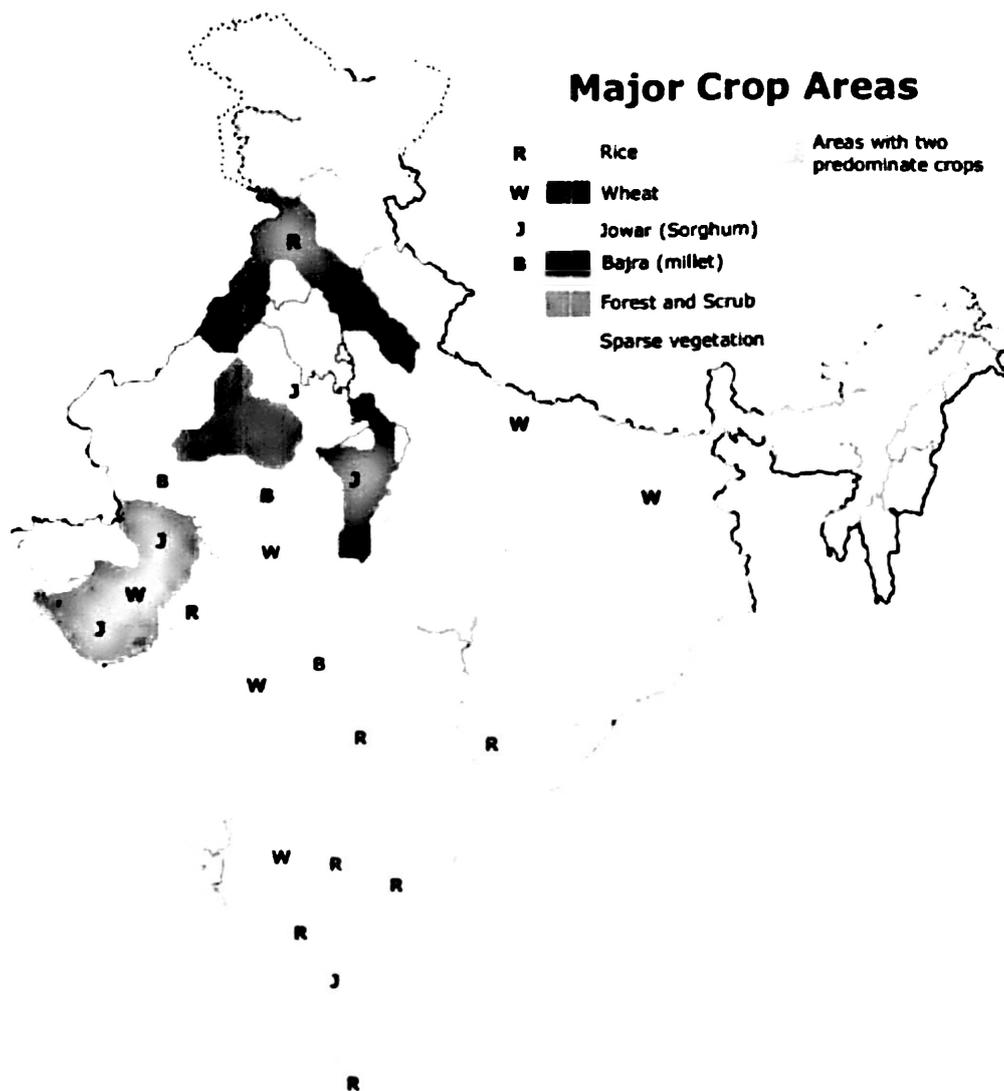
Storage of food grains is a big problem. Nearly 10 per cent of our harvest goes waste every year in the absence of proper storage facilities. This colossal wastage can be avoided by developing scientific ware-housing facilities. The government has taken several steps to provide storage facilities.

- Ask students to find out the methods adopted by the farmers to store the grains and other food crops. Let them also find out the storage measures adopted by the cooperative society who buy the grains from the farmers. Ask them to look into the

old editions of newspapers where there was a news of throwing away the large quantities of wheat which was stored in the godowns, without supplying to the public.

(f) Farm Implements:

Although some mechanization of farming has taken place in some parts of the country, most of the farmers are poor and do not have enough resources to purchase modern farm implements and tools. This hampers the development of agriculture.



- While teaching social studies, students may be asked to identify the states where the above mentioned crops are grown using the India map.

Factors to be considered for sustainable agriculture

Water. When the production of food and fiber degrades the natural resource base, the ability of future generations to produce and flourish decreases. Water is the principal resource that has helped agriculture and society to prosper, and it has been a major limiting factor when mismanaged. Several steps should be taken to develop drought-resistant farming systems even in "normal" years, including both policy and management actions: 1) improving water conservation and storage measures, 2) providing incentives for selection of drought-tolerant crop species, 3) using reduced-volume irrigation systems, 4) managing crops to reduce water loss, or 5) not planting at all.

Water quality. The most important issues related to water quality involve salinization and contamination of ground and surface waters by pesticides, nitrates and selenium. Salinity has become a problem wherever water of even relatively low salt content is used on shallow soils in arid regions and/or where the water table is near the root zone of crops. Tile drainage can remove the water and salts, but the disposal of the salts and other contaminants may negatively affect the environment depending upon where they are deposited. Temporary solutions include the use of salt-tolerant crops, low-volume irrigation, and various management techniques to minimize the effects of salts on crops. Pesticide and nitrate contamination of water can be reduced

Air. Many agricultural activities affect air quality. These include smoke from agricultural burning; dust from tillage, traffic and harvest; pesticide drift from spraying; and nitrous oxide emissions from the use of nitrogen fertilizer. Options to improve air quality include incorporating crop residue into the soil, using appropriate levels of tillage, and planting wind breaks, cover crops or strips of native perennial grasses to reduce dust.

Soil. Soil erosion continues to be a serious threat to our continued ability to produce adequate food. Numerous practices have been developed to keep soil in place, which include reducing or eliminating tillage, managing irrigation to reduce runoff, and keeping the soil covered with plants or mulch.

Energy. Modern agriculture is heavily dependent on non-renewable energy sources, especially petroleum. The continued use of these energy sources cannot be sustained indefinitely, yet to abruptly abandon our reliance on them would be economically

catastrophic. However, a sudden cutoff in energy supply would be equally disruptive. In sustainable agricultural systems, there is reduced reliance on non-renewable energy sources and a substitution of renewable sources or labor to the extent that is economically feasible.

Sustainable practices

Sustainable production practices involve a variety of approaches. Specific strategies must take into account topography, soil characteristics, climate, pests, local availability of inputs and the individual grower's goals. Despite the site-specific and individual nature of sustainable agriculture, several general principles can be applied to help growers select appropriate management practices. Some of them are as follows.

Selection of species and varieties those are well suited to the site and to conditions on the farm

When site selection is an option, factors such as soil type and depth, previous crop history, and location (e.g. climate, topography) should be taken into account before planting.

Diversification of crops (including livestock) and cultural practices to enhance the biological and economic stability of the farm

By growing a variety of crops, farmers spread economic risk and are less susceptible to the radical price fluctuations associated with changes in supply and demand. For example, in annual cropping systems, crop rotation can be used to suppress weeds, pathogens and insect pests. Also, cover crops can have stabilizing effects on the agro ecosystem by holding soil and nutrients in place, conserving soil moisture with mowed or standing dead mulches, and by increasing the water infiltration rate and soil water holding capacity. Livestock can buffer the negative impacts of low rainfall periods by consuming crop residue.

Management of the soil to enhance and protect soil quality

In sustainable systems, the soil is viewed as a fragile and living medium that must be protected and nurtured to ensure its long-term productivity and stability. Methods to protect and enhance the productivity of the soil include using cover crops, compost and/or manures, reducing tillage, avoiding traffic on wet soils, and maintaining soil cover with plants and/or

mulches. Regular additions of organic matter or the use of cover crops can increase soil aggregate stability, soil tilt, and diversity of soil microbial life.

Efficient and humane use of inputs

Sustainable farmers, however, maximize reliance on natural, renewable, and on-farm inputs. Equally important are the environmental, social, and economic impacts of a particular strategy. Sustainable approaches are those that are the least toxic and least energy intensive, and yet maintain productivity and profitability. Preventive strategies and other alternatives should be employed before using chemical inputs from any source.

Consideration of farmers' goals and lifestyle choices.

Management decisions should reflect not only environmental and broad social considerations, but also individual goals and lifestyle choices. For example, adoption of some technologies or practices that promise profitability may also require such intensive management that one's lifestyle actually deteriorates. Management decisions that promote sustainability nourish the environment, the community and the individual.

Animal Production Practices

In earlier days, most farmers integrated both crop and livestock operations. The two were highly complementary both biologically and economically. Though there are certain changes now, yet, we find that Crop and animal producers are still dependent on one another to some degree. Management of animal nutrition, breeding, grazing, health etc, need to be given importance.

The following activities may be incorporated while teaching the units related to agriculture, poultry and animal farming in social studies and science subjects.

- Keep old rice/ wheat/ flour and observe the weevils. Try if it can be expelled using neem leaves. It is followed by a discussion on the advantages of using plants as insect repellents and its importance in maintaining a healthy living.
- Identify a moist soil and dig a pit of 25cm X 25cm X 25cm. Count the number of earthworms and it indicates the soil health. The school can prepare a

vermicompost so that it can be helpful for the vegetable garden or medicinal garden in their school

- In India how many students below 5 years of age die of malnutrition? Ask students to collect data and present it in the class.
- A role play may be enacted by students on the impact of chemicals. Eg. Endosulfan. This may be followed by a poster presentation about the impact of using such chemicals.

Relief eludes many endosulfan victims

Distribution of compensation to 210 people in Belthangady taluk kicks up a row

Sudipto Mondal

BELTHANGADY/MANGALORE: The distribution of compensation to 210 purported endosulfan victims from the Kokkada, Nidle and Patrame villages in Belthangady taluk by the Chief Minister on February 28 has kicked up a controversy.

In the absence of a coherent scientific methodology to identify the victims, doubts are being raised by doctors and members of the public about the eligibility of those who have been compensated. Anybody with over 40 per cent disability is eligible for compensation. Because of this, claim for compensation has allegedly become a free-for-all.

For instance, a 26-year-old man who lost his fingers in dynamite explosion has been given compensation. The list, a copy of which is available with *The Hindu*, also has several persons who were born with congenital disorders much before the pesticide spray began.

"How can those born 60, 70 or 80 years ago with birth defects have suffered because of

endosulfan which was sprayed around 25 years ago?" asked a doctor.

Belthangady Taluk Health Officer Ravindranath T. said: "Our job was only to ascertain the percentage of disability in a person not to identify endosulfan victims".

According to him guidelines for identifying pesticide poisoning victims should be done by a team of forensic scientists.

However, the former Minister and MLA Shobha Karandlaje said: "Only genuine sufferers have been compensated."

She said: "A more scientific identification method can be adopted only after national level consultations."

Guruva (38) in Kokkada village of Belthangady taluk has rashes and scaly skin all over his body, including his face and scalp that bleed during summer.

He said that he developed the condition after he came into contact with endosulfan. But he was left out because skin disease does not qualify as a "disability".

Pushpa (34) from Patrame village has very little mobility



WILL THE SCARS HEAL?: Guruva (38) has a skin disease reportedly caused by endosulfan and has been declared ineligible for compensation.

- PHOTO: SUDIPTO MONDAL

in the fingers on her right hand and she too attributes her condition to the spraying of pesticide. "My disability

was certified as below 40 per cent," she said.

B. Shyamraj, Democratic Youth Federation of India

• Our job is to only identify persons with disability, says official

• People with skin diseases, infertility not eligible for compensation

Belthangady unit president is compiling a list of such persons and claimed that there were hundreds of such cases.

The three villages of Kokkada, Nidle and Patrame, which were considered worst affected by the pesticide, also has a high incidence of infertility/impotency with 54 officially recorded childless couples.

Dr Prakash, who heads the Kokkada PHC, said there could be many more such couples since most did not like to disclose such details.

"We cannot attach a disability percentage for infertility/impotency," said Dr. Ravindranath while Ms. Karandlaje said, "we cannot endlessly give compensation to everybody."

Touts prosper

Thanks to the lax victim identification regime, locally influential persons and touts

as well as small-time politicians, cutting across party lines, have started going into the villages and enlisting persons with disability with promises that they will secure the Rs. 50,000 compensation for them by getting them "over 40 per cent disability" certificates.

The going rate for this 'service' provided by the touts is alleged to be between Rs 1,000 and Rs 1,500 per certificate. Dr. Ravindranath confirms this trend. When The Hindu visited the Kokkada PHC recently, a 32-year-old man, who lost one of his limbs in motorcycle accident, had come to apply for a disability certificate so that he too could claim compensation. "Nowhere is it said that one needs to be an endosulfan victim."

Between February 28 and March 12, nearly 600 persons applied for disability certificates with the Kokkada PHC.

- A debate may be conducted on the topic- 'Genetically engineered crops- a boon or a bane'
- Initiate a discussion on how organic farming is better than chemical farming.
- **Designing of a project:** Two pots are taken. One with compost and the other with chemicals. Pour water in both and find out which retains water and in which the salt get dissolved (in chemical fertilizers). Students may be asked to discuss on the impact of using chemical fertilizers and pesticides in the agricultural fields.

- A role-play may be enacted where one student act as farmer, other as a bank manager, some as the family members of the farmer. The life of the farmer, unable to grow crops properly due to the high amount of chemical components in the soil, the various financial problems they face, their dependence on banks, unable to pay the loan which ultimately results in suicide may be focussed in the role play. The students may be asked to reflect on this role play critically.
- The following field activities may be carried out by the students.

A visit to a prominent chemical farm and an organic farm and interact with the farmers. Make a report on the following

- What are the agricultural crops that are grown by them?
 - What are the changes in agriculture that they have experienced?
 - What is their opinion on the recent agricultural practices?
 - Are the existing agricultural practices suits our climate?
- Divide the class into groups and each group may be asked to collect information about the different cash crops grown in their area and what are the reasons for farmers shifting to cash crops. They may be asked to visit few farmers staying near their houses and find out the reasons for shifting to cash crops. They may also be asked to collect information from various resources about how growing of different cash crops have impact on the environment. (E.g. Cultivation of rubber in Kerala or Ginger in Coorg etc.)
 - In a village, how food for all, and its sustainability is possible- students can discuss on this and write their own ideas.
 - **Projects**
 1. Preparation of a vermicompost in school/ at home and spread the information among the community
 2. Develop a vegetable garden in a school by using compost prepared from biodegradable wastes from the school or one or more classes may be asked to adopt a patch of land and recognise to the best managed garden.

3. Undertake a survey of organic farmers in the area/location where the students live.

Reflect on...

- Integration of the concepts of sustainability of agricultural concepts in science and social science subjects.
- Transactional strategies and the activities planned.
- Questions encountered during the process in the class.
- Understanding of the main focus points by the students.
- Attitudinal changes, sensitivity to the issues raised, and value development in students
- Participation and involvement of students in the field and project activities
- What you ought to have done better, and what methods and strategies could have been used as alternatives?

Module Eight :

Energy alternatives for Sustainable Development

Introduction

Energy is the basic necessity for life. But for energy no form of life would have ever emerged. We all know energy for providing us light and comfort. It helps us to go from one place to another. All automobiles need energy to run; but even otherwise all other means of transport need energy. But even though we use it every moment of our life and learn about it at school it often remains a riddle for many all through the life. It is very important to understand the energy crisis that the world, especially our country is facing due to maximum use of energy in all walks of life, starting from homes to industrial productions, to nuclear plants. It is necessary to know about alternative and renewable energy sources, so that as teachers, you can develop awareness and positive attitudes in students.

This module focuses on the renewable energy as alternatives for sustainable development and its integration in school subjects through relevant activities and projects.

Focus Points

Universal source of energy, types of energy, energy demand and supply, energy alternatives, energy conservation, and energy efficient appliances.

Objectives

This module facilitates you to

- Make learners realize the importance of renewable energy as not just an alternative to non renewable energy but as a safe and sustainable source of energy.
- Make learners to analyze the importance of non renewable resources and its need to be conserved
- Enable learners to identify the reasons for depletion of non renewable resources.
- Create situations for students to reflect on the need for alternative energy sources like renewable energy sources.

- Make learners review the alternative energy sources.
- Enable the learners to quantify the energy from each alternative source.

Issues to be focused

- What are the importance of non renewable resources and why it needs to be conserved?
- Why the non renewable resources are getting depleted and how human beings are the main cause for its depletion.
- Why do we need to look for alternative energy sources like renewable energy sources
- Do we have enough sunshine uniformly throughout the country throughout the year to harness solar power?
- Are solar panels affordable for a common man
- Are there any alternatives to the expensive solar panels?
- Several tonnes of organic wastes is being generated, especially, urban and semi/peri urban areas. If landfills are properly designed a substantial quantity of fuel (biogas) can be generated. Why it is not planned?
- Several tonnes of animal dung if properly managed can generate sufficient methane to be converted into electricity?
- Can government policies be ordained that every major institution should compulsorily generate at least 10% of their energy consumption through renewable means?
- What has been the traditional method of usage of fuels (firewood, coal, and biomass and cattle dung) were they efficient?
- Are the chulas efficient enough to harness maximum energy from the renewable sources that are used, or do they require redesigning? How do they affect the health of women who use them?
- What are the alternative sources of transportation using renewable energy? (Petrol cars→ Electric cars→ hybrid cars→ Solar cars
- Can government policies include cycle tracks to encourage cycling, there by conserving utilisation of energy
- What are the methods one can apply in conservation of energy in various forms?

Content and Processes

Very often, experts on television or in newspapers speak of India facing an energy crisis. The government encourages people to use fuel wisely through awareness programmes. They also tell us that the government cannot afford to sell cheap fuel any more due to rising deficits. The shortage of power does not merely affect the government. It affects the common man, companies involved and banks too. India faces a significant energy shortage. This is an excess demand over the supply. A high growth economy needs energy. India imports coal and diesel for consumption and to generate power. The excess demand leads to imports of energy resources. This is measured in million tonnes of oil equivalent or 'mtoe'. India's annual energy deficit – that is excess demand over supply – is expected to rise to 490 million tonnes of oil equivalent (mtoe) by March 2020 from 233 mtoe for the year to March 2013. The power deficit or the shortage of power also results in more spending on diesel to power back-up generators. Each year, Rs 43,800 crore is spent on diesel under this head, according to a report by KPMG, a consultancy. Understanding the energy crisis not only in our country, but all over the world, there has been a lot of concern among the world organizations to evolve technologies to sustain energy.

Sustainable energy is defined as that which meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable Energy has two key components: renewable energy and energy efficiency. Energy efficiency and renewable energy are said to be the *twin pillars* of sustainable energy. Sustainable Energy is also viewed as something which is replenishable within a human lifetime and causes no long-term damage to the environment. (*Jamaica Sustainable Development Network*).

How do we conserve energy for sustainability?

Energy conservation means to reduce the quantity of energy that is used for different purposes. This practice may result in increase of financial capital, environmental value, national and personal security, and human comfort. It is very important for the individuals and organizations to conserve energy, as there is a tremendous energy crisis all over the world, and specifically in India. We have been experiencing the power cuts quite frequently in many parts of the country. The institutions, factories and industries, sometimes, function depending on the timings when the electricity is supplied during the day. On a larger scale, energy conservation is an important element of energy policy. In general, energy

conservation reduces the energy consumption and energy demand per capita. This reduces the rise in energy costs, and can reduce the need for new power plants, and energy imports. The reduced energy demand can provide more flexibility in choosing the most preferred methods of energy production. By reducing emissions, energy conservation is an important method to prevent climate change. Energy conservation makes it easier to replace non-renewable resources with renewable energy. Energy conservation is often the most economical solution to energy shortages.

Technologies that promote sustainable energy include renewable energy sources, such as hydroelectricity, solar energy, wind energy, wave power, geothermal energy, artificial photosynthesis, and tidal power. and also technologies designed to improve energy efficiency.

Of late, green energy is widely spoken about in order to reduce the harmful effects of other kinds of energy which add to the pollution. Green Energy is energy that can be extracted, generated, and/or consumed without any significant negative impact to the environment. Green power is a subset of renewable energy and represents those renewable energy resources and technologies that provide the highest environmental benefit. It is used to avoid environmental impacts and green house gas reduction.

Green power is defined as electricity produced from solar, wind, geothermal, biogas, biomass, and low impact small hydroelectric sources. (The U.S. Environmental Protection Agency)

Renewable energy technologies

Renewable energy from sun is solely responsible for the production of food for the entire biosphere. Technology made us dependent on non renewable energy called as fossil fuels. Fossil fuels though source from degradation on time from biological specimens is finite and limited. These products are known to us as coal, petrol, kerosene, gas and wax. Not only are these components limited, but combustion of these products release unfavourable end products such as compounds of carbon, sulphur and nitrogen apart from a number of organic compounds into the environment. However, anticipating the depletion of these resources the world is looking towards renewable energy as a safe and permanent alternative for non renewable energy.

Renewable energy technologies are essential contributors to sustainable energy as they generally contribute to world energy security, reducing dependence on fossil fuel resources, and providing opportunities for mitigating greenhouse gases. There are many sources of renewable energy technologies which are as follows:

- a. Hydropower
- b. Biomass combustion
- c. Geothermal power
- d. Solar heating
- e. Wind power
- f. Bio energy
- g. Bio mass gasification
- h. Bio refinery
- i. Solar thermal power
- j. Ocean energy
- k. Nanotechnology

Renewable energy is also known as green energy. Green energy is an umbrella term used to describe any sort of alternative energy that is produced with less negative impact on the environment than 'non-green' energy sources such as fossil fuels. Solar, wind and hydro energy are commonly cited examples of green energy sources. It is believed that a combination of these technologies would reduce global warming and other harmful effects of pollution.

Renewable energy is derived from natural processes that are replenished constantly. In its various forms it derives directly from the sun or from heat generated deep within the earth. Included in the definition is electricity and heat generated from solar wind, ocean, hydropower, biomass, geothermal resources, and bio fuels and hydrogen derived from renewable resources

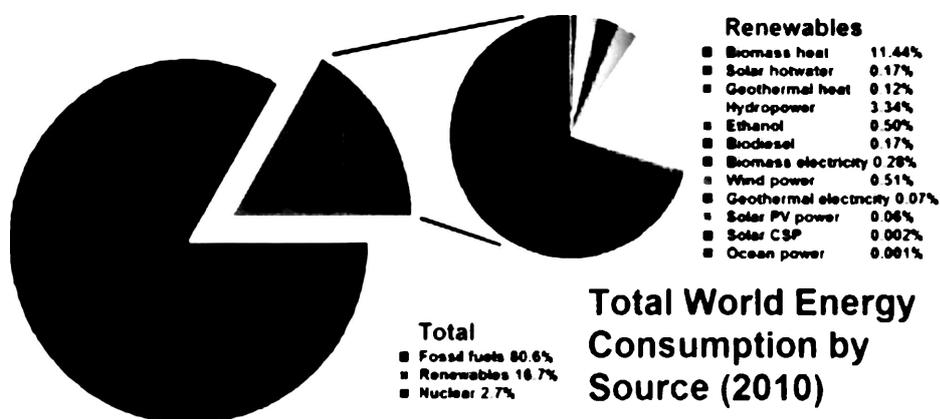


Fig.14 Total world energy consumption by source (2010)

- Explain the world energy consumption by using the above graph. Let the students find out from the internet sources the energy consumption in India per year.
- Students may be asked to visit a petrol bunk near their area and asked to list down the amount of petrol and diesel that is been sold in a day; to find out the market rate of petrol and diesel and analyze on the amount that is spend on these per day. They may be asked to find out how much is spent per month and per year on these non renewable resources and discuss on the impact of it, if it continues for several years.
- A discussion may be initiated in the classroom to discuss on the various alternative sources that can be utilized to reduce the pressure on non renewable sources.
- Students may be asked to take two pieces of banana and dry one in a Micro oven and the other piece in sunlight: observe the difference in taste. This may be followed by a discussion on how we can use solar energy in food preparation (E.g. of preparing rice using locally available materials and using solar energy)
- Students may be asked to enquire the cost of solar panel in the market/ through internet and analyze its cost benefit with respect to usual energy cost.
- Students may be asked to visit a biogas plant: Visit an eco san (eco – friendly sanitary toilets) in their area.

- Students may be asked to visit sacred grooves, and find out the relation between the plants and water bodies seen there. Discuss on how it can be considered as a balanced ecosystem.
- Let students do this activity: Keep a paper and hold a magnifying lens above it and place it in the sunlight for some time. Observe the changes occurring to the paper. This may be followed by a discussion on how much energy is being produced from sun and how can we make use of it for domestic purposes.
- Let students make a small paper fan to demonstrate the functioning of a windmill and compare it with that of a windmill in producing energy.
- Let students reflect on the impact of using the non-renewable sources of energy and how these can be overcome by using various non- conventional power plants that are helpful in order to save energy. They may also be asked to reflect upon the impact of using cables through underground and how one can develop environmentally friendly cables.

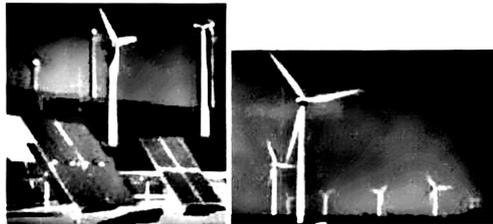


Fig.15 a&b Wind Mill



Fig.16 Solar Panel

- Few students who stay nearby sea may be asked to narrate about the climatic changes they have noticed during daytime and nighttime. They may also be asked about the direction in which the wind blows during day and that which blows during night. Discuss on the differences they have experienced during a sea breeze and land breeze and how it can be harvested in the form of wind energy.
- Students may be shown pictures of some equipment that are run with the help of solar energy. E.g. Solar heater, solar cooker etc. They may also be asked about the importance of using these types of things for house hold purposes. A discussion may be followed which focuses on the importance of using solar energy in place of utilizing other resources as a source of energy. Ask them to reflect on how they can increase the use of renewable energy for various purposes so that we can limit the consumption of non-renewable energy resources.
- Let the students do this activity: Take two identical tin cans. Paint the outer surface of one black and of the other white. Pour equal amounts of water in each and leave them in the mid-day sun for about an hour. Measure the temperature of water in both the cans. They may be asked to find out if there is any difference in the temperatures, in which can is the water warmer etc. let them fill the two cans with the same amount of hot water at the same temperature and leave the cans in a room or in a shade; note the temperature of water after 10- 15 minutes. They may be asked to find out whether the temperature of water in both the cans fall by the same amount. Discuss with them on its application for domestic purposes
- Let the students visit places, factories and houses to see the uses of different kinds of energy and make a list of their utilities

Sl. No	Energy	Uses
1	Electricity	Heating, light
2	Coal	

- Ask them to note down the cost of each fuel being used. Also find out the relative cost of energy obtained from different sources such as electricity, coal, kerosene, petroleum gas and firewood. For this identical job (say boiling 2 litres of water) would be done using different fuels and the cost should be estimated. Thus the relative cost of using different fuels could be calculated.

Energy used to boil 2 litres of water

Energy/ Fuel	Amount	Cost (Rs)
Firewood	(kg)	
Electricity	(Units)	

- Ask the students to survey at least 25 families in different localities and note down the total amount of different kinds of energy used by them in a week/month. From this calculate the average amount of fuel used by one person per day. Estimate the total amount of different fuels consumed over during a month by the village/ city.
- Ask students to collect the data about the consumption of coal, electricity and petroleum products in India over the last couple of decades and extrapolate its demand for the future.
- Students may be shown a working model of a windmill where it is used in generating electricity and also for grinding flour. The working of the windmill may be demonstrated and the production of a cheaper source of energy explained. A discussion may follow on the importance of conserving non-renewable resources and how one can make use of renewable sources of energy in various household activities.

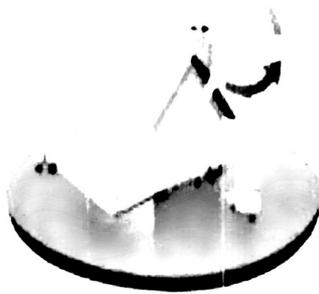


Fig.17 Working Model of wind mill

- Students may be asked to prepare two dustbins outside the classroom; to dispose all the degradable wastes in one dustbin and non degradable ones in the other. Let them provide reasons for separating them. They may also be asked to reflect on 'How wastes can be made into some useful products of economical value'
- Students may be asked to collect data regarding the energy being burnt in the school in terms of Kwh; list the number and the types of bulbs used in the school.
- A project may be planned for a small biogas plant on the school campus.
- A collage may be prepared by the students by listing out the types of energy consuming items, instruments, places in the school.

Reflect on...

- How effectively were you able to integrate the concepts given in this module?
- How effectively the students participated in carrying out the projects, and activities given by you?
- Do you think that you ought to have done better in order to promote the awareness of students?
- What were the behavioral changes that you could observe in students regarding conserving energy in schools? Do you think that more awareness inputs are required? If so, what they ought to be and what activities should be planned in order to improve upon the awareness of students?

Module Nine :

Climate change, Global Warming and Air Pollution

Introduction

The Earth's climate has changed over the last century and by 2001, there was strong evidence that most of the warming observed the previous 50 years was attributable to human activities. Human activities are increasing significantly the concentrations of some gases in the atmosphere, such as greenhouse gases (mainly CO₂), which tend to warm the earth surface, and anthropogenic aerosols, which mostly tend to cool it. Both natural and human systems are vulnerable to climate change because of their limited adaptive capacity. This module highlights the importance of saving the earth by providing insights into the existing problems such as climate change, air pollution and global warming with relevant facts and illustrations. The module also discusses about pedagogical strategies to be used while transacting sustainability of environment.

Focus points

Climate change, Green House Gases (GHG), CO₂ emission, its impacts-global, regional, local; Causes for global warming. Preventive measures, Carbon trading, Ozone-layer- its importance, reasons for depletion, ozone hole, impacts on natural ecosystems, preventive/control measures.

Components of atmosphere, and their importance; natural atmospheric processes, Air pollution- causes and effects, pollutants, control/preventive measures, indoor air pollution, Environmental legislations-Air Pollution Act, Polluters Pay Principle, Alternative Fuels.

Objectives: This module facilitates you to enable the students to

- Understand and appreciate the concept of climate change, factors influencing the climate change, its impacts on environment.
- Critically evaluate the impact and related issues for climate change and global warming.
- Review the national and international efforts with respect to climate change and sustainable development.

- Understand the natural atmospheric processes the important issues of atmospheric pollution, its causes and effect with special emphasis to responsible actions to control/prevent it.
- Explore the possible and effective control measures or SPMs and gaseous pollutants, usage of alternative fuels.

Issues to be focused

- What are possible effects of warmer world-issues involved in mitigation and adaptation?
- How to deal with the threats of global warming/climate change- review national policies, international conventions/conferences/ protocol, community involvement.
- Why ozone layer protection is so crucial?
- How severe is the impacts of air pollution on life on Earth?

Content & Processes

As you must have experienced, there is drastic changes in the climate from your younger days to the present. This climate change has become a great concern at the national and international level and efforts are being made to save the earth from further adverse effects. The extreme weather events and the damage, hardship, and death its causes are projected to increase with global warming. There is also a potential for large-scale and possibly irreversible impacts which pose risks that have yet to be reliably quantified; their likelihood is probably very low but is expected to increase with the rate, magnitude, and duration of climate change. Man will have to adapt to and cope with the climate change consequences that are not prevented by mitigation. Economic losses can be expected, especially in poorest regions; the higher the warming, the greater the losses. Promoting adaptation, sustainable development and equity can be mutually reinforcing. Awareness about the climate change and its impacts has to be started from the students so that they can equip themselves to adapt and contribute a lot to reduce the impacts of climate change. The following activities could be planned for students in order to make them aware about the climate change and its impacts.

dimensions where they can find the effect of climate change. They can present their observation on the health effects of climate change and discuss the same in groups.

- Let the students study the picture given below and present the different problems connected with climate change.
- Ask the students to gather news paper cutting related to the effect of climate change on Polar Regions, Himalayan Glaciers etc. Let them discuss the effect of these things on life on earth.

Do power plants that burn coal and emit carbon dioxide have anything to do with wheat farms in the Midwest? Yes, because the process of burning coal gives off carbon dioxide, a greenhouse gas that contributes to rising global temperatures. Higher temperatures can change the way rain falls in the world. Rainfall affects crop growth and rates of soil erosion. The Intergovernmental Panel on Climate Change (IPCC) stated in its 2002 report Climate Change and Biodiversity that: “Increasing global mean surface temperature is very likely to lead to changes in precipitation and atmospheric moisture because of changes in atmospheric circulation, a more active hydrological cycle. . . .” (From the book, Environmental issues, Climate Change, Edt. Yael Calhoun, Chesea House Publishers, USA, 2005, p-61)

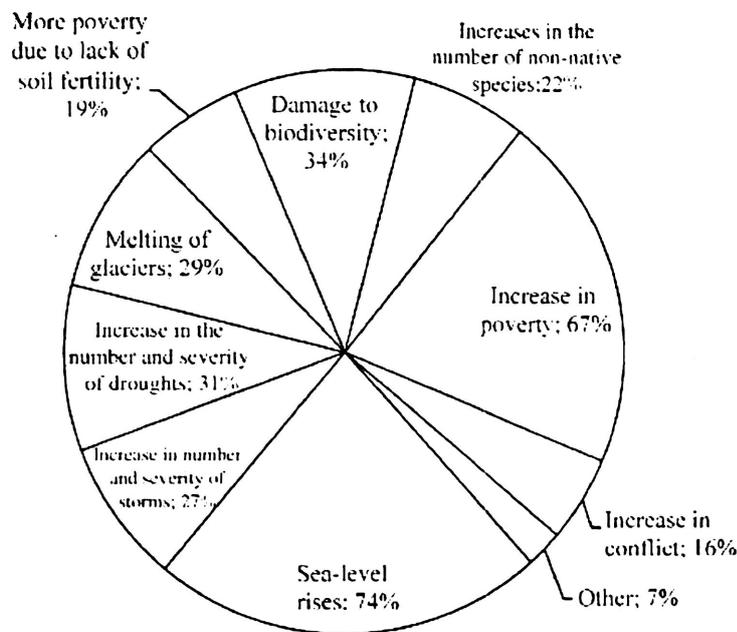


Fig. 19 Problems of climate change

Atmospheric Pollution

The entire globe is facing the challenges of pollution in general and air/atmospheric pollution in particular. Population explosion in geometrical progression is the basic reason. Human interactions with the atmosphere results in various damages, one of which is air pollution. The reasons are multifarious starting from individual to the societal level. Most of the developmental activities are questioned with its impact on the environment. The judicious uses of the resources, controlled interactions and deliberate attempts to mitigate the pollution problems are needed from all the sectors of the society.

- Ask the students to prepare charts on different atmospheric layers. Let them use different colours to represent different layers. Let them discuss the importance of different atmospheric layers.

The gaseous composition of unpolluted air

The Gases	Parts per million (vol)
Nitrogen	756,500
Oxygen	202,900
Water	31,200
Argon	9,000
Carbon Dioxide	305
Neon	17.4
Helium	5.0
Methane	0.97-1.16
Krypton	0.97

Nitrous oxide	0.49
Hydrogen	0.49
Xenon	0.08
Organic vapours	ca.0.02

National Ambient Air Quality Standards

POLLUTANTS	AVERAGE TIME	CONCENTRATION
Sulphur dioxide (SO₂)	Annual average	60 µg/m³
	24 hour	80 µg/m³
Oxides of Nitrogen (NO₂)	A.A	60 µg /m³
	24H	80 µg /m³
Suspended Particulate Matter (SPM)	A.A	140 µg/m³
	24H	200 µg/m³
Lead	A.A	0.75 µg/m³
	24H	1.0 µg/m³
Carbon Monoxide	A.A	2.0 µg/m³
	24H	4.0 µg/m³
Respirable Particulate Matter (RPM)	A.A	60 µg/m³
	24H	100 µg/m³

- Make students aware of the composition of unpolluted air using the above table. Then take the students to nearby pollution control board office and collect relevant data on air pollution of the city. Let them collect the standards for air pollution parameters and identify the meteorological parameters and their impacts on pollutant



Projected Premature Annual Deaths due to Urban Air Pollution, Total and by Economic Group or Region, 2001–2020

Region	Premature Deaths (thousand per year)
Established market economies	20
Former socialist economies	200
China	590
India	460
East Asia and the Pacific	150
Latin America and the Caribbean	130
South Asia	120
Middle East Crescent	90
Sub-Saharan Africa	60
World	1,810

Source: World Bank

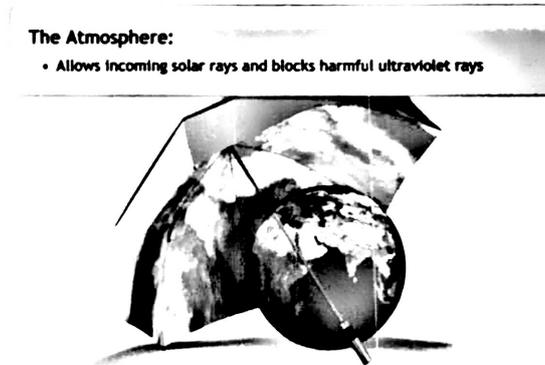
transport and dispersion. It could be followed by group discussion on the comparison of polluted air and unpolluted air and arrive at conclusions regarding the causes of air pollution and some controlling measures.

- Ask the students to study the data given and let them infer the impact of air pollution on human life. Also let them identify the diseases caused by air pollution. Let them discuss the control measures that can be taken at each levels of society towards air pollution and understand its importance towards sustainable development.
 - Ask the students to observe the above picture and write on their own what they feel.
 - Ask the students to collect information about some classic air pollution episodes like London Smog, Los Angeles Smog and Bhopal Gas Tragedy. Let them discuss among themselves and come to certain decision regarding their role in controlling air pollution.

Global warming

The two processes of global warming and damage to the ozone layer: The former is the warming of the earth's surface and lower atmosphere by the action of certain greenhouse gases, such as CO₂, which are emitted by

industrial and other processes, and which act to retain heat energy reflected from the earth's surface. The latter is the reduction in the concentration of stratospheric ozone by certain industrially-produced chemicals (notably chlorofluorocarbons), leading to a reduction in the protection that the atmosphere affords from the harmful effects of ultraviolet radiation from the sun.



- a) Let children imagine the consequences if there are holes formed in the umbrella? Relate their answer to atmospheric or ozone layer depletion and its effect on life on earth.

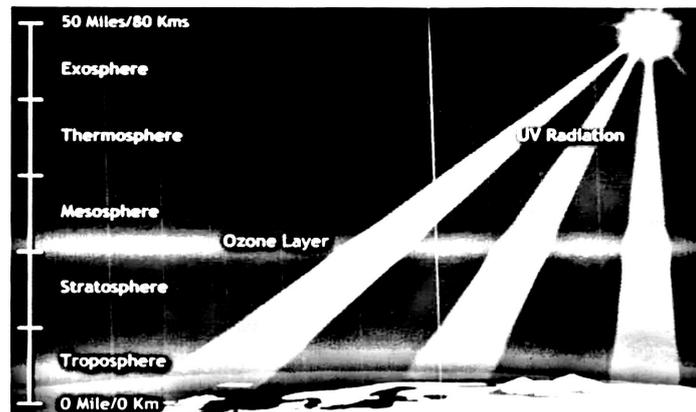
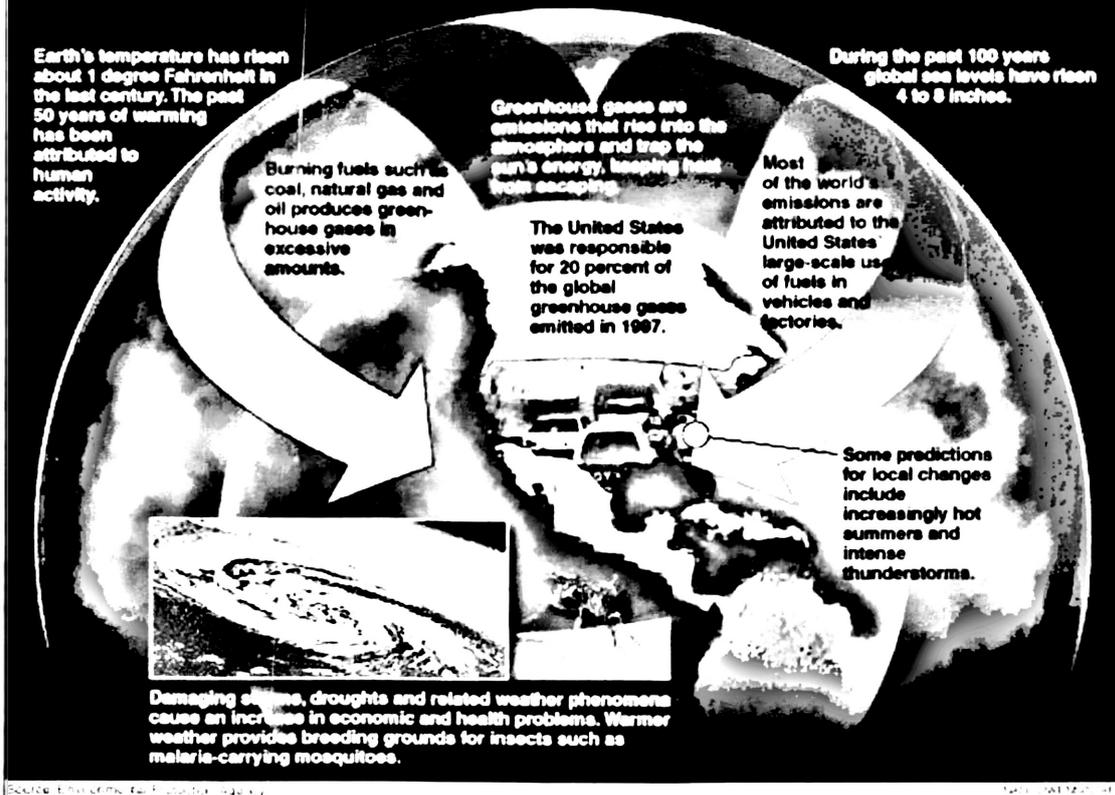
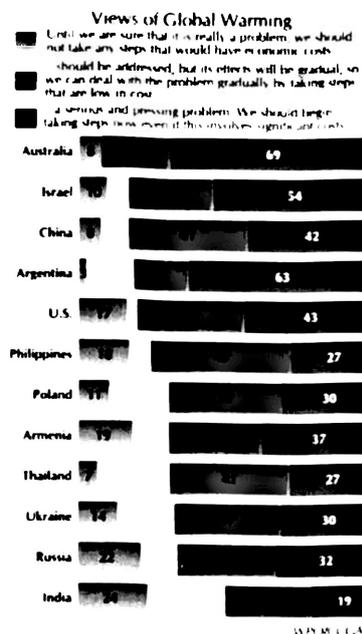


Fig. 20 Ozone layer

Global warming: Causes and effects



- b) Use the picture of this kind, in order to make the students aware of the atmospheric layers and their role in protecting the earth.
- Discuss the causes and effects of global warming. You may draw the attention of students to some of the real life examples observed in the surroundings.



- Ask the students to study the graph given and present their observations regarding the global warming scenario in different countries. Let them compare the data and appreciate why India has got lesser issue of global warming while comparing with other countries. Analyze the views of countries like Australia, Argentina, Israel and US which are showing great concern regarding control of global warming when compared to other countries, ask them to relate it with the status of development and industrial growth in these countries.
- Collect, show some satellite imageries on vegetation cover, ice caps, ocean level in the class and ask the students to make comparison with time lined visuals in order to identify the changes. The comparison could lead them to identify the human activities that lead to climate change and global warming.
- Let the students observe the picture given below. Let them discuss the effect of global warming on other living organisms such as plants and animals. From their experiences let them give examples of other effects of global warming.



Fig. 21 Effect of global heat on human beings

- Ask students to collect/ download and bring out the salient features of available protocols with respect to climate change and global warming.
- Ask the students to observe the picture shown and study about the global heat flows. Let them suggest some measures to reduce the heat flow which in turn results to reduce global warming.

- Initiate a discussion on the measures with which one can reduce the production of green house gases. Let the students suggest some alternatives to reduce green house gas emission at their level.
- Ask the students to study the data given below and arrive at conclusion regarding the green house gases and their characteristics.
- Let the students collect the weather forecast from news paper: let them record the temperature during summer, monsoons and winter. Let them compare the variations and predict the temperatures for the forthcoming years.

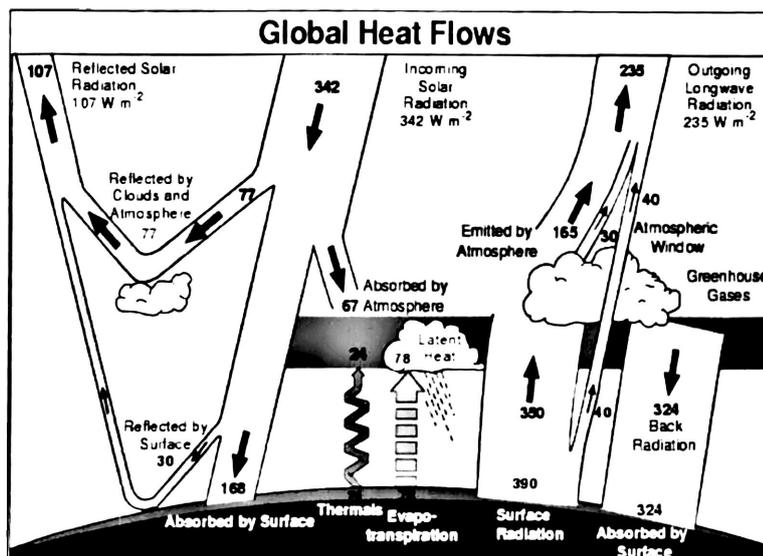


Fig.22: Circulation of global heat

Listed below are the major air pollutants and their sources.

Carbon monoxide (CO) is a colourless, odourless gas that is produced by the incomplete burning of carbon-based fuels including petrol, diesel, and wood. It is also produced from the combustion of natural and synthetic products such as cigarettes. It lowers the amount of oxygen that enters our blood. It can slow our reflexes and make us confused and sleepy.

Carbon dioxide (CO₂) is the principle greenhouse gas emitted as a result of human activities such as the burning of coal, oil, and natural gases.

Chlorofluorocarbons (CFC) are gases that are released mainly from air-conditioning systems and refrigeration. When released into the air, CFCs rise to the stratosphere, where they come in contact with few other gases, which lead to a reduction of the ozone layer that protects the earth from the harmful ultraviolet rays of the sun.

Lead is present in petrol, diesel, lead batteries, paints, hair dye products, etc. Lead affects children in particular. It can cause nervous system damage and digestive problems and, in some cases, cause cancer.

Ozone occurs naturally in the upper layers of the atmosphere. This important gas shields the earth from the harmful ultraviolet rays of the sun. However, at the ground level, it is a pollutant with highly toxic effects. Vehicles and industries are the major source of ground-level ozone emissions. Ozone makes our eyes itch, burn, and water. It lowers our resistance to colds and pneumonia.

Nitrogen oxide causes smog and acid rain. It is produced from burning fuels including petrol, diesel, and coal. Nitrogen oxides can make children susceptible to respiratory diseases in winters.

Suspended particulate matter (SPM) consists of solids in the air in the form of smoke, dust, and vapour that can remain suspended for extended periods and is also the main source of haze which reduces visibility. The finer of these particles, when breathed in can lodge in our lungs and cause lung damage and respiratory problems.

Sulphur dioxide (SO₂) is a gas produced from burning coal, mainly in thermal power plants. Some industrial processes, such as production of paper and smelting of metals, produce sulphur dioxide. It is a major contributor to smog and acid rain. Sulphur dioxide can lead to lung diseases.

Reflect on...

- How effectively you integrated the concepts and used various techniques and activities
- Issues raised related to climate change, and the response of students in terms of their receptivity, sensitivity, attitude, and participation.
- Decisions taken by the students to play active role in preventing pollution, and to protect the planet.

Module Ten :

Sustainability of water

Introduction

One of the greatest challenges facing the world in this century is the need to rethink the overall management of water resources. The total annual freshwater withdrawals today are estimated at 3800 cubic kilometres, twice as much as just 50 years ago (World Commission on Dams, 2000). Studies indicate that a person needs a minimum of 20 to 40 litres of water per day for drinking and sanitation. More than one billion people worldwide have no access to clean water, and to many more, supplies are unreliable. India is expected to face critical levels of water stress by 2025. At the global level 31 countries are already short of water and by 2025 there will be 48 countries facing serious water shortages. Oceans and seas are another area that needs to be protected for sustainable living. The oceans and seas are also facing many problems which are mainly due to different human activities like transport, oil mining and communication. With the growth of human population there is an increasing need for larger amounts of water to fulfil a variety of basic needs. Today in many areas this requirement cannot be met. Thus water is a crucial and significant component that has to be taken care while working towards sustainable development. This chapter focuses on the various issues related to water, including oceans and seas in order to equip the teaching community with skills and abilities to facilitate the understanding of sustainable development among their learners.

Focus Points

Importance of water in day to day life; economic and commercial values of water; pollution of water and its impact on eco systems; water conservation approaches for sustainable development;

Objectives:

This module facilitates you to enable the students to

- Appreciate water as a life supporting element and for sustainable development.
- Understand and appreciate the economic and commercial values of water.

- Understand the significant contribution of water resources for life on earth and need for protecting them from pollution and also conserve the diverse life forms.
- Analyze how the water transport, oil spillage and waste dumping affect the marine life.
- Assess/ evaluate the impact of pollution in water on ecosystems-human, animal and plant.
- Interpret the impact of melting of polar ice caps resulting in sinking of coastal areas and islands.
- Explore the ways by which water from oceans and seas can be converted into usable water that can be used for domestic purpose.
- Plan suitable water conservation approaches for sustainable development.

Issues to be focused:

- Why there are conflicts about sharing of water locally, between regions and between the nations?
- Can we reduce water wastage?
- What are the human activities that lead to scarcity and pollution of water?
- Why is it important to maintain a balanced percentage of water cover on the earth?
- How can we reduce human activities that cause natural disasters related to water?
- How the different life forms in the oceans and seas are being disturbed due to various human activities?
- What are the different possibilities to harness sea water for useful purposes?

Content and Processes

Generally under the unit water, the content covered is importance of water, sources of water, pollution of water and purification of water. The new text book of NCERT also covers “waste water management”. While teaching the unit ‘water’ the above mentioned concepts and issues related to sustainability of water may be integrated through suitable activities and illustrations to create an awareness of need for sustainability of water among learners. Some suggested activities and illustration are as follows:

Importance of water and its consumption:

Students already know that water is very important for all the living organisms. Discuss with them what happens if water is not available for plants and animals of different regions. Provide the following picture to show how water is important for human body. Let the students discuss the following question in their group and come out with answers:

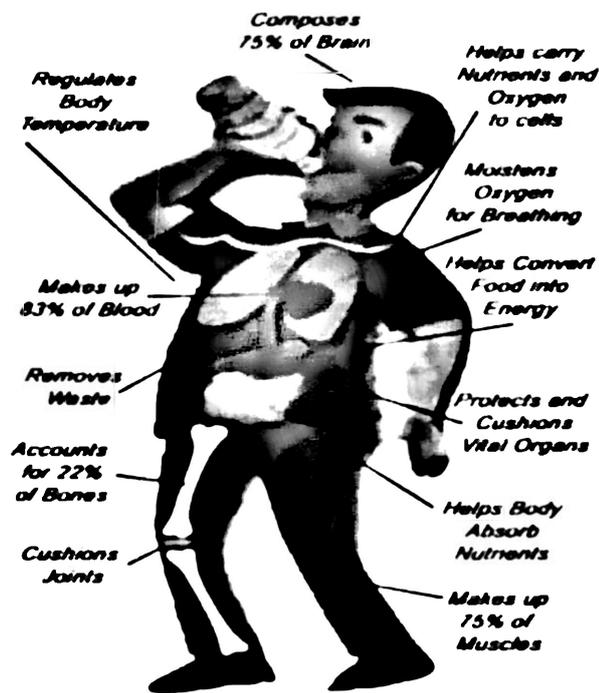
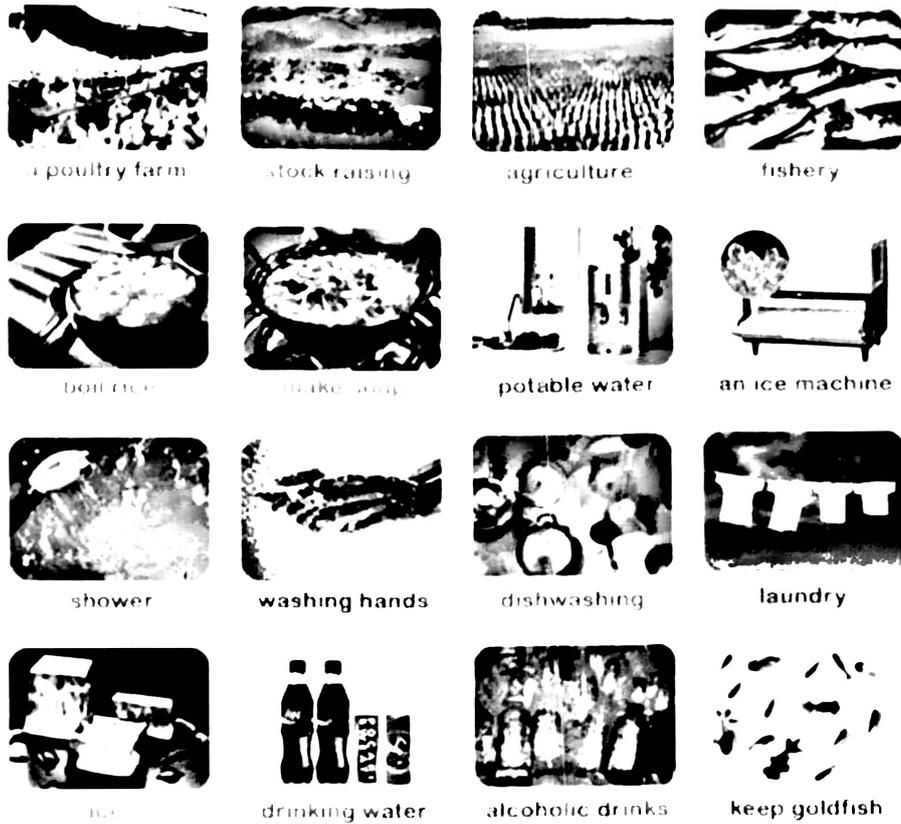


Fig.23 water and human system

- What our body mostly consist of?
- What happens if we do not take water for a long period?
- What happens to our body during dehydration?
- Can we drink water from all sources? If not, Why?
- How do we need to value water, if it is very important for our body?

- Brainstorm using the picture given below regarding the uses, misuses, abuses and judicious uses of water in day to day life



- Ask the students to analyze the picture given below. ask them to find out about the water consumption in different continents in different types production

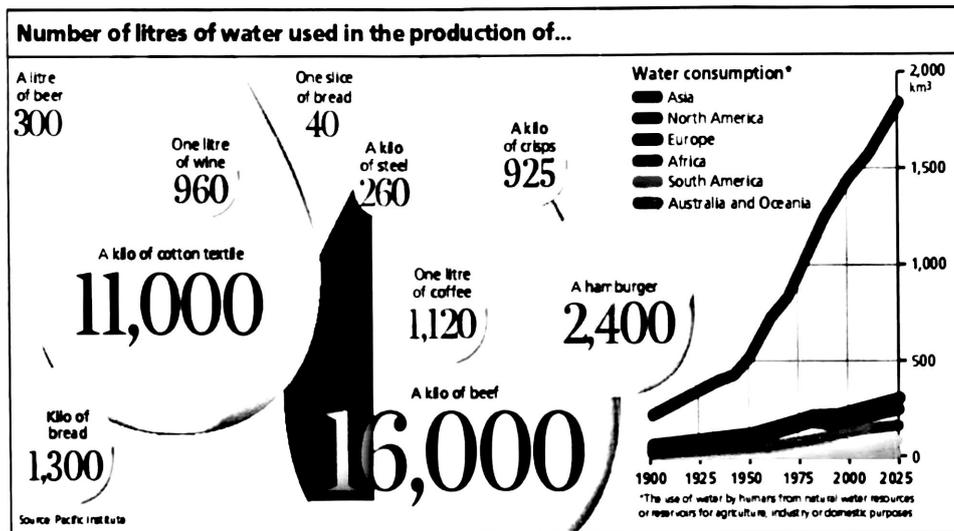


Fig. 24 Water consumption

- Let the students find out the water consumption for different purposes in our country. It is observed that on an average 40 liters of water is being consumed by an Indian every day. Do you think, with the increasing population and consumption pattern, water will be available in the same quantity in future also?

- Showing the given picture ask students to analyze the data shown in the picture and discuss the percentage of population with access to safe drinking water.

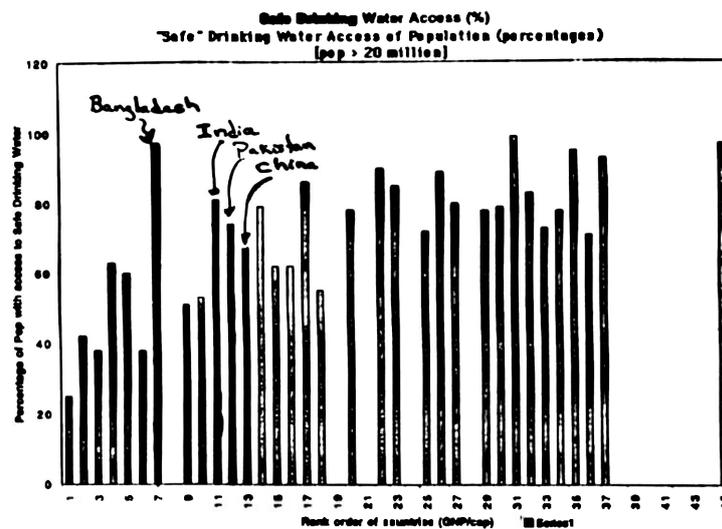
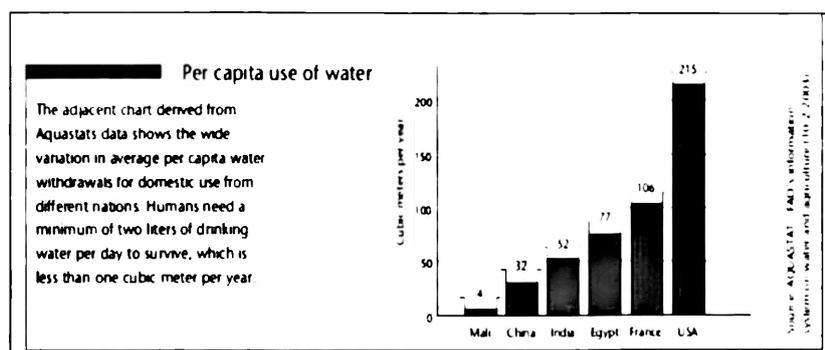


Fig. 25: Safe drinking water in different countries

- Make students aware of the fact that human beings need a minimum of 2 liters of drinking water to survive which is less than one cubic meter per day. Looking into the given picture let the students analyze and interpret the per capita use of water in different countries. Let the students present their findings followed by discussion.



Fresh water is one of the most important substances for sustaining human life. Although it is a renewable resource, only 3% of earth's water supply is fresh. About 90% of the world's population gets its water supplies from river basins. More than 200 rivers are shared by two or more countries and more than 40% of the world's population relies on water originating in a country other than their own. Despite its availability, water is not evenly distributed or used around the world. More than 1.2 billion people do not have access to adequate and safe water supplies. Six of the 20 major river basins in India suffer from water scarcity. Water has already become one of the most limiting resources in the country.

Scarcity of Water

In olden days, water was abundant to use it for any human need. Over a period of time with increase in population, human activities and climatic changes, the rivers, wells and lakes were dried up. Even though some of the rivers are filled with water, they are not fit to use for any purpose because of the human activities and dumping the different wastes.

- Ask the students to find out the rivers and lakes in and around their locality- whether they are usable or not. Ask them to discuss with their parents and elderly people in the community to find out the lakes and rivers which existed during their times but dried up now. Let them identify the causes for drying up of the rivers and lakes

Some of the causes for drying up of lakes and rivers are:

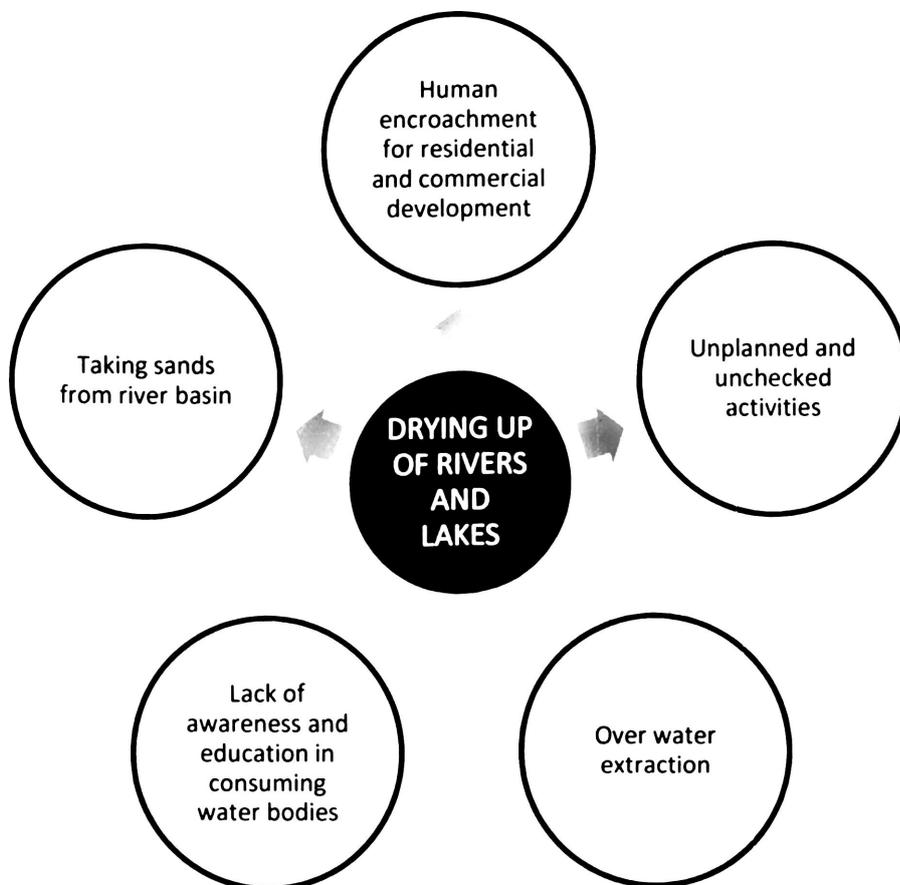


Fig. 26 Causes-drying up of lakes & rivers

- Ask the students to identify the states where water scarcity is severe by locating in the map. Let them explore the reasons for the scarcity.

WITHDRAWAL OF WATER- 2050, AVAILABILITY

India's Yearly Requirement in 2050 (Km³ = BCM)

- For growing food and feed at 420 to 500 million tonnes = 628 to 807 BCM
- Drinking water plus domestic and municipal use for rural population at 150 lpcd and for urban population at 220 lpcd = 90 to 110 BCM
- Hydropower and other energy generation = 63 to 70 BCM
- Industrial use = 81 to 103 BCM
- Navigational use = 15 BCM
- Loss of water by evaporation from reservoirs = 76 BCM
- Environment and ecology = 20 BCM

Total 970 to 1200 BCM

Availability 1100 to 1400 BCM

FACTS

The rivers under threat in the globe

River Basin	Corresponding Threats	Suggested Solutions
Salween-Nu	Infrastructure-Dams	Assign a location for the river's main stem and flood plains. Allowing fish passage. Non control of natural water flows. Controlling thermal pollution. Maintaining sediment and nutrient flow.
Danube	Infrastructure-Navigation	
La Plata	Infrastructure-Dams and Navigation	
Rio Grande-Rio Bravo	Water Over Extraction	Improving water allocation and rights. Establishing environmental flows. Improving efficiency in water use. Switching to production of less thirsty crops.
Ganges	Water Over Extraction	
Indus	Climate Change	Technology transfer, reducing green house gas emission, improving the resilience of forest watersheds, rivers, lakes and other wet lands
Nile-Lake Victoria	Climate Change	
Murray-Darling	Invasive Species	Vector control, laws to prevent introduction of new invasive species, control of exotic (foreign) species.
Mekong-Lancang	Over fishing	Increasing local capacity to manage

- Following is given a case study which describes a solution for water scarcity problem. Identify similar such case studies and discuss with the students.

CASE STUDY

Pani Panchayat – Pune District, Maharashtra

Mahur village in Pune District of Maharashtra is situated in a drought prone area. People were not able to grow a good crop in most years. Clean drinking water was also scarce. Vilasrao Salunkhe initiated a movement known as Pani Panchayat, to conserve water in this drought prone area. Watershed development was initiated on a barren and uncultivated piece of land belonging to a temple. Conservation of soil and water harvesting through a comprehensive micro watershed management program gradually led to a surplus of water. Out of the 16 hectares of land in the village, 9.6 hectares were brought under irrigation, 2.4 hectares was afforested and 4 hectares was converted into percolation tanks. Wells and field bunds were built. While 200 quintals of grains were produced on 24 acres of Salunkhe's land, 40 acres in the same area yielded only 10 quintals. This made other villagers follow suit. The area rapidly turned green and productive.

Impact of Human Activities on Water bodies

Though 75% of earth is covered with water, the scarcity problem is crucial nowadays. Around two billion people, approximately one third of world's population, depend on ground water for their daily needs. About 600-700 cubic kilometre of ground water is withdrawn ever year. Water scarcity does not mean the absence of water, but it also means that, water which cannot be used. This situation arises because of the water pollution. Water pollution is a major threat to the usability of water. There are various reasons for water pollution including human activities, climate change, industries etc. Regaining water from all the possible resources without pollution is a real challenge before mankind. It is the high time to develop the awareness and even equip the students to act at their level to reduce water pollution, conserve water and strive for the sustainable existence.

- Ask students to make a report on the number of wells, lakes, rivers which are not useful in their locality with the possible reasons. They can include some suggestions to rejuvenate the same water bodies. This activity could be either a group activity or project. The students should be informed about the resources where they can collect the data. If possible the same activity could be done in a field trip mode.
- Ask the students to collect and compile information on the water pollutants including sources of ground water pollution. Let them make charts and present in the class followed by the discussion on the possible control measures.

- Collect some videos on water pollution cases of river Ganga and could be shown to the students. Make a discussion on the visuals they have seen, guide the discussion such a way they could experience the human activities that are leading to kill the holy river.



- Ask the students to collect the information regarding the different ways used to measure the quality of water, such as Biological Oxygen Demand, and present in the class.
- Ask students to take a mug of water and add some oil in it. Let them observe the changes. They may be asked to discuss about the reasons for oil spills entering the sea and how it affects the life forms in the oceans and seas.
- A news paper clipping with a picture on mining of oil from the sea beds in Mumbai may be shown to the students. They may be asked to reflect on the consequence of it. They may be asked to present their conclusions in the class room.
- You may show some pictures on oil spillage and make the students to discuss about how oil spillage results in water pollution, how can it be reduced. Raise a discussion on how oil spillage affects the marine life. Ask students to collect examples and illustrations from various sources.

In Gulf of Mexico, oil spill that happened in April 20, 2010 is the largest oil spill in the history of oil industry

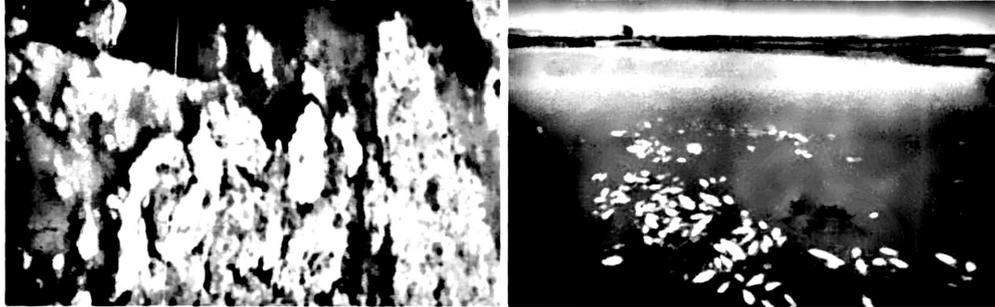
- After the discussions on water pollution and control measures, students could be asked to prepare a role play on water pollution- its reasons, human impacts and control measure.
- Raise the question “is the bottled mineral water safe to drink?” Can have either a debate or discussion in the groups. Before the activity starts, they should be well informed about bottled water- the commercial part and safety part.
- Ask students if they have seen the sign boards with instruction “*Do not dump plastics and waste into the water*” on their visit to water bodies during picnics and excursions. Raise a question why is it said so.

- A debate may be organized on the topic '*Oceans are the main waste disposal area of the world*'.



- In order to explain the effect of global warming on melting of ice caps and glaciers, an experiment could be shown to demonstrate the impact of melting of ice to the low-lying areas using some ice-cubes and a simulated situation. They may also be asked about the reasons for melting of ice is and how it can influence the life forms in low-lying and coastal areas. They may be asked to reflect on the impact of melting of polar ice caps on the life in Polar Regions also.
- To illustrate the above, students may be asked to do the following activity: Ask students to take a glass and place it on a flat dry surface. Ask them to put ice cubes into it until one or two pieces stick above the brim and fill the glass with coloured water (with ink) up to the brim such that it can hold no more water. Ask them to be careful not to spill the water and observe it after a while. Ask them to observe till the ice melts completely. Ask them to present their observations.
 - A video clipping on the tsunami that occurred in 2004 may be shown in the class followed by a discussion on the cause and impacts of tsunami. Let the students analyze the role the human activities that leads to natural disasters like tsunami.
 - Students may be asked to collect information regarding the different ways of culturing sea foods (e.g. Molluscs, fish etc.) and discuss the advantages of cultivating such sea foods and how it can reduce the pressure on depending directly on sea for sea foods.

Eutrophication: Addition of excessive chemical nutrients such as nitrogen and phosphorous results in algal bloom that reduces amount of dissolved oxygen in water. Reduction of dissolved oxygen in water results in the death of fish and other aquatic animals, termed as eutrophication.



Sustainability of Water

Only 0.3 percentage of fresh water is available in the globe. With the increase in population, there will be shrinkage in availability and human beings can't survive without water. In order to have a sustainable life on earth, water is vital, such that there is a necessity to conserve water which is available.

Water conservation

- Important step for conserving environment and find solutions for water problems is to change people's attitudes and habits
- Conserve water because it is right thing to do!

What you can do to conserve water?

- Use only as much water as you require. Close the taps well after use. While brushing or other use, do not leave the tap running, and open it only when you require it. See that there are no leaking taps.
- Use a washing machine that does not consume too much water. Do not leave the taps running while washing dishes and clothes.
- At the end of the day if you have water left in your water bottle, do not throw it away, pour it over some plants.
- Re-use water as much as possible

- Change in attitude & habits for water conservation are required.

Ask students to prepare a report on the various modes water consumption in their home- by using the following steps:

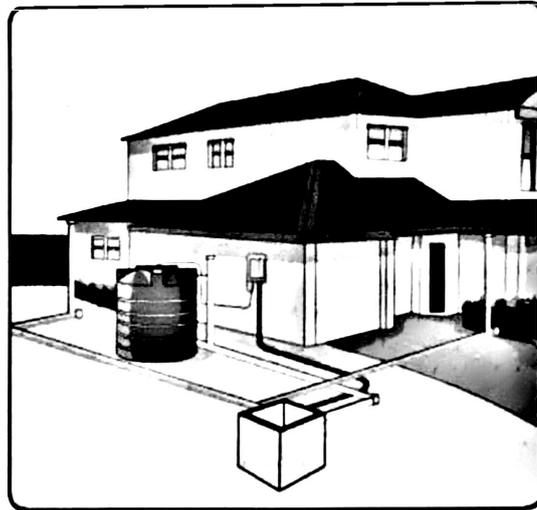
- Collection of data (amount of water used for all the activities at least for one complete day).
- Categorizing the information to identify which activity consumes excess water.
- Discuss in groups to identify the household activities where water consumption could be minimized (Personal use of water- use showers and tubs for bathing, frequent cleaning of houses and vehicles with water).
- Comparison of data gathered by students coming from different localities- for example, localities where water supply is low and where water supply is more. Sharing of experiences with students coming from different localities of the above kind will provide lessons as to how to manage water for daily usage.
- Let students decide about the minimum usage of water for their daily usage.

Waste water recycles and reuse of water: Take the students to nearby sewage water treatment plant and let them collect information on how the waste water is treated and reused.

- The students may be asked to utilize the water used in the kitchen to clean the vegetables, rice and cereals for watering the plants.
- Some of the conserving measures to sustain water may be explained to the students such as,
 - Rationing of water for agriculture and domestic purposes
 - Improved agricultural practices such as drip irrigation spray irrigation and soil moisture retention techniques
 - Rain water harvesting.
 - Optimizing the crop pattern and crop rotation
 - Zero effluent system in industries

Rain water harvesting (RWH)

- Rain Water Harvesting RWH is a process of collecting, conveying & storing water from rainfall in an area for beneficial use.
- Storage is done in tanks, reservoirs, underground storage- groundwater
- RWH - yield copious amounts of water. For an average rainfall of 1,000mm, approximately four million litres of rainwater can be collected in a year in an acre of land (4,047 m²), post-evaporation.
- As RWH is neither energy-intensive nor labour-intensive
- It can be a cost-effective alternative to other water-accurring methods.
- With the water table falling rapidly, & concrete surfaces and landfill dumps taking the place of water bodies, RWH is the most reliable solution for augmenting groundwater level to attain self-sufficiency



- a) Ask the students to prepare a model for rain water harvesting plant. You may initiate to have a rain water harvesting plant in your school with the help of your colleagues. This will inspire and motivate the students, the teachers and others in school towards the judicious use of water. It will also bring in positive attitude and values towards conserving and sustaining water.

Methods of RWH

- Roof Rain Water Harvesting
- Land based Rain Water Harvesting
- Watershed based Rain Water harvesting
- For Urban & Industrial Environment
- Roof & Land based RWH
- Public, Private, Office & Industrial buildings
- Pavements, Lawns, Gardens & other open spaces

Advantages of rain water harvesting

1. Provides self-sufficiency to water supply
2. Reduces the cost for pumping of ground water
3. Provides high quality water, soft and low in minerals
4. Improves the quality of ground water through dilution when recharged
5. Reduces soil erosion & flooding in urban areas
6. The roof top rain water harvesting is less expensive and easy to construct, operate and maintain.
7. In desert, RWH can serve the human needs.
8. In saline or coastal areas and islands, rain water provides good quality of water.

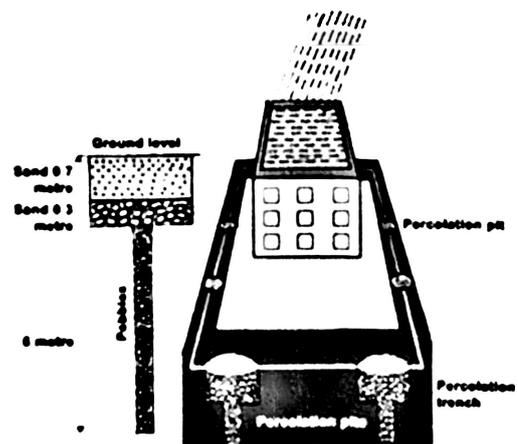


Fig. 27 Rain water harvesting

Reflect on....

- The integration of concepts stated in this module while teaching.
- The methods and activities used
- The participation of students in the activities provided.
- Could you develop the sense of responsibility in students in saving and using water judiciously?
- The observations made by you on students' attitude and behaviour towards using water responsibly in schools.
- The measures taken by you to assess the projects and the activities carried out by students.

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