

Environment Education for Ecosystem Conservation

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INTRODUCTION

India is a mega diversity country with an enormous repository of biological wealth in terms of flora (45,000 species), fauna (75,000 species) and microorganisms. It is also endowed with a rich and invaluable, cultural and traditional knowledge, and practice systems. Our country is well known for its indigenous systems of medicines like Ayurveda, Unani, Siddha, etc. New pharmaceutical products are being identified based on this and their effects are to be validated. We need to plan to conserve and sustain this biological wealth for our next generations.

Conservation of this biodiversity through sustainable ecosystem management approaches is important to humankind for various reasons. Ecosystems are the life supporting systems. It facilitates mankind with several services like extractive benefits (such as foodstuff, fibres, timber, biomass fuel, precursors to various industrial and pharmaceutical products, etc.) and non-extractive benefits (such as water purification, renewal of soil fertility, climate regulation, pollination, pest control, etc.). In addition, it also provides intellectual, aesthetic, cultural, religious and spiritual values. Human health and well-being is directly proportional to the environmental conditions that prevail in a particular geographical region.

Human beings have been interested in ecology since the beginning of civilization. Even our ancient scriptures have included practices and values related with ecological and environmental conservation. The concept of ecological and environmental conservation "*enters into every form of religion.... It rests on the earliest conceptions of the unity of life in nature, in the sense of communion and fellowship with the divine centre and source*

of life...". The protection of forests as sacred forests and of several tree species as sacred trees belongs to the religion-based conservation ethos of ancient people all over the world. Although such practices became extinct in most parts of the world, basically due to changes in religion, and during recent times due to changes in resource use patterns, conserving sacred forests continue to be of much importance in religion, culture and resource use systems in many parts of India. Indian nationalism has grown out of the amalgamation of scores of nature-based local cultures and practices, evident from the worship of plants, groves, animals and natural objects like rivers, mountains, ant-hills and rocks. Ancient Indian scriptures, while advocating conservation of sacred forests, do highlight the importance of planting trees and groves. For example, the *Vriksotsavavidhi* of the *Matsyapurana* attaches great importance to the planting of trees and even to the celebration of the tree festival or 'vana mahostav'. It emphasises the importance of planting a tree thus: "A son is equal to ten deep reservoirs of water and a tree planted is equal to ten sons". A tree laden with flowers and fruits saves its dependents (birds, humans, etc.) from distress, just as a good son saves his family.

One of the most widespread conservation practices in India is the protection given to trees of the genus *Ficus* (*Ficus religiosa*; *pipal* tree or *ashwatta*), which dot the countryside and are often the only large trees in the midst of towns and cities. These trees have a conspicuous position in the cultural landscape of India for more than 5,000 years. It was depicted even on Mohenjo Daro artefacts. Buddha had attained enlightenment under a *pipal* tree. *Ficus* sp. are now recognised as keystone resources of tropical forests, 'fruiting' often at times when most other species are without fruits. Thus, humans are inextricably linked to and dependent upon ecosystems for their very survival. However, enhanced human activities during the recent years have induced stresses on ecosystems, necessitating the understanding of ecosystems.

The life supporting systems of the planet's biosphere are being threatened due to deforestation, destruction of habitats, overuse of energy resources and environmental pollution (Ramachandra et al., 2005). Changes in the Earth's climate, decline and deterioration of natural resources, the accumulation of waste products, soil exhaustion and the destruction of ecosystems, are already apparent. In the recent past, the anthropogenic activities triggered by the burgeoning human population, ever expanding industrial and urban growth, changing values, lifestyles, and many other factors have led to the overuse of natural resources, accumulation of waste products, pollution, soil exhaustion, deforestation, destruction of natural habitats, etc. These have altered ecosystem structure in terms of its function and distribution resulting in the extinction (gone forever or irreversible) of a large number of plant and animal species, many more are in the verge of extinction, while others are threatened or vulnerable. Consequent to this, changes in the Earth's climate have also led to global warming, stratospheric ozone depletion,

bioaccumulation of toxic chemicals, and increase in the natural disasters such as earthquakes, floods, droughts, etc., that have made everyone aware of the growing environmental concerns. The process of degradation and species loss could be arrested through an understanding of ecological processes. It is essential to adopt several different approaches for managing the ecosystem and biodiversity, in order to bring about conservation of natural resources through sustainable management approaches. The need for sustainable development is a key to the future of humankind (Ramachandra et al., 2002a; 2002b).

It is even more critical than ever before for the humankind as a whole to have a clear understanding of environmental concerns and to follow sustainable development practices now. The degradation of our environment is linked to the continuing problems of pollution, loss of forest, solid waste disposal, and issues related to economic productivity and national as well as ecological security. Environmental management has gained momentum in the recent years with the initiatives focussing on managing environmental hazards and preventing possible disasters (Ramachandra and Ahalya, 2001).

Environmental education focussing on real-world contexts and issues often begins close to home, encouraging learners to forge connections with and understand their immediate surroundings. The awareness, knowledge, and skills needed for these local connections and understandings provide a base for moving out into larger systems, broader issues, and a more sophisticated comprehension of causes, connections, and consequences. Thus, environmental education will certainly help us to recognise the importance of investigating the environment within the context of human influences, incorporating an examination of economics, culture, political structure, and social equity as well as natural processes and systems. The ultimate goal of environmental education is to develop an environmentally literate public. It needs to address the connection between our conception and practice of education and our relationship as human cultures to life-sustaining ecological systems. For each environmental issue there are many perspectives and much uncertainty. Environmental education cultivates the ability to recognise uncertainty, envision alternative scenarios, and adapt to changing conditions and information. This knowledge, skill, and mindset translate into a citizenry who is better equipped to address its common problems and take advantage of opportunities, whether environmental concerns are involved or not.

ENVIRONMENT EDUCATION—HISTORICAL BACKGROUND

Efforts to define environmental education as a specific endeavour began in the 1960s. They were given international support at the United Nations Conference on the Human Environment held in Stockholm in 1972, where participating governments recommended that it be recognised and promoted on an international scale through the United Nations. One of the initial tasks

was to develop some consensus on what environmental education could and should become, and to assist governments in implementing relevant programmes as soon as practicable. Two major conferences, supported by regional meetings of experts, were hosted by the newly formed UNESCO-UNEP International Environmental Education Programme. The purpose of the first (Belgrade, 1975) was to draft concepts and a vision for environmental education. The second, an Intergovernmental Conference on Environmental Education (Tbilisi, 1977) formally approved the scope and action plans put forward from the previous conference. The provisions of the 'Tbilisi Declaration on the role, objectives and characteristics of environmental education, appended to this document, has remained in wide international use and have sustained their role as a guiding influence over the past two decades. Other major milestones are as follows:

- **The IUCN World Conservation Strategy (1980)** suggested requirements for human survival and prosperity, putting forward the conservationist concept of sustainable development.
- **Our Common Future (1988)** was the name of the report published by the World Commission on Environment and Development, chaired by the Prime Minister of Norway, Mrs. Brundtland. It emphasised the relationship between the under-developed nature of several parts of the world, and existing social and environmental problems. The report is a survey of the planet's health, presenting the problems of atmospheric pollution, desertification, over-population, over-consumption, water shortages, poverty and under-development.
- **Agenda 21 (1992):** The United Nations Conference on Environment and Development in Rio de Janeiro established further strategies for a sustainable future. Chapter 36 of the action plan adopted by the Conference, Agenda 21, focussed on public education, awareness and training, which confirms the role of education and the importance of positioning environmental education in the perspective of sustainable development.
- **UNESCO Thessaloniki Declaration (1997),** Educating for a Viable Future: A multidisciplinary vision for concerted action sought to further clarify the concept of education for sustainable development. It presented sustainability as an ethical and moral imperative and the objective to which education should devote itself as an instrument of choice. Education is described as an ongoing process aimed at developing the capability of adapting to rapid changes in the world, but first and foremost as a process of transmitting knowledge and information to make the public understand the problems and to stimulate awareness.

During the same period, individuals and groups, both within and outside formal education systems and agencies, began to generate new emphases in their educational work, finding and expressing different focal points and relationships as well as a new urgency in their treatment.

Recent Developments

The United Nations Conference on Environment and Development held in Rio De Janeiro in 1992, and the World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of the global community to discuss problems concerning environment and development. In order to achieve the goals of sustainable development, people need to become aware of the environmental issues and acquire background knowledge to enable them to make and influence decisions. Environmental education is thus concerned with attitude towards, and decisions about environment quality, with informed management of resources, and with the ethical considerations that relates to these. Recognising the importance of environmental education at all levels, the Hon'ble Supreme Court of India ruled that a course on Environment be made mandatory at the undergraduate level to sensitise the youth to environmental issues and concerns. As per the Supreme Court direction, the University Grants Commission introduced six months of compulsory environmental course in all the universities and colleges during the academic year 2004-05.

The declaration of the decade for Education for Sustainable Development (ESD) beginning in 2005, by the United Nations has provided further impetus. The goal is to create a *sustainable world* through active participation of citizens. Thus, ESD is seen as a process that develops vision, builds capacity, and empowers to make changes in human societies. Education has a pivotal role to play in achieving a sustainable economy and society. The dilemma that an educator faces today is that, by and large academic institutions try to teach everyone to accept the economic system and to succeed within it. Unfortunately, that success pretty much guarantees the accelerated blighting of the planet and all living organisms, without exception. The cognitive and cultural separation of "ecology and environment" from the human enterprise, has led to a large-scale degradation and depletion of natural resources. The guiding ideology needed to learn and teach sustainability is an ideological orientation that emphasises conserving cultural values, beliefs, and practices that contribute to sustainable relationship with the environment. All the citizens must be environmentally literate. Perhaps the best way to visualise is by incorporating environmental education in the structure, pedagogy and curriculum of academic institutions.

KNOW YOUR ECOSYSTEM

'Know Your Ecosystem' is an environmental education programme (initiated in 1997) for conservation of ecosystems, environmental management, and sustainable planning education for schools. Its holistic, participatory approach and combination of learning and action make it an ideal way for schools to embark on a meaningful path for improving the environments of schools and their local communities, and for influencing the lives of young people,

school staff, families, local authorities, NGOs, and many more. 'Know Your Ecosystem' is a participatory programme that provides an excellent opportunity for students to take decisions to improve both school and home environments. It strives to increase environmental awareness of students, staff and communities and to improve school environments through this. Actions taken during the programme have also led to financial savings for the school regarding electricity and water consumption costs. The schools are given the opportunity to create links with the other schools (rural, urban, etc.), giving them the chance to share environmental education ideas and creating a means for cultural exchange and language improvement.

Environmental education programme encompasses raising awareness, acquiring new perspectives, values, knowledge and skills, and formal and informal processes leading to changed behaviour in support of a sustainable environment. The skills acquired include capacities to:

- define and explain fundamental concepts such as environment, ecological systems, community development and technology and being able to apply them to specific situations using a range of relevant resources and technologies
- analyse problems, and frame and investigate relevant questions
- assess and evaluate differing points of view
- develop hypotheses based on balanced and accurate information, engage in critical analysis and careful synthesis, and test new information and personal beliefs, with explorations and experiences against these hypotheses
- communicate information and points of view effectively
- develop partnerships and the foundation for cooperative and consensual action
- develop strategies for action, including locating appropriate resources, and means for their implementation.

Objectives

Objectives of 'know your ecosystem' are to tap the potential of high school students by involving them in environmental awareness programmes through extensive field-based learning and creation of regional environmental information made available through a content management system (<http://drupal.org>) over the internet. This involves:

- Running environment education programmes in a network of schools (rural and urban)
- Conducting training and awareness building workshops for students and teachers
- Developing and disseminating Environment Education materials in self-learning format to all the sections of the society through the web and print media

- Networking and coordinating among school communities across the country
- Building a network of high school students and teachers for creating an environmental information system that is accessible over the internet
- Developing regional environment information system with the help of high school students (interactive spatial decision support system)

Functional Aspects of 'Know Your Ecosystem'

The programme involves several steps that any school can adopt. Based on the elements of an environmental education programme, the process involves a wide range of stakeholders, but it is the pupils who play the most important role.

The seven steps include

- **Selection of schools and establishment of Eco-Club in each school.**
- Constitution of a committee to organise and direct the activities of the environmental education programme.
- **Environmental Review and an Action Plan** to set achievable targets and deadlines for raising awareness, acquiring new perspectives, values, knowledge and skills; and formal and informal processes leading to changed behaviour in support of a sustainable environment.
- **Essay competition and quiz programmes.**
- **Workshop/training programmes** to train students and teachers in environmental monitoring (this would include hands-on training). Paper presentation by students in international and national symposium/seminars.
- **Development of environment education materials in self learning format:** Each section/chapter should include learning activities. Five modules have been developed and currently we are involved in the validation and pilot testing of these modules.
- **Development of interactive database** which would help a student to access the quality data compiled by students.

Current programme focusses on aquatic ecosystems involving mapping of natural resources in a lake/stream catchment, land use analysis (GIS), water quality (physical, chemical parameters, and in some schools, biological parameters), soil quality assessment (physico-chemical).

Methods/Strategy

- Initially organise intense workshops and training programmes to provide hands on training to high school teachers and students.
- Devise field-based surveys and sampling procedures to be carried out by the high school students, under the guidance of high school teachers, on various themes under environmental education (like ecological, socio-economic, natural resources, etc.).

- Create mechanisms to collate and assimilate relevant data collected from the field surveys and sampling.
- Use of Simputers (hand held computers) for data collection and analysis.
- In the process, students get sensitised with various issues concerning their neighbourhood, ranging from ecological to socio-economic and natural resources.
- Further, create mechanisms to spread the message amongst the students to various strata of the society.
- Disseminate the collected environmental information through an open-source content management system (<http://drupal.org>) or Wiki engine making it accessible to everyone with add on features like
 - Loading of data and analysis
 - Visualisation of analysed data
 - Query-based generation of scenarios

Web-based spatial decision support system aid the decision makers in visualising the health of natural resources at a local level.

Role of Stakeholders

- Ideally state education department and the local body need to support this activity both in principle and material. This programme would generate ecological and environmental quality data at a regional level, which helps the local administration in the management of natural resources. Involvement of schools (every year) helps in getting the data updated.
- Principle – refers to making it mandatory for all high schools and making the activity attractive to teachers by offering some incentives for those teachers involved in this activity by the state education department.
- Material – refers to providing logistic support to the experts for training. Any support and cost would be incurred by students for field surveys and sampling a local body, cost of website, etc. are to be borne by the local body.

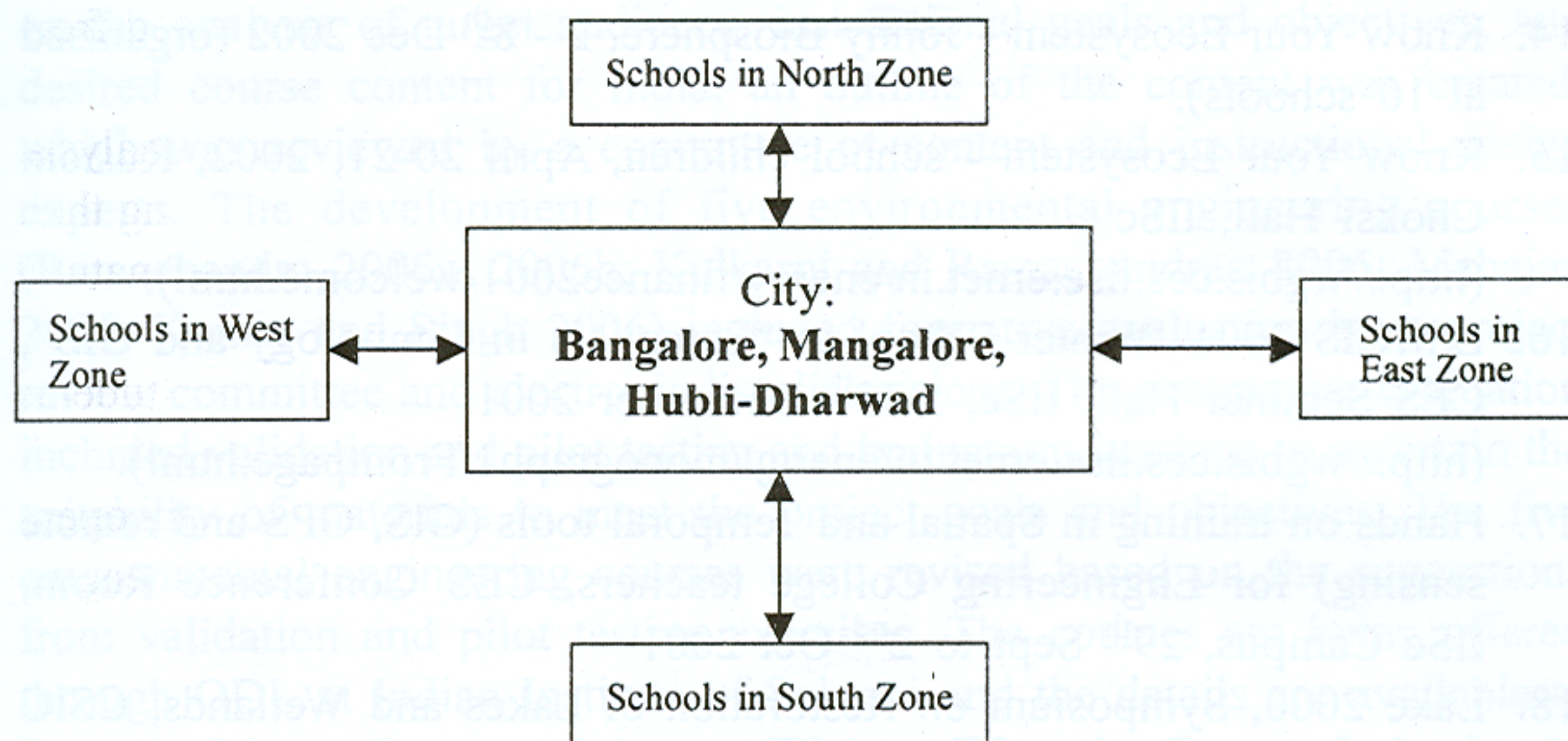
Selection of Schools

Stage I: Ecological and Environmental Monitoring in Peri Urban and Rural schools

Workshops and Training Programmes

Workshops, symposia and training programmes for capacity building at various levels are:

1. Lake 2006: Symposium on Environment Education and Ecosystem Conservation, 28-30th December 2006, Rustom Choksi Hall, Indian Institute of Science.



2. Course on Environment Management for in-service working professionals, August-December 2006, Proficiency, Centre for Continuing Education, IISc.
3. Environment Awareness Workshop, 14-15th July 2006, K K English High School, Varthur.
4. One day 'Ecology Workshop', 18th March 2006, St. Joseph English School, Whitefield.
5. Course on Environment Management for in-service working professionals, January – May 2006, Proficiency, Centre for Continuing Education, IISc.
6. Round table meeting 'Environmental Education in India', 12-13th Feb 2006, CES Seminar Hall, IISc.
7. One day 'Ecology Workshop', 16th February 2006, Satya Sai Residential School, Muddenahalli, Kolar.
8. Course on Environment Management for in-service working professionals, August-December 2005, Proficiency, Centre for Continuing Education, IISc.
9. QIP Short term course on "GIS and Remote Sensing Applications in Environmental Management", 12th to 18th August 2005 at CCE seminar hall, IISc (Sponsored by AICTE).
10. Three Days 'Green Workshop', 3-5th June 2005, K K English High School, Varthur.
11. Lake 2004, International Conference on Conservation, Restoration & Management of Lakes and Coastal Wetlands, Berhampur University, Orissa.
12. Short-term course on "Environmental Management", 12th to 17th May 2003, at SDM College of Engineering, Dharwad.
13. Lake 2002, International Symposium on Conservation, Restoration and Management of Aquatic Ecosystems, 9-13th December 2002, Satish Dhawan Auditorium, IISc
(<http://wgbis.ces.iisc.ernet.in/energy/water20/Lake2002.html>).

14. Know Your Ecosystem - Johny Biosphere, 2 - 8th Dec 2002 (organised at 10 schools).
15. Know Your Ecosystem - school children, April 20-21, 2002, Rustom Choksi Hall, IISc
(<http://wgbis.ces.iisc.ernet.in/energy/finance2001/welcome.html>).
16. LIMGIS 2001- Winter School in "Essentials in Limnology and GIS", CES Seminar Hall, IISc, 5-13th December 2001
(<http://wgbis.ces.iisc.ernet.in/energy/monograph1/Frontpage.html>).
17. Hands on training in Spatial and Temporal tools (GIS, GPS and remote sensing) for Engineering College teachers, CES Conference Room, IISc Campus, 29th Sept to 2nd Oct 2001
18. Lake 2000, Symposium on Restoration of Lakes and Wetlands, CSIC Auditorium, IISc, Nov 27-29, 2000
(<http://wgbis.ces.iisc.ernet.in/energy/water/lake2000conference.html>).
19. Know Your Ecosystem – Johny Biosphere, 24th Nov-10th Dec 2000 (organised at 10 schools)
(<http://wgbis.ces.iisc.ernet.in/energy/finance/2000/welcome.html>).
20. Discussion meeting at Kolar - Integrated Energy Planning using GIS, May 25, 2000.
21. Energy Alternatives 2000 - Exhibition on Renewable energy technologies, 24-25 June 2000, Mahila Seva Samaja, Kolar.

Information System developed at ENVIS centre, CES, IISc (through summer research fellows and summer trainees)
(<http://wgbis.ces.iisc.ernet.in/biodiversity/database>).

Establishment of Sahyadri Eco Clubs (with regular monthly seminars and field activities) at K K English High School, Varthur and St. Joseph English School, Whitefield (since 2004).

Environmental Engineering Courses

Rapid industrialisation of developing countries has led to a shortage of engineering personnel at all levels, including the industrial sector and in the infrastructure management. As engineers play a key role in the process of development, the World Federation of Engineering Organisations came up with its proposal for the World Engineering Partnership for Sustainable Development. This necessitated the design and development of Environmental Engineering Courses in Self Learning Format, taking advantage of recent developments in Information Technology, so that the Courses could be taught in distance mode. Recognising this need, COL-IISC (Commonwealth of Learning, Canada – Indian Institute of Science, India) developed a series of learning materials in environmental engineering for teaching environmental engineering professionals through ODL. The courses with student relevant examples were directed at practicing professionals in India and the developing commonwealth countries for continuous professional development. Based

on the analysis of target audience, instructional goals and objectives, and desired course content for India, an outline of the content was created, which was reviewed by a committee of content and instructional design experts. The development of five environmental engineering courses (Ramachandra 2006a, 2006b; Kulkarni and Ramachandran 2006; Mahajan 2006; Kumar and Singh 2006) included formative evaluation by a project review committee and electronic list discussions. The summative evaluation included validation and pilot testing and brainstorm sessions to ascertain the suitability of materials to meet the project goals and objectives. The five environmental engineering courses were revised based on the suggestions from validation and pilot testing exercises. The courses are being offered through ODL at Indian Institute of Science and the details are available at (<http://wgbis.ces.iisc.ernet.in/energy/DistanceEducationCourses/index.htm>).

Environmental Education Modules for School Children and Teachers

In this context, based on the need for assessment (in consultation with the teachers and administrators), IISc in collaboration with COL developed the 15 self-learning environment education modules (ecology, energy, environment, water, etc.) during 2002-2005. Evaluation and pilot testing was done to ascertain the suitability of materials to meet the goals and objectives of the endeavour.

Evaluation

To ensure that progress is made and that achievements are celebrated, monitoring and evaluation are done. This also ensures that environmental care and education is an ongoing process. Certain themes are studied in the classroom through Curriculum Work, and all students are involved in practical initiatives. Schools are encouraged to make outside contacts and ties to enhance their learning experience and to inform the wider public about their activities. Each school develops its own Eco-code (like not using plastics in schools located in urban areas, etc.), outlining the environmental values and objectives and what the students are striving toward.

After a period of participation, an evaluation of the success of these initiatives and the methodology is undertaken, and the whole 'Know Your Ecosystem' programme for each school is assessed. Successful Eco-clubs (and schools) and students are awarded with the **Eco Award** during the national/international symposium (Lake 2000, Lake 2002, Lake 2004....), held once in two years.

BENEFITS OF ENVIRONMENT EDUCATION PROGRAMMES

The management of ecosystem involves inventoring and monitoring, and applying integrated technologies, methodologies, and interdisciplinary approaches for its conservation. Hence, now it is even more critical than

ever before for the human beings to be environmentally literate. To realise this vision, both ecological and environmental education must become a fundamental part of the education system at all levels of education. Environmental education programme at schools would generate ecological and environmental quality data at regional levels, which helps the local administration in the management of natural resources. Involvement of schools (every year) helps in getting the data updated. The benefits are:

- At the students level – students and local public get sensitised about their local/neighbourhood environment, socio-economic backgrounds and ecological relevance.
- When carried out periodically, over a period of time a good repository of local environmental information is generated by the high school students for their neighbourhood, which is a *contribution* in itself.
- The local body in terms of documenting what is in and around their neighbourhood – when this content is put online, it virtually reaches almost everybody.
- The state education department may stand benefited in terms of achieving its goal of enhancing quality (environmental) education.

Fate of the Earth's remaining natural resources depends on the sustainable management and development actions by humans. India will certainly achieve the goals of sustainable development only if it succeeds in developing environmentally literate public with the knowledge of ecosystems and the environment. This requires sincere effort and involvement of all sections of the society—decision makers, educators, and general public at large. It is the right time for all of us to plan our natural resources through conservation approaches. Sustainable ecosystem management and development leading to conservation of natural resources is the key to our secured future.

Conserve or perish!

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