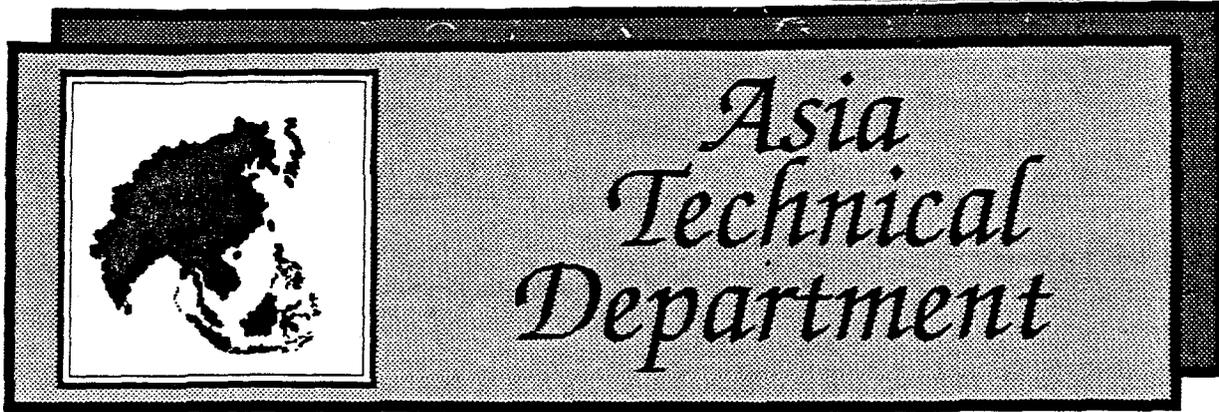


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Departmental Papers Series, No. 1

# Environmental Education in Asian Countries

by  
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FILE COPY

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## PREFACE

This paper is the first in a series of Asia Technical Department papers dealing with cross-sectoral issues relevant to a broad range of situations and users within the Region and outside. Through this series, the Department hopes to provide a service to the Bank of distributing technical information on topics of timely importance to Regional work that is not available in more formal Bank publications.

A key strategy for addressing environmental problems of deforestation, desertification, loss of biodiversity, and air and water pollution is environmental education. Countries are increasingly recognizing the need to introduce more environmental education at all levels. Curricula in the primary and secondary school levels and in non-formal education programs helps to build citizen awareness of environmental concerns and to build support for concrete activities to improve the environment. Teaching basic principles of science through experiments with environmental issues is an effective way to raise student awareness. Such experiments also require much less expensive equipment than do the more traditional science experiments, which is an important additional benefit for developing countries with limited school budgets.

Environmental curricula at the secondary school level also makes students aware of career opportunities in the environmental sciences and environmental engineering fields, channelling individuals into these lines of study at university level. As countries increase the rigor of environmental assessment and monitoring procedures for planned development interventions in industry, infrastructure development, agriculture, urban development, and resource extraction and mining, there is a growing demand for in-country specialists in a wide range of environmental fields. Bank investments in the education sector can play a major role in developing country capacity in this regard, through support to teacher training, school curricula, and the quality improvement and expansion of environmental research and training institutions.

This paper is a comprehensive review of the status of environmental education in the Asian countries. Its primary target audience is education sector specialists working on both formal and informal education, although it should also prove useful to those developing environmentally-sensitive projects, who wish to draw upon existing environmental education programs for specific purposes.



Daniel Ritchie  
Director  
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## **INTRODUCTION**

This paper summarizes the current status of environmental education in Asian countries and identifies the current trends. This work is the product of a joint program of ASTPH and ASTEN carried out between July and December 1990 under the direction of Mr. Erik Thulstrup, then Science and Technology Specialist in ASTPH. It is intended to primarily serve as a handbook to staff formulating projects in the education sector, but also to inform staff developing environmentally-sensitive projects and those involved in institution-building in the environmental sector about resources upon which they can draw. The paper is the result of a desk review of the materials available on the subject, which has been broadened by feedback from Bank staff, other international specialists, and the institutions concerned. In addition, the author participated in the preparation of a China education project, and cross-checked the information on China during her visit there.

The author, Bojana Boh, is completing her PhD in biochemistry at the International Center for Chemical Studies, Edvard Kardelj University in Ljubljana, Yugoslavia. She has been actively involved in international science education for a number of years. At the Center, she has worked on a number of industrial projects and also organized science education camps for high school students from Yugoslavia and other European countries.

The review covers both formal and non-formal programs for presenting environmental education and examines both governmental and non-governmental materials and programs. The original terms of reference were to focus mainly upon secondary education, but the study was widened to meet the needs of a much broader audience within the Bank and outside. During the limited time available, Ms. Boh collected as many different sources of data as possible. The following sources were used to obtain information and cross-check that obtained on environmental education in Asian countries:

- a) bibliographic databases:
  - UNESCO Database,
  - ERIC Database,
  - ENVIROLINE Database,
  - ENVIRONMENTAL BIBLIOGRAPHY Database;
  
- b) microfiche collections, journals, conference proceedings, books and other publications in the World Bank Sectorial Library, Joint Library Network, and UNESCO Library and Documentation Services in Paris and Bangkok;
  
- b) inquiries were sent to respective institutions and/or individuals active in the field of environmental education in Asian countries. Up-to-date data were received from individuals who kindly provided information on environmental education or sent materials describing the activities of various environmental research/education institutions in their countries (their names are listed under the title "Contact persons" in the last section of country reports);

- c) a draft version of the report was submitted to some of the World Bank specialists, who work on environmental projects or on educational projects in individual Asian countries. Their comments and suggestions have been incorporated in this version of the report.

The following information has been collected for each country:

#### COUNTRY

##### Basic indicators:

Population  
 Area  
 GNP per capita  
 Average annual growth rate  
 Adult illiteracy  
 Percentage of age group enrolled in education  
   Primary  
   Secondary  
   Tertiary  
 Primary net enrollment  
 Primary level pupil-teacher ratio  
 Total expenditure on education as % of GNP

##### Major environmental problems

##### School system

General education  
 High schools  
 Universities

#### ENVIRONMENTAL EDUCATION

1. Formal environmental education
  - Pre-school level
  - Primary school level
  - Secondary school level
  - University level
  - Extension programs (for government officials, specialized technical training)
2. Non-formal environmental education
  - Out-of-school activities
  - Mass media
  - Voluntary organizations
3. Training of environmental education personnel
  - Teacher training
  - Organizers of non-formal education
4. Major environmental education problems and future plans
5. List of institutions and/or individuals engaged in environmental education

In the country reports, these themes form the backbone around which the information has been collected, compared and structured. In cases, where plenty of publications were available, all of the branches in the country report are well documented. In some cases, sections of the country reports are empty, while for a few countries, there was no environmental education data available for analysis.

The literature reviewed for the paper has been organized into a small, specialized library collection shelved in ASTPH, which is available with Mr. James Socknat, Chief. It is organized as follows:

- a) documents cited in the report (listed in the Reference section) organized around the following thematic groups:
  - basic indicators,
  - school systems in Asian countries,
  - environmental education in Asia,
  - directories, and
  - environmental education in individual Asian countries;
  
- b) literature for further reading (listed in the section of Additional literature) includes:
  - selected examples of environmental education projects from non-Asian countries,
  - bibliographies, directories and lists of environmental education literature and other teaching materials,
  - examples of environmental education materials for teacher training and curriculum development,
  - general documents on environmental education.

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**Country: AFGHANISTAN****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): ?  
 Area (thousands of square kilometers): 652  
 Adult illiteracy, 1985 (percent): ?  
 Percentage of age group enrolled in education (1986):  
     Primary: 18  
     Secondary: 6  
     Tertiary: 1.4  
 Primary level pupil-teacher ratio (1986): 37  
 Total expenditure on education as % of GNP (1981): 1.8

**Major environmental problems (NCERT, 1987; Wafamal, 1981):**

- deforestation, denudation, soil erosion,
- pasture land limitation (by cultivation) and overgrazing,
- pesticides and fertilizers causing vegetable, fruit and water pollution,
- water pollution on a country-wide scale, lack of potable water,
- river floods causing crop destruction, human and animal death and land slides,
- energy crisis,
- extinction of wild life,
- population growth,
- poor health and sanitation - lack of city-wide sewage disposal systems in the country and sanitation facilities in cities, unhealthy latrines in homes and public places, harmful insect population explosion from late spring through early fall, diseases (small-pox, chicken-pox, malaria, cholera, typhoid, measles, diarrhea),
- lack of balanced diet, proper nourishment and capability on the part of individuals and communities to improve their immediate environment, poor food preservation facilities and techniques,
- illiteracy, ignorance, poverty,
- an unprecedented drift of rural population to the cities and towns, inadequate housing,
- air and noise pollution in most urban and in some rural areas.

**School system:****General education:**

10 years - primary school grades I-IV, incomplete middle school grades V-VIII, complete middle school grades IV-X (Fazil, 1988).

**Distribution of school time (UNESCO, 1986):**

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	18.8	22.3	26.3
Science:	-	2.4	8.7
Mathematics:	4.5	4.5	-
Technology:	-	-	-

Science teaching on primary level starts in Grade 3.

Science teaching on secondary level:

Integrated science is followed to Grade 10. Optional courses during the late secondary school years include physics, chemistry, biology and astronomy (UNESCO, 1986).

There are 3370 primary and incomplete middle schools, 200 lycees (high schools) and 25 vocational schools. There are two universities, one Polytechnic school and several other institutes of higher learning (Fazil, 1988).

#### ENVIRONMENTAL EDUCATION:

##### 1. Formal environmental education:

Ecological education is an integral part of the educational system. The Biology Section of the Compilation and Translation Department is concerned with the curriculum of biology subjects for the whole country, with the revision of textbooks and teacher's guides for all schools in Afghanistan, and has written syllabi for grades 3-10 (Fazil, 1988).

**Primary and secondary school level:**

The time allocation for biology teaching in grade 1 through 10 has been approved by the Ministry of Education as follows:

Grades 1 and 2: biology is taught as a part of Language Arts program which contains certain information on biology and environmental phenomena.

Grades 3 and 4: there is a separate Natural Studies syllabus for grades 3 and 4. Textbooks focus on acquainting students with their environment and the interpretation of events or phenomena that occur in the national environment. Students acquire knowledge, skills and values concerning animals, plants and their environment.

In grades 5-10 environmental concepts about safety and protection practices at home, school, community and nation, as well as conservation of lands and protection of fauna and flora are taught (Fazil, 1988).

Along with the introduction of health education as a major subject at the primary level, a significant step was made with the development and implementation of a Pilot project in Environmental Education for 7th grade students. Since the project was at the stage of trial-testing, environmental education was introduced to students of grade 7 as a separate subject in the form of self-learning modules. The activities included simple, practical and safe experiments, lectures, films, study-tours and field trips. A survey of the 600 students revealed a high degree of interest in such topics as soil conservation, forest conservation, community health and safe drinking water. Instructional materials for retraining supervisors and teachers also were developed.

However, this project operation was on a very limited scale (Wafamal, 1981; UNESCO-UNEP, 1987).

University level: (No data available)

## 2. Non-formal environmental education:

### Education for adults:

Environmental education is frequently designed within the framework of literacy and adult education programs developed by health institutions (Fazil, 1988).

### Governmental and voluntary organizations:

The National Science and Audiovisual Center in Kabul has the following functions at the national level:

- training of teachers, leaders, specialists,
- production and evaluation of instructional materials (textbooks, books, research reports), provision of monitoring kits (air, water, noise), and audiovisual aids (films, slides),
- development of learning environments and facilities offering first-hand experiences,
- organization of meetings, conferences, workshops, exhibitions,
- exchanges of ideas and information.

The target groups include primary and secondary school students, teachers, community leaders, and the general public (UNESCO, 1989).

## 3. Training of environmental education personnel:

### Teacher training:

The Pedagogical Academy is the institution concerned with the training of teachers for Bachelors and Masters Degrees. It is also responsible for training of teachers for institutes of teacher training, primary schools and kindergartens.

The environmental education program in teacher training institutes for pre-service and in-service training focuses on environmental study, social environment and sanitation, geological structure and protection of the environment (Fazil, 1988).

## 4. Major environmental education problems and future plans:

The main problems, identified by UNESCO-UNEP in 1976, are given below:

- Primary and secondary level: shortage of qualified teaching personnel in environmental education.
- Tertiary level: relative lack of educational facilities such as laboratory equipment, specialized centers and libraries.
- Out-of school education: shortage of instructional materials for environmental education, i.e. audio-visual supports, games, guides, books and magazines.

According to NCERT report, 1987, the country is facing additional problems, such as:

- illiteracy, ignorance and poverty,
- lack of financial capability and information on the part of individuals and communities to improve their immediate environment,
- poor and untimely planning, implementation and evaluation of environmental improvement projects,
- poor cooperation and coordination among various Ministries to reduce duplication and wastage of financial resources,
- poor planning and management on the part of some government departments to secure and absorb the assistance of international organizations,
- inadequate national material and human resources, insufficient facilities and poor techniques of socio-economic development.

Following are the main priorities and plans for future development of formal and non-formal environmental education in the country (Fazil, 1988):

- creation of all essential provisions for an effective struggle against illiteracy;
- expansion of intermediate, high and vocational education to train the academic and professional cadre of the country and review school curricula;
- further development of environmental education programs,
- coordination between health institutions and the Ministry of Education with regard to formal and non-formal education;
- joint work by the Ministries of Education and Public Health to improve the concepts of environmental education;
- organization of seminars and workshops in the areas of health, environment and methods of teaching environmental education;
- organization and preparation of health and environmental concepts for the mass media, especially for radio and TV,
- preparation of environmental education programs for the general public, using simple language,
- production of pamphlets, posters and other supplementary materials for teachers, curriculum developers and supervisors to transfer awareness, sensitivity and consciousness to the people;
- searching for the assistance and cooperation of other nations and international organizations in the practical implementation of health and environmental education.

**5. Some institutions engaged in the environmental education (Fazil, 1988; UNESCO, 1989):**

- Ministry of Education,
- Ministry of Public Health,
- National Science and Audiovisual Center, Jamal Mena, Kabul (Tel.: 40007 or 41371).

**Country: BANGLADESH****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 108.9  
 Area (thousands of square kilometers): 144  
 GNP per capita, 1988: \$170  
 Average annual growth rate, 1965-88 (percent): 0.4  
 Adult illiteracy, 1985 (percent): total 67 (female 78)  
 Percentage of age group enrolled in education (1987):  
     Primary: 59  
     Secondary: 18  
     Tertiary: 5  
 Primary gross enrollment (classes 1-5), 1987: 61.0% (male 71.5%, female 49.8%)  
 Secondary gross enrolment (classes 6-10), 1987: 24.4% (male 34.0%, female 14.5%)  
 Primary level pupil-teacher ratio (1987): 48  
 Total expenditure on education as % of GNP (1986): 2.1

**Major environmental problems (Haq, 1988; Latif, 1981):**

- dense population, high population growth, poverty;
- lack of pure drinking water, water-borne diseases;
- water pollution (industrial wastes, fertilizers, toxic chemicals, synthetic detergents);
- air pollution (industrial effluents, automobile emissions, brick field smokes, etc.);
- desertification, caused both by climatic factors and by man-made disturbances - deforestation (especially in the northern region),
- ecological imbalance due to unplanned and uncoordinated action in the name of development in urban areas, especially in Dhaka,
- adoption of unsuitable technologies,
- extinction of wildlife, almost no virgin land.

**School system:**

The educational system has changed little since British colonial times, and remains highly centralized. Public examinations, conducted after class 10 and class 12, are administered by four semi-autonomous regional examination boards.

The science subjects are the traditional ones and science teachers are normally qualified in only one science subject.

Printed science materials are highly academic, and the poor quality of paper and binding allows a maximum life of 1 year.

The teaching style in schools is formal and encourages rote learning. Very little practical science work is done. There is a serious shortage of laboratories and scientific equipment. In the last years, a major project has been launched to equip the under-privileged secondary schools with laboratories and equipment (Reeves, 1987).

**General education: 12 years (pattern: 5+3+2+2)**

(In addition, there is also a parallel religious education system of education offered at similar levels.)

**Primary education:**

Over one-third of the children of primary school age are not enrolled. Only one in three school-age girls is in school. Dropout rates in primary education have been high, resulting in only 14% of primary students reaching 5th grade within five years. Three-quarters of those who enter the primary school system never complete it (The World Bank, 1990).

**Secondary education:**

Most of secondary schools are private. Less than half of the students are able to pass the Secondary School Certificate examinations or Higher School Certificate examinations (The World Bank, 1990).

Enrollment and number of educational institutions data for 1987 (The World Bank, 1990):

School level	Total enrollment	Number of institutions
Primary and Secondary	15,351,100	68,346
Intermediate, Diploma and Degree	1,160,000	2,394
Colleges	5,400	17
Universities	46,300	7

Formal science education is not stressed- number of students in 1978 (Islam, 1982):

School level	Science	Others
Secondary level (Classes 9,10)	107,000	31,000
College level	7,000	23,000
University level	8,000	17,000

In "The World Bank Bangladesh General Education Project" increased emphasis is given to health and environmental issues in curricula and textbooks (The World Bank, 1990).

**ENVIRONMENTAL EDUCATION:**

**1. Formal environmental education:**

**Primary school level:**

A program of "Open-Air Education" was launched as a pilot project in the late seventies, which made use of the out-of-doors as a means of developing environmental sensitivity and a love for nature.

This program has been replaced by a new curriculum for the primary grades. The National Curriculum Committee included in the first and second level (grades I, II) a subject "Environmental Studies". The contents headings for the syllabus include environmental topics such as:

- family environment,
- food and shelter,

- domesticated animals and birds,
- climate and seasons,
- environment of the school and village,
- importance of clear and clean environment,
- observation of local environment and its natural characteristics.

There are no textbooks for the pupils, and only guidebooks for the teachers. Pupils are encouraged to use models, pictures, sketch-maps, and sketches wherever possible (Haq, 1988; Ponniah, 1982; UNEP, 1986). For grades 3,4 and 5, the subject Environment Learning has been divided into two separate subjects:

- Environment Learning - Social,
- Environment Learning - Science,

with the content drawn from physical geography, zoology, agriculture, physics, chemistry, health and nutrition (Latif, 1981).

#### Secondary school level:

##### Junior secondary level (Grades VI-VIII):

The National Curriculum and Syllabus Committee included topics of environmental education for the junior secondary level in two different subjects - General Science and Social Science. Various topics relating to the country's environment have found a place in discussions on physics, chemistry, biology, hygiene, population education and history (Haq, 1988).

The population education curricula includes environment-related topics, such as population and environment, population growth and natural environment, nature and human society, population and environment - soil, water and air (Latif, 1981; Ponniah, 1982).

##### Higher secondary level (Grades IX, X):

There is no well-defined syllabus on environmental education for the higher secondary level. Elements of environmental studies have been included in subjects like geography, civics, economics, history, integrated science (physics, chemistry, biology), general science, food and nutrition, clothing and housing (Haq, 1988).

##### Higher Secondary level:

There is no separate subject on environmental studies. Most of the environmental aspects are covered in the subjects like botany, biology, zoology, geology, geography, physics, chemistry, civics, economics, history and other subjects of general science and social science (Haq, 1988).

Future plans for the development of formal environmental education are given below (Haq, 1988):

- more emphasis will be given to the formal environmental education,
- teachers are to take more initiative for motivating their students, and set examples by their own lives,
- more practical works are to be assigned to the students of all stages: primary, secondary and higher,
- environmental education studies must be made an examination subject or a part of an examination subject for the secondary as well as the higher secondary stages,

- more opportunities will be provided for nature study field trips.

#### University level:

There are at least three tertiary level institutions offering environmental education and training courses (UNEP, 1986):

- Bangladesh University of Engineering and Technology,
- Jahangir Nagar University,
- Rajshahi University.

## 2. Non-formal environmental education:

#### Out-of-school activities:

The education is rather examination oriented. Students aim to cover the topics of the syllabus and to get good marks in the final examination. This has led some of the younger people to form science clubs. All the guides of the science clubs are voluntary workers. Elderly teachers, research workers or scientists and technologists are on the advisory councils of the clubs. The activities of the clubs include, among several science topics, study of the local flora and fauna, and original research work on local environmental problems (Islam, 1982).

Two non-governmental organizations - Bangladesh Youth Council and The International Civil Service Bangladesh - work in the field of out-of-school environmental activities for youth (UNESCO, 1989).

#### Mass media:

Due to the high illiteracy rate, radio plays a vital role in mass communications, especially in the fields of agriculture, health, sanitation and family planning (Islam, 1982).

#### Non-governmental organizations:

The Bangladesh Youth Council is a national non-governmental organization, active in the fields of:

- environmental studies,
- disasters,
- land use and misuse,
- food and agriculture,
- animal and plant wildlife,
- recreation,
- habitats and human settlements,
- technology and industry,
- pollution,
- health and human well-being,
- population,
- labor, employment and manpower,
- socio-economic and socio-cultural aspects.

The council is involved in formal and non-formal education systems, taking part in the following activities:

- preparation of curricula,
- production and evaluation of instructional materials,
- elaboration and assessment of teaching/learning methods,
- advisory services in education,
- research in education,
- exchange of ideas and information,
- documentation services,
- provision of guides, periodicals, research reports,
- provision of monitoring kits (air, water, noise),

- organization of meetings, conferences, exhibitions.

The programs are designed for various target groups, including students from pre-school to higher education levels, out-of-school youth, teachers in service, education specialists, youth and community leaders, illiterates, workers, farmers and general public (UNESCO, 1989).

The International Civil Service Bangladesh works in the following fields of environmental education:

- food and agriculture,
- water resources,
- disasters,
- environmental studies,

and focus on youth leaders, out-of-school youth, community leaders, and students from secondary and higher school levels. The main functions of the organization are (UNESCO, 1989):

- education in the non-formal system,
- development of learning environments and facilities offering first-hand experiences,
- elaboration and assessment of teaching/learning methods,
- production and evaluation of instructional materials, publishing of guides, textbooks, reports,
- exchange of ideas and information,
- providing documentation, technical services, audiovisual aids, monitoring kits,
- organizing conferences, workshops, meetings and exhibitions.

The Monsoon Region Environment Society (MONRES) was established in May 1980. The main objectives of MONRES are (Haq, 1988):

- promotion of environmental education and dissemination of environmental knowledge to the people,
- monitoring various factors of environmental pollution and their impacts,
- undertaking scientific research and surveys in relation to environmental protection,
- arranging workshops, seminars, symposia, conferences, and case-studies in respect of environmental pollution problems in land, water and air,
- development and maintenance of necessary libraries, reading rooms, auto-visual materials, etc., and to publish books and journals regarding environmental pollution (MONRES publishes a quarterly bulletin *Parisesh*),
- cooperation with national governmental and international agencies of the Monsoon region with similar problems and objectives.

The Society for Conservation of Nature and Environment (SCONE) has been publishing a quarterly bulletin, which covers important aspects of environment, e.g. (Haq, 1988):

- Integrated development in Bangladesh and environment,
- Afforestation plan of the Bangladesh Government,
- Better sanitation and drainage for Dhaka,
- Enforcement of Wildlife (Preservation) Order, 1973,
- Conservation and the rural economy,
- Local trading of wild birds,
- Pure drinking water for rural population,
- Water pollution - A growing menace in Bangladesh,
- Man-eaters of the Sunderbans (Royal Bengal Tigers),
- Low-cost sanitary latrines for rural people,
- Wildlife heritage,
- Tree plantation with a difference,
- Forest wealth of Bangladesh,
- How chemical industries pollute the environment,

- Estuarine crocodiles and their environment in Sunderbans,
- Bangladesh and Bengal floricans,
- Tropical rain forests,
- World Environment Day,
- Export of frog legs,
- Diarrhea - the worst child killer in the third world,
- Floods in Bangladesh,
- Environmental hazards of global concern,
- The interdependence of human and genetic futures,
- Ecologists' view: conservation is key to drought prevention,
- Bhopal disaster.

There are about 19,000 religious institutions in the country, called Madrasahs. In some, science education has been introduced on an experimental basis (Islam, 1982).

There are some other self-governing environmental organizations, e.g. the Society for Conservation of Nature and Environment (Badhu, 1982).

### 3. Training of environmental education personnel:

#### Teacher training:

There are 51 Primary Training Institutes (PTIs) and 10 Teacher's Training Colleges for primary and secondary school teachers in the country. The National Academy for Primary Education (NAPE) organizes refresher courses and workshops on different academic subjects for primary school teachers and supervisory staff. The National Institute of Educational Administration Extension and Research (NIEAER) arranges short training courses, seminars, symposia and workshops for school and college teachers as well as educational administrators, including curriculum development. These training institutes neither offer directly any course on environmental education, nor have they any specific curriculum program (Haq, 1988).

Most secondary science teachers are graduates without any training beyond one or two 2-week in-service courses. About 1200 science teachers a year, after teaching for a few years, take a 1-year B.Ed. course at one of the ten teacher training colleges. The science and science methodology components of the B. Ed. course amount to only 8 per cent of the total time allocated, and what are included are taught formally in lectures. In-service training courses accommodate approximately 150 science teachers per year out of a teaching force of 14,000 science teachers. In the last years, new courses for teachers' college lecturers have begun, and a science teacher training manual has been produced. Science centers are being set up in each teachers' college to provide in-service training and resource materials (Reeves, 1987).

#### Training of non-formal environmental education personnel:

In February 1981, thirty representatives from Unesco Clubs, Boy Scouts, Girl Guides, youth organizations, women's associations and social

welfare organizations participated in the National Workshop in non-formal environmental education in Dhaka (UNESCO-UNEP, 1987).

**4. Major environmental education problems and future plans:**

The following are the main problems identified by UNESCO-UNEP, 1976:

Pre-school level: lack of funds and teachers.

Primary and secondary level: shortage of qualified teachers and teacher training organizations in the field of environmental education.

Tertiary level: insufficiency of specialists qualified in the different aspects of the environment and, to a lesser degree, an inadequate number of educational facilities (buildings, libraries, laboratories, specialized centers).

Education of out-of-school youth: shortage of personnel for youth programs (guides and leaders), as well as insufficient instructional materials designed for youth programs (audio-visual aids, games, guides, books and magazines).

Adult education: deficiency of instructional materials for the general public.

**5. Some institutions engaged in the environmental education (UNESCO, 1983; UNESCO 1989):**

- Bangladesh School Textbook Board, Dhaka;
- National Curriculum Development Center, Dhaka;
- Institute of Education and Research, Dhaka;
- National Institute of Educational Administration, Extension and Research; Dhaka
- Department of Environmental Pollution Control, Government of Bangladesh, Dhaka;
- International Civil Service Bangladesh, Dhaka;
- Bangladesh National Youth Council, Dhaka Metro.

**Country: BHUTAN****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions):1.4  
Area (thousands of square kilometers):47  
GNP per capita, 1988: \$180  
Percentage of age group enrolled in education (1987):  
  Primary: 24  
  Secondary: 4  
  Tertiary: ?  
Primary level pupil-teacher ratio (1986): 37

**ENVIRONMENTAL EDUCATION:**

(No data available.)

**Country: BRUNEI-DARUSSALAM****Basic indicators (Soerjani, 1989; The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (thousands): 241  
Area (thousands of square kilometers): 6  
GNP per capita, 1983: over \$20,000  
Primary level pupil-teacher ratio (1986): 17

**Major environmental problems (Soerjani, 1989; UNESCO, 1990):**

- land problems: land construction projects have caused damage to the drainage system, erosion and silting,
- problems with solid wastes: indiscriminate dumping of rubbish, including disposal of garbage by illegal hawkers and food stalls, blocking of drains from solid wastes and overgrowth of aquatic vegetation,
- waste waters, sewage: incomplete sewage treatment and its discharge near the shore; dumping of effluent from septic tanks,
- water pollution: oil pollution; pesticide pollution; illegal use of poisons and explosives for fishing; faecal contamination,
- air pollution: emissions from motor vehicles,
- noise pollution from traffic and power generation plants,
- hazardous wastes (handling of hazardous wastes is not regulated),
- environmental health problems (there is a possibility that vectors of malaria, typhus, dysentery fever and infectious diseases will be spread),
- extinction of wildlife.

**School system:**

In the country there are 118 primary schools, 34 secondary schools (of which 50% are private), three technical schools, Institute of Technology, Institute of Education, and University of Brunei-Darussalam. In general, the educational system follows the British Cambridge System (Soerjani, 1989).

**ENVIRONMENTAL EDUCATION:****1. Formal environmental education:**

At present environmental studies are not taught as a subject in any secondary school or university. However, there are environmental components incorporated into various subjects (UNESCO, 1990).

**Primary and secondary school level:**

Environmental issues have been integrated into primary and secondary school curricula.

An integrated new curriculum for primary schools was introduced in 1983, consisting of science (including health), geography, and history. Integrated modules are based on the individuals and their immediate surroundings of the house, school, village, district, country, and the earth, including their living and non-living components (Soerjani, 1989).

At the secondary level, Scottish Integrated Science Syllabus was adapted for use throughout the country. Examples of environmental topics are given below (Soerjani, 1989):

- respect for living things, interest in conservation,
- how to manage energy resources efficiently and carefully,
- the need for conservation sources of energy,
- water pollution and purification of water supply,
- the danger of erosion.

Environmental topics are incorporated into the following subjects (UNESCO, 1990):

- integrated science,
- biology,
- physics,
- combined science,
- human and social biology,
- geography.

**University level:**

Environmental components such as:

- environmental systems,
- ecology,
- geomorphology,
- climatology,

are taught to students who are studying BA - Education and BA - Primary Education at the university level (UNESCO, 1990).

**2. Non-formal environmental education:**

**Out-of-school activities:**

In primary and secondary schools, students are encouraged to do gardening as an extra-curricular activity, and to keep their school clean for a healthy environment ( Soerjani, 1989; UNESCO, 1990).

**Governmental organizations (UNESCO, 1990):**

The Ministry of Education is conducting the following programs:

- an inter-school cleaning competitions (annually),
- courses for cleaners, foremen and gardeners to update knowledge on maintaining a clean environment,
- exhibitions with themes pertaining to current environmental issues,
- anti-smoking campaigns,
- immediate disposal of write-off materials such as chairs, desks, etc. in schools,
- landscaping and beautifying school surroundings.

The Resource Center of the Curriculum Development Department provides materials for environmental education such as audio visual aids, charts and printed matter.

**Non-governmental organizations (UNESCO, 1990):**

BASE (Brunei Association of Science Education) regularly publishes printed materials for its members and organizes Science Project Competitions in schools pertaining to environmental matters.

The Brunei Chemical Society invites speakers and experts from overseas to give talks on current environmental issues on a regular basis.

The Nature Society has contributed to the collection of data on wildlife in Brunei Darussalam.

**Mass media (UNESCO, 1990):**

Mass media support national campaigns to make Brunei a clean and healthy place to live. Almost every night, radio and TV broadcast a short feature on polluted areas in Brunei and possible consequences of such pollution.

Lately, the public has launched several complaints about some polluted areas. As a result, the Municipal Board has acted to provide more dumping areas in various places to ensure a rubbish-free environment.

### **3. Training of environmental education personnel:**

**Teacher training:**

Several initiatives have been taken by the various institutions in providing seminars for teachers (UNESCO, 1990).

### **4. Some institutions engaged in the environmental education**

(Soerjani, 1989; UNESCO, 1990):

- Ministry of Education (courses, exhibitions, campaigns),
- Ministry of Development - Agricultural Department (reforestation programs),
- Ministry of Development - Town and Country Planning Department,
- Ministry of Home Affairs (national campaigns),
- Brunei Association of Science Education (projects and competitions on environmental issues),
- Resource Center of the Curriculum Development Department (printed materials, audio-visual materials),
- Brunei Chemical Society (lectures),
- The Nature Society (wildlife).

**Country: CHINA, People's Republic of****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 1,088.4  
Area (thousands of square kilometers): 9,561  
GNP per capita, 1988: \$330  
Average annual growth rate, 1965-88 (percent): 5.4  
Adult illiteracy, 1985 (percent): total 31 (female 45)  
Percentage of age group enrolled in education (1987):  
    Primary: 132  
    Secondary: 43  
    Tertiary: 2  
Primary net enrollment, 1987 (percent): 98  
Total expenditure on education as % of GNP (1985): 2.7

**Major environmental problems (Chen, 1981; Shen, 1984; Yang et al., 1989)**

The environmental problems with which the country is most seriously concerned are those related to the repercussions of a large population dependant upon a limited natural resource base. Concerns include land and water pollution stemming primarily from urban and industrial sources, atmospheric pollution aggravated by coal use, natural habitat destruction and problems of sustainable agriculture.

Priority areas related to pollution identified by the government are:

- urban water pollution due to urban growth, a high concentration of heavy metals from industries, and lagging of urban infrastructure, including sewage collection and waste treatment
- urban air pollution which is high due to the heavy dependence on coal energy for electricity, industrial use, and domestic cooking and heating (76% of total energy used)
- rural environmental pollution due to outdated technologies, lack of education about controls, and limited regulatory network at local levels

Other pollution concerns include ground water pollution, vehicular emissions, non-point source pollution and noise pollution. Land-based pollution is also the main source of the heavy pollution in coastal oceans.

In the agricultural sector, China faces problems of land degradation that hinder sustainable growth: soil erosion, salinization, water logging, and land deterioration due to irrational use of fertilizers and pesticides, flooding, and desertification. Population pressures has led to conversion of cultivated land to urban and industrial uses and increasing exploitation of marginal lands for agriculture. These problems combine with deforestation, siltation of major inland lakes, loss of wetlands, conversion of coastal areas, and marine pollution to create serious natural habitat destruction.

China is also concerned with global environmental problems, specifically CO<sub>2</sub> emissions and ozone layer depletion due to CFCs and Halons. China is an active participant in the Intergovernmental Panel on Climate Change.

Institutionally, there has been substantial progress in environmental management in the National Environmental Protection Agency and the Sector Ministries. The system mandates that provinces are responsible for the implementation of national policy at local levels. Local governments and enterprises formulate agreed-upon environmental protection goals with the coordination of Environmental Protection Boards (EPBs), of which there are 2,400 bureaus at provincial, municipal, and country levels.

Constraints on efficient environmental protection in the country include: lack of appropriate research and development, limited expertise in policy analysis and social sciences, particularly economics and management, inefficient policies and incentives for state enterprises, understaffing of environmental units, and lack of coordination among ministries and agencies.

#### School system:

General education: 12 years, through 3 levels:

primary school - 6 (or 5) years,  
lower secondary school - 3 (or 4) years,  
upper secondary school - 3 years.

In 1986, a 9-year compulsory education was introduced by law (Compulsory Education Law of the People's Republic of China).

Following is the situation of Chinese education system in 1988 (Dept. of Basic Education, 1989):

School level	Number of schools	Number of children	Number of teachers
Kindergartens	171,845	18,545,300	
Primary schools	793,300	125,358,000	5,501,300
Secondary schools	91,492	47,615,200	2,959,600

There are two separate curricula for the 6-year primary schools, one for urban areas and the other for the rural areas. Ten subjects are taught at the primary level: moral education, Chinese, mathematics, general knowledge of nature, general knowledge of geography, general knowledge of history, physical education, music, art and physical labor.

In secondary schools, 13 subjects are required: ideological and political education, Chinese, mathematics, foreign language, physics, chemistry, biology, history, geography, physical education, music, art and vocational education.

In the primary and secondary schools, there are four examinations: the term examination, the school year examination, the graduation examination and the entrance examination. Examinations taken by lower secondary school graduates are selective and the upper secondary school entrance examination is incorporated in them. Generally students are examined in Chinese, mathematics, foreign language, physics, chemistry and political studies. The graduation and college entrance examinations for upper secondary school students are taken separately: the qualification graduation examination is conducted by each school in respect of the subjects taught and their syllabuses, while the college entrance examination is a national public examination and is selective (Dept. of Basic Education, 1989).

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	18.0	19.5	22.9
Science:	-	1.1	3.4
Mathematics:	4.5	4.5	4.2
Technology:	-	-	0.7

Science teaching on the primary level starts in Grade 3. On secondary level, separate sciences are studied from Grade 7 to 12 (UNESCO, 1986):

Grade 7: biology  
 Grade 8: biology, physics  
 Grade 9: chemistry, physics, physical sciences  
 Grade 10: chemistry, physics  
 Grade 11: chemistry, physics  
 Grade 12: biology, physics.

There also are discussions about introducing some changes in secondary school science teaching, such as:

- to offer an integrated science course in the lower secondary level (instead of separate science subjects),
- to adopt science education in disciplines plus Science Technology and Society Courses in the upper secondary school,
- to make good use of out-of-school science and technology education.

Since only 40 percent of the middle schools have their own laboratories, the students master more theory than practical Applications (Zhai, 1989).

**Higher education:**

Only 5 percent of the secondary school students have the opportunity to go to the colleges and universities for higher education (Zhai, 1989).

**ENVIRONMENTAL EDUCATION:**

Environmental education has the support of the Government. The constitution of the People's Republic of China states in Article 11 that, "The State protects the environment and natural resources, and prevents and eliminates pollution and other public harms" (Chen, 1981).

The National Environmental Protection Bureau was established in 1978. Under this Bureau are the National Environment Monitoring Head Station and the Chinese Environmental Sciences Academy with the Eco-biological Environmental Research Center. Each province also set up its corresponding organizations (Yang et al., 1989).

In April 1982, UNESCO and UNDP organized an All-China Training Workshop on Environmental Education for 51 professionals from middle and primary schools and kindergartens of 23 provinces, municipalities and autonomous regions throughout the country, and for teachers and administrators from colleges, universities and polytechnic institutes. The workshop was divided into three stages: lectures on basic environmental science, reports on special environmental education subjects and exchange of environmental education experiences. It was concluded, that:

- more environmental education should be included in the secondary school program - environmental themes should be integrated into geography, biology, chemistry, physiology, hygiene and physics;
- in the universities and colleges of engineering, agriculture, medicine, economy and law, courses on environmental protection and improvement should be obligatory and universal;
- from primary to university level, out-of school environmental education activities should be incorporated into education and practice (UNESCO-UNEP, 1983 and 1987).

Great efforts have been made to train specialized personnel and to improve qualifications of in-service engineers and technicians in the field of environmental protection. (Huang, 1987).

In schools, new environmental science education is under trial implementation. The Beijing National University initiated a pilot education programme for training teachers to teach environmental science. Experiments on teaching environmental science in middle schools, primary schools, kindergartens, and out-of-school education are in progress (Chen, 1981).

## 1. Formal environmental education

### Pre-school level:

The Pilot Kindergarten of the Gansu Normal University is conducting experimental environmental science teaching. The program consists of the following topics (Chen, 1981):

- earth,
- day and night,
- climate,
- living environment,
- environmental sanitation,
- air, air pollution and its control,
- water, water pollution and its control,
- soil and plants,
- noise and music,
- natural and community environments,
- personal hygiene.

Chaozhou City (Guangdong Province) and Changtu City (Liaoning Province) began their pre-school environmental education experimental program in 1981 and 1982. The lectures and activities are all familiar to children, e.g.:

- keeping pet birds and fishes,
- growing flowers and other plants,
- visits to factories and farms,

and aim at promoting children's environmental consciousness (Ren et al., 1990).

The Northwest Normal College experimentally introduced selected topics on environmental education at a pre-school level. After five years of practice, the Textbook of Environmental Education in Kindergartens was published (Ren et al., 1990).

#### Primary and secondary school level:

Environmental education is not taught as a separate subject. The environmental dimension is partially reflected in the nature study, geography, biology, physics and chemistry courses for primary and upper secondary school students (UNEP, 1986).

In the past, environmental teaching used to be focussed only to the protection of nature. In the last years, new topics have been added, such as elimination of industrial wastes and pollution in the cities (Ren et al., 1990).

There are plans to introduce more environmental topics in the Nature and Chemistry courses in primary and secondary schools (Yang et al., 1989).

#### Primary schools:

Experiments in teaching environmental science are being conducted in some primary schools. In China, the "General Knowledge" course in different grades includes topics like animals, plants, micro-organisms, physical geography and personal hygiene. Experimentally, topics such as:

- environment,
- environmental and ecological balance,
- environment and health,
- environmental protection,

have been introduced. Pupils also are participating in afforestation and beautifying the campus, and in monitoring the air, water and noise pollution (Chen, 1981).

#### Secondary schools:

Secondary school level environmental education is carried out through various channels, using different forms, with a combination of in-school and out-of-school education activities. Environmental education is taught:

- through the courses of geography, physics, chemistry and biology,
- as a selective course on a senior middle school level (Zhai, 1990).

The synopsis concerning environmental education prescribed in the middle school teaching program in various science courses is given below (Zhai, 1990):

Junior middle school:

**Biology:**

1. Precious plant resources in our country and the protection of these resources.
2. The benefits of earthworms (decomposition of organic wastes).
3. Biological pest control (Arthropoda: Trichogramma functioning as a pesticide in farmlands and forests).
4. Protection of wildlife:
  - protection of aquatic resources in the ocean,
  - frogs are beneficial to man and must be protected,
  - the bird resources and their protection in our country,
  - the functions of beneficial birds and their protection,
  - the mammalian resources and protection.
5. Sanitary knowledge on the prevention of diseases and the protection of environment.
6. Kinetic system: influences of environmental factors on skeletal and circulatory systems.
7. Respiratory system: air pollution.
8. Digestive system: food and air.
9. Nervous system: keep in conformity with the environment.
10. Reproduction and development:
  - population and environment,
  - environment and development.

**Geography:**

1. Make use of resources and protect the environment.
2. Environmental protection: protection and utilization of the natural resources.
3. Pollution of the environment by industrial wastes: waste waters, waste gas, solid industrial residues. (Fight against pollution to improve and protect the environment).
4. Climate: influence of environmental pollution on the climate in some areas.
5. The relationship between vegetation and precipitation.
6. Rivers: river pollution, water pollution, the improvement and comprehensive exploitation of the Yangtze and the Yellow Rivers.
7. Natural environment and resources in Antarctica.
8. The erosion disaster in American history.

**Chemistry:**

1. Air pollution and prevention.
2. Water pollution and prevention.
3. Environmental harm done by carbon dioxide.
4. Noxiousness of carbon monoxide.
5. The role of methane in improving environmental and sanitary conditions in rural areas.
6. Exploration for new energies.
7. Soil improvement.
8. Side effects of chemical fertilizers in soils.

**Physics:**

1. Protection of hydro energy sources.
2. The non-polluting hydroelectric stations.
3. Solar energy - the non-polluting energy.
4. Pollution of fuel and nuclear energy and counter measures.
5. Exploration of clean energy sources: solar, wind, geothermal energy and methane.
6. Heat engine and environmental protection.

Senior middle school:

**Geography:**

1. Atmosphere around the earth.
2. Water on the earth.

3. Earth's crust and its movement.
4. Biosphere and natural habitats of the earth:
  - living things and ecological balance,
  - ecological system and ecological balance.
5. Natural resources and their protection:
  - brief introduction to natural resources,
  - soil resources and their utilization,
  - biological resources and their utilization and protection,
  - mineral resources and their utilization.
6. Energy and its utilization.
7. Population and municipalities.
8. Man and the environment:
  - environment and environmental problems,
  - coordination and relationship between the development of man and environment.

#### Chemistry:

1. Noxiousness of hydrogen sulphide and the pollution by sulphur dioxide.
2. Significance of environmental protection.
3. Pollution damage.
4. Air pollution and counter-measures.
5. Nitrogen monoxide and nitrogen dioxide pollution.
6. Electroplating without using cyanide.
7. Rational utilization of petrochemical industry wastes.
8. Protection of aquatic resources.
9. Processing and utilization of coal.
10. Rational disposal of wastes.

#### Biology:

1. Mutual influences between living things and the environment.
2. Photosynthesis, air purification by green vegetation.
3. Heredity and variation:
  - environment and heredity,
  - environmental pollution and genetic variation in species,
4. Biology and the environment:
  - introduction to the relationship between biology and the environment,
  - ecological systems,
  - protection of nature.

#### Physics:

1. Mechanical vibration and wave-mechanical vibration harms the living environment.
2. Noise - harm and control.

The possibility is also being considered of linking basic scientific principles in general chemistry courses with environmental problems such as the greenhouse effect, photo-chemical reactions, destruction of the ozone layer, photo-chemical smog, acid rain and heavy metal contamination (Yang et al., 1989).

According to the senior middle schools' teaching program, revised in 1990 by the Basic Education Department of the State Education Commission, each middle school is entitled to establish environmental education as a selective course at a senior secondary level. There are a number of middle schools which offer environmental education as a selective course at a senior secondary level. Some even offer environmental education in a junior period. Following is the teaching program of a selective course "Human and Environment", offered by the Middle School attached to Beijing Normal University (Zhai, 1990):

Subject: Human and Environment (offered in Grade 2 junior, one period a week)

1. Preface (2 periods):

- the concept of environment,
  - structure of environment: natural environment, social environment, engineering environment,
  - relationship between man and environment,
  - relationship between development and environment - arising environmental problems,
  - human society: its primary, medium stages and modern society.
2. Man and environment (3 periods):
    - races in the world and the environment,
    - environment and the population capacity,
    - environment and the upgrading of population quality,
    - population migrations and the environment,
    - current international population problems and their solutions; population growth, urbanization, ageing of population.
  3. Atmosphere (2 periods):
    - structure and components of atmosphere,
    - atmospheric environmental pollution (solid, liquid drops, gas, photochemical smog),
    - sources of pollution (factories, household cooking and heating ovens, traffic emissions),
    - conditions affecting levels and distribution of air pollution: natural conditions (wind, currents, weather, atmosphere pressure), topographic conditions,
    - social conditions of pollution,
    - counter-actions and control of air pollution.
  4. Water environment (3 hours):
    - the relationship between man and water resources,
    - natural water resources on the earth,
    - circulation of water,
    - environmental problems in water resources (uneven distribution, excessive water consumption in urban areas, water pollution),
    - counter-actions against water resource problems.
  5. Soil environment (2 periods):
    - the role of soil,
    - soil structure (farming soil, grassland soil, forest soil),
    - environmental problems of soil: soil erosion and its causes, soil pollution and its sources,
    - protection of soil and anti-pollution measures (planting of vegetation, control and elimination of sources of pollution).
  6. Biological environment (2 periods):
    - the relationship between living things and the environment,
    - ecological system and ecological balance,
    - biological environmental problems and countermeasures: violation of the ecological balance, biological pollution, diseases, and countermeasures.
    - natural reserves in China and in the world.
  7. Urban environment (2 periods):
    - urban features: classification in terms of the nature of cities,
    - urban environmental problems (over-centralized industry, excessive urbanization, drastic growth in urban population, deteriorating housing conditions, traffic disorder, noise) and countermeasures.

#### Specialized and vocational environmental secondary schools:

In spring 1978, Environmental Protection School of Guangdong Province began to admit students. In fall of the same year, Environmental Protection School of Hunan Province admitted the first generation of students. In 1983, Hongqiao District Environmental Protection Vocational School of Tianjin was formally opened (Ren et al., 1990).

By the end of 1989, 5 secondary schools specialized on environmental protection were newly built and over 10 specialties related to environmental protection were introduced in more than 80 specialized secondary schools (Zhu, 1990).

**University level:**

The Chinese environmental science higher education system was formed during the 1970's. A special college for environmental sciences was established in Suzhou, Jiangsu province. Departments of environmental science, environmental engineering, environmental protection, environmental monitoring, etc. were set up in many universities (Yang et al., 1989).

In 1973, there were only few universities and colleges which had environmental protection courses (e.g. Beijing University, Zhongshan University, Beijing Industry University, Tongji Medical University). By 1990, 64 universities and colleges were set up, in which 15 different undergraduate programs concerning environmental protection were offered (Ren et al., 1990; Zhu, 1990).

There are 38 higher education units that offer post-graduate doctoral degrees in 14 environmental sub-branches, e.g. Tsinghua University, Beijing University, Tongji University, Tongji Medical University, Research Institute of Environmental Protection of the Academy of Sciences, etc. Post-doctoral training programs have been established as well (Zhu, 1990).

Some examples of tertiary level institutions, offering environmental education and training courses are given below (Huang, et al., 1990; UNEP, 1986; UNESCO, 1983; UNESCO, 1989):

- Beijing Normal University, Research Institute on Environmental Sciences, Beijing,
- East China Technical University of Water Resources, Institute of Environmental Protection, Nanjung,
- East China Normal University, Department of Environmental Science, Shanghai,
- Fudan University, Environmental Science Institute, Shanghai,
- Hangzhou University, Department of Chemistry, Zhejiang,
- Jilin University, Environmental Specialty, Changchun, Jilin,
- Nanjing University, Department of Environmental Sciences, Nanjing,
- Nankai University, Department of Environmental Sciences, Tianjin,
- University of Inner Mongolia, Department of Biology, Huhehot,
- The University of Science and Technology of China, Department of Chemistry, Hefei, Anhui,
- Tsinghua University, Department of Environmental Engineering, Beijing,
- Xiamen University, Institute of Environmental Science, Xiamen, Frijian,
- Zhejiang Agricultural University, Department of Environmental Protection, Hangzhou, Zhejiang.

The research institutes and university departments with environmental science and engineering programs form one third of the whole research institutions in China. There are more than 1200 full time research fellows employed in this field. In addition, three new national research

centers are being under construction with the following research programs:

- Environmental Pollution Control and Ecology Simulations,
- Coal Combustion Techniques with High Efficiency and Low Cost,
- Control and Re-usage of Pollutants (Zhu, 1990).

At the universities, which offer environmental protection programs, the following subjects are covered (Huang, 1987; Ren et al., 1990):

- environmental engineering (subdivided into three branches: engineering, monitoring, and management),
- environmental chemistry,
- environmental biology,
- environmental earth science,
- environmental protection for agriculture and
- environmental medicine.

The university courses are oriented mostly toward solid and liquid waste treatment and disposal. Air pollution courses have been added recently, but courses such as hazardous waste management and toxic substance control are yet to be added (Shen, 1984).

At the Tsinghua University, Beijing, a comprehensive and systematic environmental education was introduced in 1979. Since then, the "Introduction to Environmental Science" course is being taught as an elective subject to the non-science students of all departments. Following are the main contents of the course:

- The fundamental knowledge of ecology,
- Population dynamics,
- Sources of energy and environment,
- Environmental conservation in modern cities and the solution of problems arising from the environmental pollution,
- Economic and social development and environmental planning.

Technicians are given advanced in-service courses of environmental engineering and 2,300 of them have completed the courses. The teaching material compiled by the Tsinghua University has been used by twenty high learning schools. Central Radio and Television University plan to make an educational film for students majoring in city planning (Ren et al., 1990; Jing et al., 1990).

During the implementation of the UNESCO sponsored Pilot Project for Incorporation of the Environmental Dimension into General University Education (February 1988 - June 1989), the following activities were carried out (Jing , 1989):

1. Evaluation of environmental education in university courses.
2. Publication of a book "Environmental Problems of the Contemporary World" (in chinese) with the following contents:
  - Environment and environmental science,
  - The basic principles of environmental ecology,
  - Modern world environmental problems,
  - Economical development and environment,
  - Population and environment,
  - Environmental problems in agriculture,

- Industry in environment,
- Energy and environment,
- Water resources and water pollution control,
- Control of modern municipal environmental problems,
- Natural resources and environmental conservation,
- Environment and human health,
- Environmental management,
- Trends of environmental changes in the modern world.

Contents of the book were presented in the form of lectures in 55 universities and colleges, and in 7 research institutes.

3. Training courses for multi-disciplinary university personnel:  
A two-week training course, "Environmental Problems of the Contemporary World", was carried out.
4. Stimulation of activities concerning the introduction to environmental protection.  
Over 200 undergraduates from 30 different disciplines took an elective course, "Introduction to Environmental Protection".
5. Multi-disciplinary symposium for professors on environmental education.  
43 participants from 25 universities attended the teacher training course. 21 lecturers presented a wide range of environmental topics, including environmental trends, strategies, management, water and air pollution control, groundwater pollution and environmental monitoring.

**Extension programs (for government officials, specialized technical training):**

Since 1980, managers and technicians from the Ministries of the State Council and bureaus of all the provinces and municipalities involved in environmental protection, received training - in rotation. The Ministry of Urban and Rural Construction and Environmental Protection established a base for training technical cadres at Tongji University, Shanghai, where in-service personnel are being trained for a half-year period. A secondary specialized school has also been established in Qinghuangdao only for training managers in environmental protection. A number of 2-months seminars have been organized. Apart from this, several classes for further studies have been provided in Beijing University, Tsinghua University and Beijing Normal University, where the participants systematically learn technology and theories of environmental sciences (Ren et al., 1990; Huang, 1987).

The Government in 1985 set up an Environmental Management Cadre College for upgrading the managerial skills of young environmental cadres. In addition, the government has set up Environmental Research Institutes, or Divisions, in 22 universities and colleges in addition to the existing Research Academy and Institutions directly under the National Environmental Protection Agency (UNEP, 1986).

The State Council and the Environmental Education Committee of the Chinese Society of Environmental Sciences organize short-term training courses for leading cadres in environmental protection, in which the following topics are covered (Chen, 1981):

- environment,
- ecosystem,
- sources of pollution,
- air pollution and its control,
- water pollution and its control,

- land resources and their management,
- noise pollution and its control,
- environmental protection and human health,
- environmental legislation,
- environmental standards,
- environmental quality assessment,
- environmental monitoring,
- environmental economy,
- environmental management.

#### Teaching materials:

Many teaching materials on environmental science and engineering have been published in China. Some examples of books are given below (Ren et al., 1990; Zhu, 1990):

- Environmental Engineering,
- Microbiology and Environmental Engineering,
- Solid Wastes Disposal,
- Control of Noise,
- Water Pollution Control,
- Air pollution Control,
- A Course of Environmental Law,
- Environmental Economics,
- Concise Environmental Science,
- An Introduction to Environmental Science,
- We Only Have One Earth,
- Our Common Future,
- Encyclopedia of China, Vol. Environmental Science,
- English-Japanese-Chinese Dictionary of Environmental Science, etc..

In addition, there are other teaching materials available, such as video films and slides (e.g. "Environmental Chemistry" prepared at the Beijing Polytechnic University), exercise sheets, and experiments (Ren et al., 1990).

## 2. Non-formal environmental education:

#### Out-of-school activities:

The schools often offer various extracurricular activities to their students, such as science groups, hobbyist associations, knowledge contests, summer or winter camps, love week and tree planting (Dept. of Basic Education, 1989; UNEP, 1986).

During the "Love for Science Month", for example, groups of children observed natural phenomena, and one of the summer camps was devoted to biological protection in a panda reserve in Sichuan Province (Wang, 1982).

Various out-of-school environmental activities for middle school students are being organized by environmental protection organizations, and China's Association for Science. Some examples are given below (Zhai, 1990; Zhu, 1990):

1. propaganda and educational activities on special days, such as the Tree Planting Day, Week of Loving Birds, World Non-Smoking Day, World Environmental Day, etc.,

2. lectures, exhibitions, competitions,
3. investigations of the environment (pollution sources, ecological balance, environmental monitoring, acid rain, noise).

The Metropolitan Environmental Protection Bureau, Education Bureau, Children's Palace and Children's Scientific Center have jointly set up the Shanghai Primary and Middle School Co-ordination Committee on Environmental Education, which is conducting lectures on environmental protection, teacher training, visits, and exchange of experiences (Ren et al., 1990).

Students from the Tsinghua University, Beijing, are encouraged and supported to take part in the environmental conservation activities. During their summer and winter vacations they make environmental investigations and research in the polluted areas, and give advice on environmental problems (Jing et al., 1990).

The Poyang Lake nature reserve provides environmental education and publicity activities in the local communities. These are aimed at the schools and local fishermen and use audio-visuals, video-films, exhibition boards and bird-watching activities (AWB, 1990).

#### Mass media:

The mass media attaches great importance to environmental events like World Environment Day. The Government also publishes an environmental newsletter and a quarterly magazine (UNEP, 1986).

During the Environmental Protection Propaganda Month, active propaganda for environmental protection was carried out all over the country, using all kinds of mass media - press, radio, television, films, lectures and photo exhibitions (Huang, 1987; Ren et al., 1990).

In 1984 during the promulgation of laws on water pollution control and environmental protection, the central radio and TV stations broadcasted a series "Be Aware of Water Pollution" (Ren et al., 1990; Zhu, 1990).

In April 1985, a competition on environmental conservation was held jointly by the Beijing EPA and Beijing Broadcast Station. After listening to the radio lectures, people had to answer questions. About 60,000 answer sheets were handed in. In addition, many proposals of practical value were offered. Facts have proved that the competition is a good means of environmental education (Huang, 1990).

In 1988, the central TV station introduced a specialized course on environmental protection (Ren et al., 1990).

There are more than 50 periodicals and magazines on environmental protection and environmental sciences. The Journal of Environmental Protection, edited by the Beijing Research Institute on Environmental Protection, has a circulation of 70,000, and a newspaper, Voice of the Environment, published by the Chinese Researchers' Association on Environmental Sciences, has a circulation of more than 400,000 (Chen, 1981).

The Renmin Ribao, Guangming Ribao, Renmin Huabao, and other central and local papers are constantly reporting on the environmental situation,

publish environmental education articles and readers' letters (Ren et al., 1990).

**Specialized governmental organizations:**

The National Environmental Protection Agency - Dissemination and Education Division, is involved in formal and non-formal environmental education in China. Its programs cover different target groups, from pre-school children to university students, teachers, youth and community leaders, workers and the general public, and include a wide range of activities (UNESCO, 1989):

- publication of guides, textbooks, periodicals, directories, bibliographies, reports,
- audiovisual aids, monitoring kits,
- training of teachers, specialists, leaders,
- advisory services in education,
- documentation and technical services,
- research in education,
- elaboration and assessment of teaching/learning methods,
- development of learning environments and facilities offering first-hand experience,
- funding for programs.

**Non-governmental organizations:**

There are at least two major non-governmental organizations involved in environmental education:

1. The Chinese Society of Environmental Sciences, which has an Environmental Education Committee, responsible for in-school education, and an Environmental Propaganda Committee, responsible for non-formal education,
2. The Chinese Researchers' Association on Environmental Sciences, which also takes an active part in disseminating environmental knowledge (Chen, 1981).

At the Tsinghua University, Beijing, a "Green Association" was formed on the initiative of some students from the environmental science course. Its aim is to propagate the afforestation, environmental conservation and to beautify the environment. The association organizes lectures on special environmental topics and holds photo-exhibitions at public places (Jing et al., 1990).

**3. Teacher training:**

In general, there are two types of teachers' in-service training programs: full-time and part-time. During the in-service training teachers receive full pay, and all expenses are covered by the government. There are several forms of in-service teacher training (Dept. of Basic Education, 1989):

1. Teachers' in-service training colleges
2. Teachers in-service training schools
3. College extension classes at undergraduate level or junior college level
4. Part-time classes run by colleges and universities
5. TV universities and TV teachers' colleges
6. Correspondence courses
7. Seminars on teaching materials and methods organized by teaching and research sections at various levels
8. Participation in teaching and research activities related to particular subjects
9. Self-study.

Teacher training in the field of environmental education is still in the initial stage; there still remains a lack of a systematic and long-term prospect. At present, the Children and Youth Center of CAST (China Association for Science and Technology) is organizing experts from the environmental and educational sectors to write a Teacher's Guide for middle school environmental education. The guide book is planned to be published in June 1991. Besides the book, other teacher training programs are in progress (Zhai, 1990).

The following institutions are active in the field of environmental teacher training (UNESCO, 1989):

- Beijing Normal University, Institute of Environmental Sciences, Division of Environmental Education, Beijing (pre-service and in-service teacher training),
- East China Normal University, Department of Environmental Science, Shanghai, (pre-service teacher training),
- Fudan University, Environmental Science Institute, Shanghai (Pre-service and in-service teacher training),
- National Environmental protection Agency, Dissemination and Education Division, Beijing (pre-service teachers).

The Department of Geography at the Beijing Normal University, initiated a three-year pilot program for training future environmental geo-science college and university level teachers, aiming at:

1. Training post-graduate teachers to teach environmental science in other colleges and universities.
2. Training in-service teachers of other colleges and universities to teach environmental sciences.
3. Integrating or developing environmental science.
4. Developing instructional materials.

The enrolled post-graduates have a wide variety of backgrounds: geography, chemistry, mathematics, automatic control, hydraulic engineering. They have all been engaged in practical work for several years. The following five courses are required:

1. Dialectics of nature
2. Foreign languages
3. Introduction to environmental geoscience
4. Principles of environmental science:
  - interrelationships between man and his environment,
  - solving contradictions between economic development and environment protection,
  - avoiding the situation in industrialized countries of polluting first and then eliminating the pollution,
  - air, water, soil and noise pollution, their prevention and control,
  - pollution of living organisms,
  - mechanisms of pollutants and their effect on the human body,
  - evaluation of environmental quality,
  - environmental management and planning,
  - environmental economy,
  - environmental legislation.

This course (150 periods in total) has been taught by 15 teachers and experts from 10 universities, colleges and research institutes.

#### 5. Principles of environmental monitoring.

The compulsory program is supplemented by the following elective courses:

1. Environmental mathematics,
2. Large-system theory,
3. Modern control theory,
4. Biochemistry,
5. Water chemistry,
6. Electrochemistry,
7. Mathematical modelling of water environmental systems.

The graduate students participate in solving practical environmental problems, such as:

- The environmental impact assessment of Yongping Copper Mine,
- An evaluation of the environmental capacity of the Songhuajiang and Tununjiang Rivers,
- Environmental planning of Beijing Municipality.

Twenty teacher college and university teachers of various provinces and municipalities were first enrolled. These teachers wrote instructional materials on environmental science suitable for normal colleges and universities during their study at Beijing Normal University. They are now teaching courses in environmental science at their own colleges and universities in order to train teachers to teach environmental geoscience in middle schools (Chen, 1981).

In 1982 many students, nurses, teachers from kindergartens, and primary and secondary school teachers attended the "Environmental Education in China" training course in Beijing (Ren et al., 1990).

#### 4. Major environmental education problems:

The apparent difficulty of China's environmental management and education programs is a lack of available resources: money, trained professionals, and modern research facilities. The critical question is what portion of China's limited capital resources can be devoted to environmental pollution control and the training of necessary personnel (Shen, 1984).

#### 5. Some institutions active in the field of environmental education

(Huang, 1987; UNEP, 1986; UNESCO, 1983; UNESCO, 1989; Yang et al., 1989; Chen, 1981):

- Ministry of Urban and Rural Construction and Environmental Protection,
- National Environmental Protection Agency, Dissemination and Education Division,
- Chinese Environmental Sciences Academy,
- Chinese Society of Environmental Sciences, Environmental Education Committee,
- Chinese Researchers' Association on Environmental Sciences,

- Secondary Specialized School at Qinghuangdao in Hobei Province,
- Environmental Management Cadre College (for managers),
- Universities in:
  - Beijing:
    - Beijing Normal University, Institute on Environmental Sciences,
    - Beijing Normal University, Department of Geography,
    - Tsinghua University, Department of Environmental Engineering,
  - Hangzhou, Zhejiang:
    - Zhejiang Agricultural University, Department of Environmental Protection,
  - Hefei, Anhui:
    - The University of Science and Technology of China, Department of Chemistry,
  - Huhehot:
    - University of Inner Mongolia, Department of Biology,
  - Jilin, Changchun:
    - Jilin University, Environmental Specialty,
  - Nanjing:
    - Nanjing University, Department of Environmental Sciences,
  - Nanjung:
    - East China Technical University of Water Resources, Institute of Environmental Protection,
  - Shanghai:
    - East China Normal University, Department of Environmental Science,
    - Fudan University, Environmental Science Institute,
    - Tongji University (training of technical cadres),
  - Tianjin:
    - Nankai University, Department of Environmental Sciences,
  - Zhajiag:
    - Hangzhou University, Department of Chemistry,
  - Xiamen, Frijian:
    - Xiamen University, Institute of Environmental Science.

**Contact persons:**

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- Prof. Huang Minyung, Department of Environmental Engineering, Tsinghua University, Beijing (Tel. 282451, 285451; Telex: 22617 QHTSC CN).
- Prof. Hua Tongwen, Chinese Representative IUPAC/CTC, Director of Research Center of Higher Chemical Education; Chemistry Department, Peking University, Beijing (Tel.282471 ext.4551; Telex: 211215 BEUN CN).
- Prof. Ren Ren and Yang Weirong, Department of Chemistry and Environmental Engineering, Beijing Polytechnic University, Beijing.

- Prof. Yang Junying, Associate Professor of Chemistry, Chemistry Department, Peking University, Beijing.

**Country: FIJI****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (thousands): 732  
Area (thousands of square kilometers): 18  
GNP per capita, 1988: \$1,520  
Average annual growth rate, 1965-88 (percent): 1.9  
Adult illiteracy, 1985 (percent): total 15 (female 19)  
Primary level pupil-teacher ratio (1985): 29  
Total expenditure on education as % of GNP (1983): 6.7

**Major environmental problems (Bryant, 1989):**

- soil degradation and erosion resulting from the impact of logging, and as a result of mismanagement and the land tenure system under which sugar cane is cultivated (the soil erosion rate in Fiji is calculated to be 36.7 t/ha/year from cane fields on 8 degree slopes with reasonably good cropping practices);
- reduction of forest cover,
- endangered species,
- damage of productive coastal resources and fisheries,
- pesticide and heavy metal pollution,
- industrial pollution,
- lack of safe domestic waste disposal, solid waste disposal, toxic chemicals disposal,
- water shortage,
- nuclear testing.

Fiji does not have comprehensive general legislation for the protection and conservation of the environment. It has only an advisory Environmental Management Committee (EMC), which has no power to change the existing environmental problems. The more socially-oriented Fiji Labor Coalition has no environmental platform, except in relation to nuclear testing (Bryant, 1989).

**ENVIRONMENTAL EDUCATION:**

The administration of environmental management falls under the justification of the Ministry of Housing and Urban Affairs while formal environmental education is administered by the Ministry of Education and Youth (UNEP, 1986).

Environmental education has a low priority in government planning. However, formal educational institutions are being funded to an extent that enables them to enact and maintain long-term environmental training and educational programs (Bryant, 1989).

## 1. Formal environmental education:

### Primary and secondary school level:

Children attend primary or junior school from five or six years until they are about twelve years old. In the basic science courses the principles of environmental science are taught in an indirect manner, e.g. the students are instructed on the role of health and taking care of their homes; also they are taught to recognize some plants and to understand the environmental significance of trees (Bryant, 1989).

The wise management of plant and animal life is stressed in elementary science teaching while gardening provides practical experience (UNEP, 1986).

At the secondary level, subjects such as basic science, biological science and physical science aim at developing an awareness and concern for the environment (UNEP, 1986).

The UNDP/UNESCO Curriculum Development Unit for junior secondary schools produced a social science program in 1978, which examines the role of people in their environment, resource use, and the interrelationships of all parts of the system. This program is used in secondary schools in Fiji, Tonga, Western Samoa and the Cook Islands. Examples are adapted for the local environments (Bryant, 1989).

In 1979, the South Pacific Commission produced a set of Environmental Mini-Lessons for use in primary and secondary schools throughout the Pacific. They can be used either as a complete course of short units on the environment, or as supplementary material for existing courses (Bryant, 1989).

In 1985, the Preliminary Annotated Bibliography of Pacific Islands Environmental Education Materials, and five fact sheets (on soils, forests, conservation, coral reefs and pesticides) were published. The South Pacific Regional Environment Program (SPREP) is now producing environmental kits for use in schools which include fact sheets, games, student workbooks, and slide and tape sets.

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### University level:

The University of the South Pacific, a regional institution serving eleven countries, which is based in Fiji, conducts environmental research and education courses at the Department of Geography and the Institute of Natural Resources (UNEP, 1986).

The University has also established a Bachelor of Science degree in Environmental Studies in order to provide students with a background in both the social and natural sciences. In this program students

undertake a science degree majoring in either biology, chemistry or physics, and complete a program of geography that includes courses in resource management, human ecology, food and agriculture in the tropical world, as well as other human and physical geography courses. It is intended that the graduates will find work in environmental offices, or at least contribute some environmental input to national development plans for their countries (Bryant, 1989).

Despite calls by the universities to make scholarships available to enable regional students to undertake post-graduate training in environmental science and resource management, funding has not been procured to date (Bryant, 1989).

**Extension programs (specialized technical training for government officials):**

Environmental education for government officials is constrained by inadequate funding. Nevertheless, a few courses are being undertaken by the University of the South Pacific (UNEP, 1986).

## 2. Non-formal environmental education:

Informal community environmental education hardly exists, except traditionally (Bryant, 1989).

Environmental awareness programmes for the general public are attempted each year during Arbor Day, National Environment Week and National Food Day. Agricultural shows are organized at village and district levels by the Ministry of Primary Industries. The National Trust of Fiji has introduced a Mobile Environmental Education Unit that has visited villages, settlements and fairs around the country (UNEP, 1986).

**Mass media:**

An environmental education journal is published regularly in Fiji. There is also a nature column in one of the newspapers. A locally produced journal for high school students carries a number of useful and popular environmental articles (Bryant, 1989).

SPREP conducted an Environmental Radio project, in which broadcasters were instructed in incorporating environmental materials into radio broadcasts. A radio broadcasting training course for the region is also under development (Bryant, 1989).

**Governmental and non-governmental organizations:**

There are very few organizations in the South Pacific that emphasize public or community environmental education.

The National Trust of Fiji is concerned with conservation education, and each year coordinates National Environment Week, which usually involves seminars and a public lecture series, poster competitions and displays. At the University of South Pacific, the South Pacific Action Committee on Human Ecology and the Environment (SPACHEE) plays an increasing role in environmental research and education.

Throughout the Pacific, non-governmental organizations such as Ofis Blong Meri, the YWCA, various women's interest groups, and the Pacific Council of Churches are the main focus of environmental concern, although few highlight the environment as their major interest (Bryant, 1989).

### 3. Training of environmental education personnel:

The South Pacific Regional Environment Program (SPREP) has been involved in conducting a number of training courses for environmental educators and managers in the past few years (Bryant, 1989).

### 4. Major environmental education problems:

Dependence on fluctuating and declining foreign aid, equipment shortages, and the frequent absence of maintenance skills makes environmental education and dissemination of information difficult (Bryant, 1989).

### 5. Some institutions active in the field of environmental education (UNESCO, 1989):

- Environmental Education Office, Forestry Department, Suva, works in the areas of renewable and non-renewable resources, land use and misuse, and energy. It is involved in formal and non-formal education, preparation of curricula, advisory services for education, and the provision of books, periodicals, reference documents and reports. The target groups include students from pre-school to university levels, out-of-school youth, teachers, youth and community leaders, workers, farmers and the general public.
- South Pacific Action Committee for Human Ecology and the Environment, University of the South Pacific, Suva, is a non-governmental organization that works on formal and non-formal environmental education projects for students and general public, such as the production and evaluation of instructional materials, provision of literature and the exchange of information, the development of learning facilities, and funding programs. Its principal fields of interest include water (oceans, seas, estuaries, fresh water), pollution, monitoring, food and agriculture, and renewable/non-renewable resources.

**Country: HONG KONG****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 5.7  
Area (thousands of square kilometers): 1  
GNP per capita, 1988: \$9,220  
Average annual growth rate, 1965-88 (percent): 6.3  
Adult illiteracy, 1985 (percent): female 19, male 12  
Percentage of age group enrolled in education (1987):  
    Primary: 106  
    Secondary: 74  
    Tertiary (1965): 5  
Primary net enrollment, 1975 (percent): 92  
Primary level pupil-teacher ratio (1984): 27  
Total expenditure on education as % of GNP (1984): 2.8

**Major environmental problems (Keating, 1981):**

- extremely high population density, lack of space, absence of privacy,
- increasing industrialization,
- increasing consumption of energy (imported),
- heavy traffic,
- air pollution,
- noise pollution,
- vibrations.

**School system (Bray, 1989; Holbrook, 1990):**

The government of Hong Kong provides nine years of free compulsory education for every child (6 years of primary education and 3 years of junior secondary education).

The British education system is used in Hong Kong schools. Recent years have seen a transition from textbooks written by British authors to books written by local authors; however, the transition has been a force for conservatism rather than the reverse.

The school system is very examination-oriented, and most parents press for their children to take public examinations.

Science teaching at lower levels of education is rather weak. Primary schools are recommended to allocate only two periods a week to science, and junior secondary schools are recommended to allocate only four periods a week. Biology features strongly in the curriculum, but physics receives only moderate emphasis, and chemistry very little. At the senior secondary level, however, the picture is quite different. The data from the International Association for the Evaluation of Educational Achievements (IEA) show that Hong Kong ranks first in chemistry and physics and fifth in biology.

**ENVIRONMENTAL EDUCATION:**

As Hong Kong is highly urbanized, its training needs are largely confined to areas of environmental monitoring and management (UNEP, 1986).

**1. Formal environmental education:****Primary and secondary school level:**

There is no separate environmental education course in the schools. The term, "environmental education," is unknown in Hong Kong. The British educational system does not allow for environmental education as a special subject, but rather for the various areas and related skills to be subsumed within the various existing courses. Students follow the curricula in Chemistry, Physics, Biology, Geography, etc. However, such topics as:

- air pollution,
- noise pollution,
- water pollution,

are contained within these curricula in some form, ranging from factual awareness to the ability to discuss the needs for action and to design posters to educate the public.

There are moves to incorporate more environmental education in the separate disciplines, and the new curricula to be introduced in 1992/93 will reflect this trend. The new certificate level chemistry course (schooling level 10-11) includes the following environmental issues (Holbrook, 1990):

Corrosion of metals and their protection.

Characteristics of acids:

- recognize that all concentrated acids are highly corrosive and care must be taken when handling them.

Fossil fuels:

- recognize the economic importance of oil and that resources are limited.

Burning fuels:

- recognize the need to use different kinds of fire extinguishers for different types of fires,
- explain necessary precautions in using household fuels.

Environmental problems associated with the use of fuels:

- recognize the major problems associated with the burning of fuels (incomplete combustion, presence of impurities),
- state and explain the formation of the major pollutants from car exhaust,
- recognize that some gaseous pollutants, when dissolved in rain water, will make the rain acidic (acid rain),
- understand the environmental consequences of acid rain with respect to buildings, limestone, vegetation, and aquatic life,
- recognize that the following methods are used to minimize pollution from the burning of fuels:
  - a) catalytic oxidizers in car exhaust systems,
  - b) scrubbers in industry,
  - c) electrostatic precipitators in industry,
  - d) use of lead-free fuel in cars,
  - e) use of low sulfur fuels in industry,
- describe the global greenhouse effect associated with excessive production of carbon dioxide,
- specify some of the environmental consequences of oil spills,
- recognize the potential hazards of fuel storage,
- discuss the advantages and disadvantages of using fossil fuels,
- be aware of the need for considering the use of alternative sources of energy.

**Plastics:**

- understand the economic importance of plastics and pollution problems associated with the use and disposal of plastic items,
- recognize the importance and problems of recycling plastics.

**Alcohols:**

- discuss the suitability and practicability of using ethanol as a fuel for cars,
- discuss some of the physiological effects of alcoholic beverages, and some of the health and social problems associated with excessive drinking.

**Detergents:**

- explain the following problems associated with the use of detergents:
  - a) health problems, e.g. skin allergies,
  - b) pollution problems caused by the disposal of some non-biodegradable detergents and the resulting ecological disturbance.

**Nitrogen fertilizers:**

- recognize that fertilizers are added to the soil to replenish minerals that are essential for plant growth,
- discuss the desirability of local operation of an industry to produce sulfuric acid and ammonia in terms of:
  - a) availability of resources,
  - b) demand for products,
  - c) environmental impact.

**Bleach:**

- recognize both the advantages and the social problems related to the use of chlorine and sulfur dioxide as bleaches,
- discuss the desirability of operating a local plant for the production of chlorine and sulfur dioxide.

**University level:**

At the tertiary level, the following institutions are involved in environmental education, training and research (UNEP, 1986):

1. The Chinese University of Hong Kong, Department of Biology, Science Center, with links to:
  - Agriculture and Fisheries Department, Hong Kong,
  - Environmental Protection Agency, Center for Environmental Studies, Hong Kong,
  - UNESCO (ROSTSEA), Jakarta, Indonesia,
  - Bangkok MIRCEN, Thailand Institute of Scientific and Technological Research,
  - University of Liverpool, U.K.,
  - University of Nottingham, U.K.
2. University of Hong Kong.
3. Several courses are offered at the Hong Kong Polytechnic on Water Pollution Control, Noise and Vibration Control and Waste Management (UNEP, 1986).

**Extension programs (for government officials, specialized technical training):**

The Hong Kong Environmental Protection Agency organizes in-house seminars to improve environmental skills of individual officers. Technical staff from governmental institutions attend part-time day release courses at the Hong Kong Polytechnic on topics such as water, air and noise pollution control and waste management (UNEP, 1986).

## 2. Non-formal environmental education:

### Out-of-school activities:

The Mai Po Wildlife Education Center serves as a study center where students can go to study birds and other wildlife (UNEP, 1986).

### Non-governmental organizations:

There are some self-governing environmental organizations, e.g. Hong Kong Conservancy Association, and university student environmental associations (Badhu, 1982).

## 3. Training of environmental education personnel:

### Teacher training:

There are in-service courses for various disciplines, e.g. chemistry, where environmental concerns are included.

Teacher training is geared to promoting a suitable methodology that allows students in schools to attain the course objectives. Skills associated with communication (promoted through discussion), problem solving skills (promoted through projects, investigations) and decision making skills (promoted through role playing, debates) are developed and encouraged in trainee teachers (Holbrook, 1990).

## 4. Some institutions engaged in environmental education (UNESCO, 1989):

- International Council of Associations for Science Education (ICASE), Department of Professional Studies in Education, University of Hong Kong,
- City Polytechnic of Hong Kong,
- Field Studies Center, Advisory Inspectorate, Education Department,
- Hong Kong Baptist College, Department of Biology,
- Hong Kong Polytechnic, Center for Environmental Studies,
- Kennedy Road Junior High School.

### Contact person:

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**Country: INDIA****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 815.6  
 Area (thousands of square kilometers): 3,288  
 GNP per capita, 1988: \$340  
 Average annual growth rate, 1965-88 (percent): 1.8  
 Adult illiteracy, 1985 (percent): total 57 (female 71)  
 Percentage of age group enrolled in education (1987):  
     Primary: 98  
     Secondary: 39  
     Tertiary (1983): 8.9  
 Primary level pupil-teacher ratio (1984): 42  
 Total expenditure on education as % of GNP (1985): 3.6

**Major environmental problems (Atreya, 1982; Gupta, 1985; Kanwar, 1982; Malhotra, 1987; NCERT, 1987; Srinivasan, 1986):**

- overpopulation, rapid population growth rate,
- soil problems: soil degradation, soil erosion (more than 6,000 million tons of the fertile topsoil are lost every year due to erosion), desertification, increasing salinity and alkalization, poor soil management, exhaustion of nutrients, accumulations of toxic chemicals and elements, especially toxic metals,
- lack of potable water (pollution of surface and underground water; heavy withdrawal of underground water through borewells in parts of South India, resulting in seepage of saline seawater into substrates; silting of water reservoirs; only one-tenth of the 540,000 villages have protected water supplies),
- deforestation: the main causes are the shortage of fire wood (many people still use firewood as their only source of energy) and the expansion of arable land. (The National Forest Policy Act (1952) prescribed that a minimum of 33% of the country's land area be under the forest cover; today only 12% is forested and that, too, is being fast depleted);
- destruction of natural flora and fauna (the tropical rain forest is under rapid destruction), and depletion of rare animal species by unlawful poaching (e.g. export of monkeys and frog legs, destruction of snakes and crocodiles for skins, sale of wild animals to zoos and circuses),
- non-coordinated urbanization and industrialization,
- pollution of rivers and lakes (industries freely discharge highly corrosive and toxic chemicals into the nearby rivers and streams),
- silting of rivers, lakes, irrigation system, water tanks and reservoirs,
- air pollution (industrial toxic gases, automobile exhaust gases) and noise in the major cities and industrial areas (ninety percent of industrial air emissions are confined to a small number of urban pockets; industries of Greater Bombay add about 1000 tons of pollutants to the atmosphere every day),
- lack of incinerators and proper sewage facilities, indiscriminate dumping of garbage and industrial scrap in towns and cities,

- poverty, malnutrition, diseases (two-thirds of all illnesses are caused by water-borne vectors),
- natural disasters: floods, droughts.

Indian environmental problems can be classified into two main groups (Gupta, 1985):

- 1) Those arising from conditions of poverty and underdevelopment.
  - 2) Those arising as negative effects of the development process.
- Inadequate development, not industrialization, is the main cause of environmental problems in India. Poverty is the principal cause of the continual desperate destruction of India's natural resources. (Srinivasan et al., 1986).

#### School system:

General education: 12 years (pattern: variations within each state)

Legal requirement: at least 5 years.

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	20.2	23.0	32.0
Science:	1.6	2.6	4.6
Mathematics:	2.0	3.4	4.6
Technology:	5.0	3.8	3.3

Science teaching on primary level starts in Grade 1.

Science teaching on secondary level:

In Grades 9 and 10 two subject approaches are formed: biology or physical sciences. Elective courses during the late secondary school years: biology, chemistry, physics.

Universities and colleges:

In India, there are presently 149 universities and 5040 colleges, 3.1 million students are seeking postgraduate and research degrees and diplomas (Srinivasan et al., 1986).

#### ENVIRONMENTAL EDUCATION:

The new education policy of the Government of India aims to place greater emphasis on the principles of environmental conservation and the judicious use of natural resources (UNEP, 1986).

In the nationally developed curricula for all school levels, the following aspects of environmental education receive special emphasis (Bhattacharya, 1988; UNESCO, 1985):

- a) Population:
  - Population growth, history of population growth, crisis and problems of unplanned births.
- b) Land:
  - Land use, land reclamation, land and soil conservation.

- c) Resources and their uses:  
Uses of resources, conservation, recycling, water uses and conservation, energy uses and conservation.
- d) Food and nutrition:  
Food production, types, quality and supply, uses of food, food adulteration and preservation, nutritive values of foods, balanced diet, deficiency diseases and their eradication.
- e) Conservation:  
Conservation of wildlife, forests, soil, water and air, conservation of other non-renewable natural resources, preservation of natural beauty.
- f) Pollution:  
Pollution of water, air and soil; noise pollution; pollution by pesticides and other chemicals; waste disposal.
- g) Health and hygiene:  
Individual, family, community and social health hygiene; health hazards; communicable and non-communicable diseases.
- h) Man in nature:  
Man in relation to other components of the biosphere; environmental quality and man's future on earth.

### 1. Formal environmental education:

The Government and the Ministry of Education are not only aware of the need to impart environmental education to the students, but have taken substantive measures to introduce necessary curricula changes. For example, beginning in Class I, lessons on home sanitation, social forestry, health and personal hygiene, need for fresh water and pure air, etc. are included. When a student reaches the level of Class 7 and 8, he is told about the advantages of forests, impact of environmental degradation on society, destruction of forests and disappearance of orchards, the growing population pressures on the environment, widespread use of fertilizers and insecticides, and air and water pollution (Dwivedi et al., 1987).

There is no separate curriculum on environmental education for the 10 + 2 stage. Ecology and environmental problems are studied as part of such subjects as biology and geography (Sreekanteswara Swamy, 1990).

Environmental education curricula, textbooks, charts, kits and other teaching aids for primary to higher secondary school levels (both for students and teachers) have been developed by the National Council of Education Research and training (NCERT) of the Ministry of Education, Government of India (Rao, 1990; Srinivasan et al., 1986).

At the lower grades of school education, the curriculum is more centered around the child's immediate environment, while in the upper grades, interrelated principles of environmental issues and concerns are emphasized (UNEP, 1986).

#### Primary school level:

In 1963, NCERT published an experimental edition of a general science syllabus, Classes I-VIII. The contents were organized into units like: Air, Water and Weather; Rocks, Soils and Minerals, which clearly had some environmental basis. The syllabus stressed the need to encourage children to learn about things that are close to them around the home and school. A teachers' handbook of activities for classes I to V was developed. During 1969 to 1973, textbooks based on this syllabus and approach were developed. Three books were published, along with teacher

guides and a primary science kit for use in the classroom. These curricular materials were implemented throughout the country during 1970 to 1975 under the Unicef-assisted Science Education Program. In 1975, NCERT developed guidelines for the school curriculum published as "The Curriculum for the Ten Year School - A Framework". Environmental studies were identified as an important area. The physical and social environments are presented in an integral manner in Classes I and II. The contents have been organized into units such as (Atreya, 1987; UNESCO, 1985):

1. Our family - basic needs such as air, water and food, hygienic practices.
2. Our home - materials used for building, cleanliness of the house, types of materials used for clothing.
3. Our school - facilities such as drinking water, toilets, school garden, maintenance of buildings.
4. Our neighborhood - geographical features, significance and life of plants and animals, production of commodities, sanitation, amenities.
5. Our Earth - diversity of life, the atmosphere, man changes the surface of the earth, soil, minerals, exploitation of natural resources.
6. Our sky - the weather, rain, wind etc.

For grades I and II, there is no textbook for environmental studies. For classes III-V, environmental studies is divided into two parts: the social environment and the biophysical environment. The content is suggestive and flexible. For example, the "Living Things" unit specifies only the following science concepts:

- Things around us,
- Plants around us,
- Animals around us.

There are three textbooks for environmental studies that are related to the older set of books. Instead of a classroom kit, the local environment is used for the organization of learning activities (Atreya, 1987).

At grades I to IV, Environmental Studies (which combines nature study, social studies and health education) is one of the five prescribed subjects (the others being language, mathematics, socially useful productive work, and games and creative activities such as music, dancing and painting). It reaches a 20 percent allocation (Atreya, 1981).

In the "Environmental Studies" program, learning is mainly through activities based on observation of the local environment (both social and physical). Children are encouraged to investigate their immediate environment as well as to perform experiments using locally available resources (Ponniah, 1982).

Some of the effective environmental awareness programs involve maintenance of school gardens, lessons in practical hygiene and extra curricular activities, such as competitions and exhibitions on environmental issues (Srinivasan et al., 1986).

At the Regional College of Education (NCERT) in Bhopal, an experimental implementation of the environmental approach at the primary level proved that teaching through the environmental approach increases the children's environmental awareness. It also showed that when the

curriculum is interesting and relevant to children, it has more bearing on successful teaching rather than writing down questions and answers. The experimental group of children also achieved better mean scores than the control group (Rajput et al., 1982).

In the UNESCO-UNEP Pilot Project for Primary Schools (1979-80), the main objectives were preparation, experimentation and implementation of environmental education modules in selected primary schools of four Indian States. Twelve modules exemplifying science concepts derived from real-life situations in the rural environment were tried out and produced useful results. During workshops for teachers and specialists, the modules were refined, and appropriate guidelines for their use were developed. The modules have been implemented and evaluated on a national scale (Bhattacharya, 1988; UNESCO-UNEP, 1987).

Several UNICEF assisted projects, aiming at the achievement of universal elementary education and the dissemination of literacy, focus on environmental elements in their programs and instructional materials. Some of these projects are listed below (Bhattacharya, 1988):

- Primary Education Curriculum Renewal Project (PECR),
- Developmental Activities in Community Education and Participation (DACEP),
- Comprehensive Access to Primary Education (CAPE),
- Children's Media Laboratory (CNL),
- Nutrition/Health Education and Environmental Sanitation at Primary Stages (NHEES).

The Population Education Unit of NCERT developed a syllabus on Population Education in which elements of environmental education are inherent. The Source Book for teachers entitled, "Nutrition and Population Education," was developed. A massive program for implementing population education covering the entire range of school education was launched throughout the country with the support of UNESCO (Bhattacharya, 1989).

**Lower secondary school level:**

During 1966 to 1969, middle level school textbooks and teacher's guides were developed under the UNESCO project for teaching science in separate disciplines of physics, chemistry and biology. Another set of materials was developed under the guidance of NCERT. Both of them were adapted and adopted by the States and Union Territories to implement science teaching in middle schools.

The NCERT materials in biology included

- elements of nature study,
- conservation,
- population and
- general ecological principles

in a comprehensive approach to environmental awareness. Another set of instructional materials was developed through an editorial board set up by NCERT in 1975. An integrated science curriculum was first drawn up,

based on which the textbook, "Learning Science," (in three volumes for classes VI to VIII) was developed (Atreya, 1987).

At the middle level, environmental education is not a prescribed subject. However, "Science - an integrated course," which gets 4 hours per week, is strongly based on the pupils day-to-day observations in the environment, and comprises topics like (Atreya, 1981):

- food and health,
- man's dependence on plants and animals and the balance in nature,
- adaptability to the environment,
- water,
- energy,
- population,
- pollution,
- agricultural practices and implements,
- our crops,
- useful plants and animals,
- improvement of crop production,
- animal husbandry,
- conservation of nature and natural resources,
- science and human welfare.

Environmental education in schools and high schools is carried out by several methods, including:

- educational trips (visits to bird and wild life sanctuaries, factories, etc.),
- organizing simple games,
- conducting oral discussions with children about their daily life and social and physical aspects of their environment,
- simple outdoor experiments, such as studying the seasonal variations in vegetables and fruits, observing life cycle of common trees, plants and insects,
- low cost teaching aids and kits,
- songs and dramas,
- film and video shows on environment subjects.

(Sreekanteswara Swamy, 1990).

**Higher secondary school level:**

Three successive generations of instructional materials were developed by NCERT for this stage. In the first series of books for different subjects the most popular were biology textbooks published in 1967, which stressed:

- population explosion,
- food problems,
- conservation,
- food chains and food webs,
- biosphere as a whole.

In the next generation of books the biology books again followed a comprehensive approach to environmental awareness by presentation of topics such as:

- conservation,
- population,
- ecological principles.

The current generation of textbooks (developed 1975-80) in biology has followed this trend still further. Examples of environmental topics include:

- human dependence on nature,
- adaptability of animals and man to their environments,
- population,
- ecological succession and ecological crisis,

- population and conservation,
- community health.

There are two different textbooks in chemistry for secondary classes. In the first one, the environmental implications of chemical industries and nuclear armaments are not mentioned. The second textbook reveals a growing awareness of environmental problems. A full chapter provides information of environmental pollution problems:

- air pollution,
- water pollution,
- soil pollution,
- use of chemicals to maintain and promote the quality of the environment.

(Atreya, 1987).

The Kodaikanal International High School is one of the first schools in India to introduce a full course on environmental science with practical field studies, including field sampling, chemical analysis, terrain evaluation, map reading, field mapping, planting trees and using solar energy for water heating (Karanakaran, 1987).

Karnatka Secondary Education Board is intending to change the curriculum so as to teach the subjects of chemistry, physics and biology under single topic of Environment (Sreekanteswara Swamy, 1990).

#### University level:

Only a few universities and colleges include courses in environmental chemistry, environmental biology, ecology, environmental microbiology and environmental engineering. Those courses that do exist, are single discipline oriented and do not utilize an interdisciplinary approach to environmental studies. Research in many Indian universities remains mainly academic and seldom leads to solutions of real life problems relevant to environmental situations and local needs (Srinivasan et al., 1986; Subramanian, 1982).

There are around 120 engineering education institutions in India. Of these, 20 institutions offer postgraduate courses on environmental engineering. A number of institutions plan to start courses in different fields of environmental engineering in the coming 2-3 year period (Deshpande, 1987).

The main tertiary level institutions offering environmental education and training courses are listed below (UNEP, 1986):

- Anna University, Center for Environmental Studies;
- Assam Agricultural University, Department of Agrometeorology, College of Agriculture, Jorhat;
- Bidhan Chandra Krishi Viswavidyalaya, Faculty of Agriculture, Kalyani, West Bengal;
- Bhopal University, School of Biological Sciences, Bhopal;
- Center for Environmental Planning and Technology, Ahmedabad;
- G.B. Pant University of Agriculture & Technology, College of Basic Sciences and Humanities;

- Gauhati University, Department of Environmental Science, Gauhati, Assam;
- Gujarat University, Ahmedabad;
- Gujarat Vidyapith, Ahmedabad;
- Haryana Agricultural University, Hisar, Haryana;
- Indian Institute of Technology, Department of Civil Engineering, Kharagpur;
- Indian School of Mines, Department of Mining Engineering, Dhanbad;
- Jadavpur University, Civil Engineering Department, Environmental Division, Calcutta;
- Jawaharlal Nehru University, School of Environmental Sciences, New Delhi;
- Kalyani University, Center of Environmental Awareness, Kalyani, West Bengal;
- Kerala Agricultural University, Department of Forestry, Vellanikkara, Trichur;
- Karnatak University, Department of Studies in Botany, Dharwar;
- Madurai Kamaraj University; School of Energy and Natural Resources, Palkalainagar, Madurai;
- Mahatma Phule Agricultural University, Rahuri, District of Ahmednagar;
- Maratwada Agricultural University, Department of Entomology, Parbhani, and Zoology Department, Aurangabad;
- Nagarjuna University, Zoology Department, Nagarjungar, Andhra Pradesh;
- Osmania University, Regional Center for Urban and Environmental Studies, Hyderabad;
- P.G. Institute of Basic Medical Sciences - University of Madras, Department of Pharmacology, Madras;
- Panjab University, Center of Environmental Sciences, Chandigarh;
- Panjab Agricultural University, Directorate of Ecology, Ludhiana, Panjab;
- Saurashtra University, Department of Special Assistance in Bioscience, Rajkot;
- South Gujarat University, S.V. Regional College of Engineering and Technology, Surat;
- Sri Venkateswara University, College of Engineering, Tirupati, Andhra Pradesh;
- Sukhadia University, Udaipur;
- Vikram University, School of Studies in Botany, Ujjain;
- Visva-Bharati, Department of Chemistry, Santiniketan, West Bengal;
- University of Cochin, School of Environmental Studies, Cochin;
- University of Jodhpur, Jodhpur;
- University of Rajasthan, Indira Gandhi Center for Human Ecology, Environmental and Population Studies, Jaipur.

Examples of specialized courses developed by universities include:

- Energy Forestry in the Department of Forestry, Kerala Agricultural University;
- Agricultural Waste Recycling in the Directorate of Ecology, Punjab Agricultural University;

- Biogas Technology in the Centre for Environmental Science and Engineering, Indian Institute of Technology;
- M.Sc. Course on Environmental Toxicology, University of Madras;
- Environmental Geology at post-graduate level, Karnataka University,
- Interdisciplinary postgraduate program, offered by the Centre on Environmental Science and Engineering (set up by the Indian Institute of Technology, Bombay, in 1985).

One of the significant developments in environmental education at the tertiary level in India has been the appointment of a Committee on Environmental Sciences by the University Grants Commission. The Committee has suggested ways and means of reorienting and giving thrust to environmental education at the post-graduate level. A post-graduate master's course for degree-holders in physical sciences and engineering has been recommended (Deshpande, 1987; Rao, 1990).

The Environmental Geology M.Sc. course at the Karnatka University covers the following topics:

- Man and Earth,
- Earth processes that affect man: Earthquakes, earth surface movements,
- Man's alterations of environment,
- Gaseous, liquid and solid wastes and their disposal,
- Radioactive wastes,
- Water pollution,
- Water resources,
- Coastal installations,
- The physical system including oceans,
- The biological system
- Managing the environment.

The above does not emphasize the practical applications of the subject (Gourashettar et al., 1987).

At the Bangalore University, Environment Chemistry is a part of B.Sc. degree curriculum, and Environment Geology is a part of post graduate degree (M.Sc.) curriculum at the Department of Geology (Sreekanteswara Swamy, 1990).

The B.Sc. chemistry syllabus of Osmania University, Andhra Pradesh, contains a chapter on environmental chemistry, which covers air and water pollution, radioactive pollution, and their effects on human beings (Rao, 1990).

At the University of Delhi, environmental education forms a part of the B.Sc. course in Environmental Chemistry, B.Sc. course in Industrial Chemistry and B. Sc. course in Agricultural Chemistry. Broadly, the topics in environmental education include air pollution and water pollution. Each topic is further subdivided into a:

- type of pollutant,
- source of pollutant,
- effects of pollutant,
- abatement techniques for the control of pollutant.

Water pollution:

Special emphasis is laid on primary, secondary and tertiary steps in the treatment of waste water. Thermal pollution and eutrophication are also taught under this topic.

**Air pollution:**

Special emphasis is laid on the six major components that contaminate the air: oxides of nitrogen, oxides of sulfur, photochemical smog, carbon monoxide and hydrocarbons. Greenhouse effect and ozone layer are also taught under this topic.

(Sane, 1990).

The interdisciplinary postgraduate program, offered by the Centre of Environmental Science and Engineering in Bombay, is being offered from 1985. It meets the requirements of the industry, and planning, design and research organizations. The program provides a balanced training in scientific, engineering and social aspects of environmental management. The curriculum consists of a set of compulsory core courses and a choice of electives to facilitate in-depth study of various environmental problems in the first year, followed by a research project in a second year (Deshpande, 1987).

Recently a suitable curriculum is devised for undergraduate and postgraduate students of chemistry in India to familiarize them with various aspects of energy, ecology and environmental science education. The undergraduate elective course for chemistry students exposes various facts of environmental chemistry such as (Reddi et al., 1989):

- physical and chemical aspects of the environment,
- chemistry of soil environment,
- toxic chemicals in the environment,
- methods of environmental evaluation,
- chemical control of waste products.

The UNESCO-UNEP Pilot Project on the Incorporation of an Environmental Dimension into General University Education - Natural Science Area (1985-1987) had developed contents and materials for an educational program for students in natural sciences, training personnel, experimental testing of the programme and evaluating its results (UNESCO-UNEP, 1987).

**Extension programs (for government officials, specialized technical training):**

Training programs on various environmental topics have been organized for policy makers, administrators, technologists, scientists and teachers through the co-operation and support of national and international agencies (UNEP, 1986).

The Department of Environment has initiated training workshops for top level managers with the intention of sensitizing them to environmental management practices. The following topics are covered during six days training (Ramanathan, et al., 1982):

- Environmental management issues in India
- Technology assessment
- Environmental concerns and economic development
- Natural habitat
- Impact analysis
- System approach to environmental management
- Environmental conflicts
- Environmental management - indian experience
- Urban environment
- Environmental degradation in India
- Environment and health
- Silent Valley Project - A case study (discussion)
- Energy and environmental interaction

- Economics and environmental quality
- Government and pollution control
- Agroforestry
- Environmental conditions of India
- Institutionalization of environmental concerns
- Economic of resources utilization
- Monitoring environmental change
- Forest policy in India
- Water quality management
- Urban waste management.

The Administrative Staff College in Hyderabad, Indian Institute of Management, and Institute of Public Administration, are organizing regular courses on General Environmental Management and Industry Specific Environmental Management for government officials and people from public and private sector industries (Rao, 1990).

## 2. Non-formal environmental education:

There are about 20,000 non-formal education centers throughout the country. Some of these use the same syllabuses and textbooks as are being used in formal schooling whilst others use instructional materials which are more relevant to the environmental situation of the learners (UNEP, 1986).

The different forms and approaches of non-formal environmental education in India include (Gupta, 1985; Khoshoo, 1987):

- adult education (programs for illiterate and neo-literate young men and women in the age group 15-35),
- polyvalent education for urban workers,
- rural youth and non-student youth education (especially for the 6-14 years old school drop-outs),
- tribals and forest dwellers education,
- activities for children,
- eco-development camps,
- activities of non-governmental organizations,
- activities of public representatives,
- training of senior executives and administrators,
- research and development programs,
- establishment of centers of excellence,
- development of trained manpower: training of trainers, professionals, technical personnel, and legal experts,
- development of educational materials and technical aids,
- educational programs conducted by mass media,
- celebrations of world environment day,
- collaboration at the international level.

### Out-of-school activities:

Environmental education is a subject taught in non-formal education programs launched by the Government of India as an experimental project for children of 9-14 years, who have either not completed primary education or have not gone to a school at all. The emphasis in this program is on the development of competencies to solve problems of day-to-day life (Bhattacharya, 1988).

The non-formal curriculum for the 9-12 years old children, prepared at NCERT and at the state level, comprise besides literacy and numeracy also health, environmental studies, social awareness and vocation (Atreya, 1987).

Out-of school activities for school children include science clubs, visits to national parks and sanctuaries, as well as participating in essay, poster, painting and photo competitions (UNEP, 1986).

In 1976, WWF India organized the first Nature Clubs of India for youth in schools and university students. Since then, Nature Clubs have developed a wide spectrum of activities, including (Sarabhai, 1990):

- Literature: quarterly magazine "Nature News", education wall charts, features on specific environmental topics;
- Audio-visuals: Vanishing Forests, Lord of the Jungle, Wonders Around You, Plant Conservation (is under preparation), A series of audio-visuals to complement new literature is under consideration;
- Field programs: wildlife sanctuaries, nature reserves, national nature orientation camps;
- Indoor programs: Painting, essay, debating, quiz competitions, Courses on Environmental Awareness, Exhibitions, Film shows, slide-illustrated talks, audio-visual presentations for schools, Seminars and symposia;
- Future plans: Literature for camp organization and training is under preparation, Two mobile rural conservation units are under preparation in two states.

Hundreds of schools have become members of the Nature Clubs of India, which are sponsored by the World Wildlife Fund India. These clubs publish newsletters of wide circulation and they undertake nature trails in different parts of the country (Bose, 1982).

About 10,000 science clubs are running in schools. All students from the secondary classes (age group 13-17) can become members of science clubs. Activities that are generally undertaken involve:

- symposia, seminars and quiz sections,
- excursions to factories, agricultural fields, zoo or botanical garden,
- biological excursions in search of typical flora and fauna,
- collecting, identifying and preserving biological specimens,
- project work.

The environment-based projects in science clubs include problems of health, nutrition, sanitation, deforestation and pollution (Bhattacharya, 1982; Bose, 1982).

Center for Environmental Education (CEE) in Ahmedabad provides environmental education printed materials for schools and non-formal education. A list of publications for 1990 is given below (Sarabhai, 1990; Center for Environmental Education, 1988):

- Educational package on water (booklet, poster, information cards, stickers),
- Floods and drought package (set of 11 exhibition posters, handbook of activities and background material),
- Conserving our water resources package (teachers' guide, handbooks of activities and background material, color poster on water conserving),
- Information on various aspects of pollution (set of 100 copies),

- Joy of learning (handbook of 75 environmental education activities),
- Exploring a tree (module for creating awareness about trees and life around them),
- Snake folder (illustrations and information on common Indian snakes),
- Birds in Indian wetlands (information and illustrations on wetland birds),
- Ant (illustrated publication on ants),
- Workbook for junior bird-watchers,
- Handbook on nursery operations,
- Nursery calendar - plantation schedule,
- I am a tree (a poem on trees for children),
- Tiger times (illustrated tabloid),
- Posters of animals: tiger, lion,
- Labels and stickers with conservation messages,
- Articles on urban developmental issues in Ahmedabad.

National Museum of Natural History, which is under the Department of Environment, provides opportunities for students of all ages to acquire experiences in understanding the natural environment (UNEP, 1986).

Sundarvan, a nature discovery center set up in 1979 by the Karmakshetra Education Foundation, is now one of the activities of the CEE (Center for Environmental Education). Several activities are being conducted for the development of the park (CEE Annual Report, 1988-89), e.g.:

- development of small areas as representative habitats, including wetlands and aquarium,
- expansion of the library, which contains over 5000 books, subscribes over 125 international journals, has a microfiche collection with a microfiche rider and contains the complete texts of 1000 practical books and documents on village and small community technology,
- organization of weekend nature camps for primary school children and marine camps during summer vacation,
- offering regular programs for children and adult visitors of the park.

The National Council of Educational Research and Training (NCERT) has been organizing National Science Exhibitions for secondary school children. The main themes include a number of environmental topics, e.g. (UNEP, 1986):

- Renewable sources of energy,
- Industrial, community and household wastes,
- Pollution,
- Erosion,
- Water problems,
- Food preservation.

Essay writing competitions on environment are being conducted by the Department of Environment, Government of India, with the help of voluntary organizations, from 1982 onwards in all the 16 official languages of the country. On the spot painting, modelling and poster design competitions for children are conducted by the National Museum of Natural History (Rao, 1990).

In the projects conducted by the Vikram A. Sarabhai Community Service Center (VASCSC) of Ahmedabad, with student and teacher groups participating, sets of teaching/learning units on selected environmental education themes were developed, tested and finalized. Examples of materials include (Lockard, 1977; UNESCO, 1983):

- Ecology learning at the primary level,
- Students and environment Vol. I, II,
- Trial topics on energy,
- Bird study,

- Field trip for science education,
- Science and community,
- Environment-related biology and chemistry activities,
- Minibook on water,
- Minibook on energy,
- Minibooks Tree is my friend and tree is my life,
- Minibook on pollution,
- Minibook on nutrition,
- A study of the earth's environment,
- A comprehensive book on water, salt, energy and pollution,
- A questionnaire and a manual on environmental awareness,
- A film on basic ecology.

In addition,

- Traditional puppets have been used to explain the concept of nutrition and the environment,
- Exhibitions for decision makers and general public have been arranged.

In Gujarat a Nature Education Program has been launched with the collaboration of WWF India, meant mostly for lower and higher secondary school children. The program contents include day's camps in the outdoors, exposing school children to various aspects of nature and its conservation under the supervision of guides from the Forest Department and volunteer members of WWF India. Winter camps with bird banding programs on the bird migration route has been organized in cooperation with the Bombay Natural History Society (Rashid, 1982).

The Karnataka Rayja Vijnana Parishat (KRVP), Indian Institute of Science Campus, has been organizing environmental conservation camps for students and teachers. About 50 selected students from different high schools can participate the environment camp. They are given intensive training in identification of various plant and animal species, their functioning and behavior, and are trained to prepare a map of the area. Popular lectures on environment and energy conservation are organized and environment films and videos are shown for the participants. To rise environmental awareness, the KRVP is planning to organize competitions such as environmental quiz, environmental essay writing, on the spot painting competitions on environment conservation and chart drawing competitions. The KRVP has published five books and produced four films on environment and related topics. It also has a collection of video cassettes on wild life, which will circulate among KRVP units and science centers all over Karnataka (Sreekanteswara Swamy, 1990).

The Ganga Pollution Awareness Program, initiated in 1987 by the Center for Environmental Education (CEE), seeks to involve students in regularly monitoring river water quality by applying the scientific knowledge and experimental techniques learnt in school to a real-life situation. A water monitoring kit has been developed and teachers and students from about 90 schools in Bihar, Bengal and Uttar Pradesh have been trained to carry out this program (CEE Annual Report, 1988-89).

A model program of bird awareness and study for the blind and visually handicapped students was initiated by the Center for Environmental Education (CEE) and the Blind Men's Association, Ahmedabad. The program explores the use of touch and hearing in bird study. Components of the program include recording of bird sounds, touch-and-feel exhibits and a

Braille booklet giving information on birds (CEE Annual Report, 1988-89).

About ten years ago, the Committee on Teaching of Chemistry of the IUPAC in association with UNESCO, launched a pilot project at the University of Delhi. The objective of this project was to design reliable low-cost equipment for chemical education using locally available components and materials. A number of low-cost equipment packages have been developed - a typical price of each package is \$60. Over 42 teacher-training workshops have been held all over the world to introduce the fabrication, use and maintenance of the equipment. A Production Unit, employing handicapped personnel and school dropouts as the work-force, has been set up in India to manufacture and market the equipment. A low cost colorimeter, pH meter and conductimeter are amongst the equipment developed under the project. Work has been initiated to use this equipment for some simple experiments related to environmental monitoring. The initial trials are limited to water and soil analysis. Examples of environmental experiments (analytical determinations) are given below (Sane, 1990):

Experiments using a pH meter:

- pH of rain water (changes in pH in different localities of a city during rain),
- pH of surface waters (in relation to the local geology and vegetation),
- pH of soil and its application in agronomy,
- determination of alkalinity of surface waters, especially to assess their sensitivity to acid precipitation. Titration with standard acid.
- pH meter used with ion-selective electrodes, such as nitrate electrode, ammonia electrode or fluoride electrode.

Experiments using a conductance meter:

- quick survey of electrolyte concentration in environmental water samples - which can be correlated with water quality,
- conductance titration for low alkalinity,
- conductance titration for very low chloride concentrations.

Experiments using a colorimeter:

- colorimetric determination of phosphate in surface waters or in synthetic detergent formulations (in relation to eutrophication of surface waters),
- colorimetric determination of iron in surface waters or water from underground wells.
- colorimetric determination of trace metals in fertilizers (e.g. Fe, Mn, Zn, Cu).

**Adult education:**

A National Adult Education Program (NAEP) was launched on mass scale in 1978 with components of literacy, functionality and awareness. The curriculum prepared includes contents of (Gupta, 1985):

- healthy environment,
- hazards of the existing environment like disposal of human excreta, open and overflow drainage,
- importance of hygienic and sanitary living conditions, pure drinking water, pure air, plant life,
- water pollution,
- soil pollution,
- air pollution,
- improvements of environmental conditions.

The present program of Adult education is also based almost on the NAEP pattern and the environmental education contents are reflected in:

- Basic literacy package,
- Post-literacy and follow-up materials,
- Training materials,

- Motivational and supplementary materials.  
The content areas of environmental aspects integrated in these materials are (Gupta, 1985):

- Environmental sanitation, cleanliness,
- Protection and plantation of trees for ecological balance,
- Environmental conservation and enrichment,
- Environmental and social pollution.

**Activities for the general public:**

The Nutrition/Health Education and Environmental Sanitation Project, implemented by Unicef and the Science Education Program (SEP) has attempted to develop a dynamic program for school children and population of the community, to help them adopt desirable nutrition, health and environmental sanitation practices. The project was fairly well linked with the primary science syllabus. Some messages extended from the school to the community were (Atreya, 1987):

1. Use clean, safe water for drinking and cooking
2. Keep your school, home and village surroundings clean
3. Do not pollute sources of water
4. Do not defecate or urinate or spit anywhere but in the places provided.

Polyvalent programs have been developed through establishment of a network of Shramik Vidyapeeths (Polyvalent Education Centers). The program represents adult education for illiterate, semi-literate or literate workers in urban and industrial areas, for skilled, semi-skilled or unskilled, for men and women in organized and unorganized sectors. People living in slums with problems of environmental degradation can receive non-formal environmental education through this program (Gupta, 1985).

The Gurajat state introduced non-formal environmental education for children and adults from tribal areas in three subjects: language, mathematics and environmental education. In the environmental education course science is taught through the environment. Course content of non-formal environmental education for children in 9 to 14 yr age group is given below (Rawl, 1987):

**Natural environments (Science):**

Our vegetation; Our waters; Our atmosphere; Water; Our body; Our health; Our village; Our Gujarat state; Our country India; Our world; Transport and communication.

**Social Environment (Social Science):**

Our home; My family; Our food; Our school; Our neighbors; Our great men.

The Center for Environmental Education (CEE) initiated the Ranthambhore Eco-development Program as a part of its program of evolving development and communication program for rural populations around reserve forests, national parks and sanctuaries. Five village-level adult education centers have been initiated in five selected villages around Ranthambhore National Park. The main objectives of these centers is to build up community forums, which will act towards the protection of surrounding forests, improvement of agriculture and animal husbandry, and efficient water management. Environmental education activities

suited to local needs have been initiated in six schools. Community and individual afforestation, and demonstrations on alternative technologies are planned to be taken up shortly.

In a similar Hingolghadh eco-development project, training of local people in specific skills such as tree plantation, nursery raising, soil and water conservation methods and chulha making was imparted. In practice 110 farmers planted 80,000 samplings on their farm land during the monsoon period. In the next year 150 farmers undertook tree plantation on their fields and around 150,000 samplings were planted (CEE Annual Report, 1988-89).

The Center for Educational Research and Training, founded in 1981, is conducting a program to make the education in rural and urban schools relevant to the environment (Sarabhai, 1990).

The UNESCO-UNEP Pilot Project on Environmental Problems of Urban Marginal Areas (1981-1983) aimed at developing multimedia educational materials related to major environmental problems of marginal urban settlements (hygiene, nutrition, pollution), the training of community leaders and the experimental development of actions oriented toward improvement of the environmental quality of the community (UNESCO-UNEP, 1987).

The UNESCO-UNEP Pilot Project on Environmental Education Problems of Urban Marginal Zones (1986) was aimed at developing multimedia pedagogical materials dealing with major environmental problems of urban marginal settings (nutrition, hygiene, pollution), training of teachers, community leaders and instructors, as well as the experimental utilization of materials developed (UNESCO-UNEP, 1987).

#### **Mass media:**

The mass media such as radio, television and newspapers play a significant role in informing the public about various development programs in the country as well as the need to conserve resources and to protect the environment. There are twenty television centers which regularly televise programs related to environment, health, nutrition and agriculture.

Plans are also underway to spread various environmental messages through traditional media such as folklore, music and dances (UNEP, 1986).

Content analysis of three national daily newspapers show that reports related to environmental issues often cover the following topics (Sekar, 1982):

1. Population growth and food problems.
2. Energy crisis and new sources of energy, e.g. solar energy utilization.
3. Environmental conservation: conservation of nature, maintenance of ecological balance.
4. Environmental pollution - water and air pollution, nuclear waste disposal.

The Children's Environmental Education Television Project (CEETV) is a cooperative Indo-US effort to increase environmental awareness among children in India through educational television. The project was initiated in 1987 as the collaborative effort of the Centre for

Environmental Education (CEE), established in 1984, Ahmedabad, India, and the State University of New York College of Environmental Science and Forestry (CESF), Syracuse, New York, USA. The program involves the production of a series of integrated learning modules, each consisting of a video and teacher's guide, on various aspects of India's environment. The modules are directed mainly at school children in the upper primary/middle school levels (ages 10-14), although the videos may be appropriate for older students and adults as well. The modules will be distributed through a network of non-government organizations, state governments, and other educational groups to schools through India. The videos may also be broadcast over India's national television network (CEETV Report, 1989; CEE Annual Report, 1988-89).

The Centre for Environmental Education (CEE) has launched a project to coordinate the production of eight motivational video and audio-visual slide programs on renewable energy technologies, sponsored by the Gujarat Energy Development Agency (GEDA). The audio-visual slide program on Energy Plantation and two video programs on Solar Energy Applications and Solar Cookers have been completed. A video program on Community Biogas Plants is planned to be the next in the series (CEE Annual Report, 1988-89).

**Governmental, non-governmental and voluntary organizations:**

The Society for Clean Environment (SOCLEAN), Bombay, has played a pioneering role in the country in disseminating ideas about environment, environmental crisis and problems of population growth. The Society covers various aspects of environmental education activities. Some examples from the program "Creating environmental awareness among the school children" are given below (Shetye et al., 1982):

1. Orientation lectures and discussions organized for students and teachers. e.g.:
  - Environment and balance of nature,
  - Various types of environmental pollution, their ill-effects and means of controlling pollution,
  - The impact of human population on ecosystem.
2. Field trips to selected industrial areas requiring immediate environmental improvement.
3. Investigative projects for students:
  - Collection of suspended matter in domestic water supply, examination of physical characteristics, observations through microscope.
  - Types of trees, its number, height, health.
  - Details of industrial activity in selected locality and environmental problems created by it.
  - Study of vegetation.
  - Dustfall measurements and classification of dust particles by the use of microscope.
4. Quiz, essay and painting competitions on various aspects of environment.

The Center for Environment Education (CEE), Nehru Foundation for Development, Ahmedabad (supported by the Department of Environment, Forests and Wildlife, Government of India) has an important function at the national level. The Center is involved in developing educational programs and materials to increase awareness about the environment among the school children, visitors to national parks and sanctuaries, users

of media, the rural poor living in areas where there is a severe shortage of natural resources and the general public.

The thrust areas of the CEE's activities are (CEE Annual Report, 1988-89):

1. Environmental education in schools

CEE is concentrating on developing educational materials for middle/upper primary level school (This stage offers perhaps the best opportunity for introducing change - children have developed basic skills but are not too close to school-living examinations). A variety of materials is planned and being developed, ranging from curricular activities to environment related activities and subjects like science, craft, social studies, etc. CEE conducts teacher training workshops in various aspects of environmental education. In 1988, it has initiated an internship program on environment and communications for post-graduates and persons from voluntary agencies.

2. Interpretation

The Center is developing interpretive programs for national parks and zoological parks:

- wayside exhibits,
- national parks and sanctuaries visitor centers,
- pamphlets, road guides and handbooks.

3. Media: print, television, exhibitions

CEE Special News and Features Service (CEE-NFS) offers to the press (especially to smaller newspapers in regional languages) information on nature, wildlife, natural resources, cultural heritage, problems and issues of the rural environment, along with easily reproducible line drawings and articles on environment significant topics, and brings out publications for various target groups on different aspects of the environment.

CEE is also involved in developing and fabricating exhibits on diverse environment-related subjects.

Special TV programs for schools and university students are broadcast regularly over the national network. Scripts for a television series "What on earth are we doing to our environment?" have been prepared in cooperation with the Education Media Research Center in Ahmedabad. A Gujarati video film "Rann thi Aranya" was made in collaboration with VIKSAT.

4. Natural heritage

Books, field guides, charts and posters, popular booklets and pamphlets on India's natural heritage form part of the long-term publication project of the CEE.

5. Eco-development

The need for eco-development is especially acute for tribals and those living close to forest areas. When an area is declared a national park, communities living around it find their traditional natural resource base cut off. Unless alternatives are worked out, such environmental protection would only make them hostile towards the protected areas. CEE is working on appropriate communication programs for such areas.

6. Urban environment

CEE programs are creating awareness among various target groups in a city.

7. Cultural heritage

Creating awareness of the social environment and its close link with the natural environment and the cultural heritage is a part of the educational programs of CEE.

The basic strategies of the CEE are (Sarabhai, 1985):

1. To help national networks for environmental education.
2. To use both traditional and modern media and to experiment with innovative communication ideas.
3. To develop educational materials intended for widespread use.
4. To develop programs in form of clearly defined projects with a large training component for the relevant educational staff.
5. To use existing situations and develop interpretative programs around them.
6. To use successful environmental programs and build communication strategies around them, and to develop demonstration projects where a major environmental improvement can be shown.
7. To demonstrate the efficacy of communication programs in terms of the requirements of diffusing specific technologies and processes.

The Center for Science and Environment (CSE) in New Delhi is developing a policy framework for environmentally-sound rural and urban development. Although its primary role has been in information dissemination, over the last few years CSE has expanded in several directions. Following are the main units of the Center and their ongoing projects (CSE Annual Report, 1989-90):

**Research Unit projects:**

- Ecosystem-specific development,
- The Thar ecosystem study,
- The Eastern Himalayan ecosystem study,
- Studies on village ecosystem planning,
- Studies on traditional knowledge systems,
- Village democracy studies,
- Data base on India's natural resources,
- Towards green villages: A strategy for environmentally sound and participatory rural development (a book, published in 1989).

**State of India's Environment Unit:**

- Report on the worsening flood situation in India.

**Documentation Unit:**

- The basic objective of the unit is to identify, collect, analyze, and disseminate information on environmental issues. The center gets over 30 newspapers every day and about 400 different magazines. There are more than 18,000 books on environment in the unit.
- CSE's computerized data base helps to generate listings of references and reports rapidly. The non-printed segment of the database contains over 10,000 color slides and black and white pictures on India's environment.
- The unit has started working on a directory of environmentalists, voluntary groups, government organizations, academics, research organizations and other individuals working on environmental issues.

**Environmental Campaigns Unit:**

- Seminars and conferences:
  - Indo-Pakistan Conference on Environment organized in Lahore from December 13-15, 1989;
  - Seminars on the Economics of Natural Resource Use;
  - Seminar on Wastelands Development in Meghalaya.
- Awareness raising activities for the media (scheme of awarding short-term fellowships to journalists):
  - In 1989 the two themes were:
    - Traditional knowledge and practices for environmental management, and
    - Traditional water harvesting system of India.
- Specific campaigns:
  - Land alienation in Gopalpura,
  - Pollution in Bicchri,
  - Land Alienation in Karnatka.
- Other activities:
  - National Environment Awareness Campaign,
  - Earth Day 1990.

**Environment Education Unit:**

- Audio visuals:
  - a) collection of slides, posters, video cassettes, black and white and color photographs,
  - b) Catalogue of AV slides and photographs,
  - c) Catalogue of posters,
  - d) Video tape library,
  - e) Production of AV programs,
  - f) Production of films.
- Training workshops,
- Children's resource program.
  - The center is bringing out a series of 10 booklets for children on India's environment, each focusing on one aspect of the environmental problem. Put together, the booklets will become a State of India's Environment Report for children.

**Institutional Management and Development Units.**

Karnataka Rajya Vijnana Parishat (KRVP), Indian Institute of Science Campus, Bangalore, is a voluntary organization founded in 1980 and devoted to the popularization of science and spreading of scientific temper. The main activities include:

- publication of low cost periodicals and books,
- organization of science lectures, symposia, science exhibitions, observations of the night sky,
- demonstration and diffusion of scientific and technological advances relevant to daily life,
- courses and training for teachers for update their knowledge base,
- encouragement and assistance to science clubs and institutions involved in the popularization of science,
- assistance in rural folk matters related to agriculture, animal husbandry, health, sanitation and environmental protection.

The KRVP Environmental Program Unit has been organizing environmental camps for students and teachers, where environmental films, nature studies, bird watching, expeditions, lectures, slide shows, posters, etc. are being provided. Significant programs on environment are conducted every year by KRVP units on the World Environment Day (June 5). The World Wild Life Fund Organization has funded KRVP for a project to create an environmental awareness among children and students (KRVP, 1990).

The Audiovisual Educational Resources Center (AVEHI) is a non-profit organization which makes audiovisual material available on loan to those individuals and organizations in Bombay who wish to use this tool for imparting education and creating social change. Many schools, colleges, organizations working in slums, professional groups, women's organizations, hospitals and dispensaries, rural organizations and industrial organizations are being using the audiovisual materials available from AVEHI. Since many of the users are working with low-income and low-literacy groups, the initial demands are for material most directly related to the lives of these people - health, nutrition, environmental issues and social topics (Variava, 1987).

There are several other environmental organizations and movements, e.g.:

- the Indian Environmental Society and the Consumers Associations (Badhu, 1982);
- the Social Forestry and Energy Industrial Plants movement in Gujarat state (UNESCO, 1983);
- the Save and Silent Valley movement in Kerala (UNESCO, 1983);
- The Chipko movement of the hill population in the Himalayan region, started by women, which aims at saving local forests from destruction and also at preserving forests in other regions in India (UNESCO, 1983; UNEP, 1986);

The Center for Environmental Education, Ahmedabad, is developing an Environmental Education Network, with the following goals (NEAC, 1989-90):

- networking schools and voluntary organizations in India,
- collecting, validating and utilizing existing environmental education materials,
- developing and implementing new environmental education programs,

- training environmental education resource persons.

### 3. Training of environmental education personnel:

#### Teacher training:

There is no systematic formal pre-service training of teachers in environmental education. Teacher education programs so far have been limited to in-service courses. Several approaches for the introduction of environmental education to teacher education courses have been proposed (UNESCO, 1985):

- environmental education as a separate discipline (infused or interdisciplinary),
- integration of concepts of environmental education in other fields of specialization,
- combination of both the approaches.

Model programs for all the three different approaches have already been developed by some agencies like NCERT in the forms of:

- contact programs of three to four weeks duration,
- teacher's guides and self-learning modules,
- correspondence courses,
- the use of mass media: newspapers, radio and television.

(UNESCO, 1985).

Primary and high school teachers are given a separate training in addition to teachers training programs. They are provided with workbooks, charts and pamphlets on social forestry, afforestation, environment conservation etc. (Sreekanteswara Swamy, 1990).

The Center for Educational Research and Training organizes in-service environmental education training for teachers every year. The program takes three to four weeks during the summer holidays (Sarabhai, 1990).

During 1978-79 the Department of Education in Science and Mathematics (DESM), NCERT, organized an in-service teacher training program in environmental studies, with the academic assistance from experts provided by the British Council. Under this project an useful package of six tape-slide sequences on "Using the Environment to Develop Common Skills" was developed. During 1980-85 six more workshops were organized (Atreya, 1987).

DESM also published a booklet "Using Environment and Local Resources for Science Education at the Primary Stage - Guidelines for State Institutes for Developing a Handbook for Teachers of the State". The booklet was developed through regional workshops involving three participants from each State of the country. (Atreya, 1981).

Some States have developed teacher's handbooks in the local languages on the use of the environment and local resources for teaching of science at primary level. Some examples of books for teachers, published by NCERT, are given below (Atreya, 1981):

- Teaching of science by using local resources
- Environmental studies, a teacher's guide, classes I and II
- Teacher's guide for non-formal education (in Hindi)
- Curriculum guide on nutrition, health education and environmental sanitation

Two films have been produced by the Department of teaching aids of NCERT:

- Learning science through environment - rocks and soils
- Learning science through environment.

The State Institute of Education in Gujarat created a new Environmental Division. Training of teachers and preparing Teacher's Guide is one of its main responsibilities. The course content of Teacher's Guide in environmental education from Grades I to IV are given below (Rawi, 1987):

**Natural Environment:**

**Grade I:**

Our home; Our vegetation; Our water; Our village; Air, water and climate; Our sky.

**Grade II:**

Our house; Our vegetation; Our water; Our forest; Our village; Air, Water and climate; Our sky.

**Grade III:**

Our vegetation; Our animals; Our Gujarat; Air, water and climate; Our world.

**Grade IV:**

Our vegetation; Our animals; Our body; Our Gujarat; Air, water and climate; Land, soil and agriculture.

**Social environment:**

**Grade I:**

Our family; Mental peace and health; Our food

**Grade II:**

Our house; Our neighbors; Our family; Peace in the locality; Our food.

**Grade III:**

Our family; Mental peace and health; Our food

**Grade IV:**

Mental peace and health; Our food.

For incorporating Environmental Education into pre-service and in-service training programs for teacher educators, curriculum developers and educational planners, the following ways and means have been suggested (Bhattacharya, 1988):

- a separate subject on Environmental Education may be offered in the post-graduate program for teacher educators;
- various concepts of environmental education may be integrated with various subject areas offered in the courses;
- the in-service environmental education can be organized by offering orientation programs of two week duration in which the concepts of Environmental Education and the implications for school education may be discussed;
- courses may also be provided through correspondence and mass media (radio, television);
- self-learning modules may be developed and distributed to teacher educators, curriculum developers and educational planners.

**Organizers of non-formal education training:**

The Center for Environment Education (CEE) has conducted a one-day training program as a part of Gujarat Vidyapith's intensive 15-day

training program for community youth leaders. Sixty supervisors and eight motivators were trained in environmental education, its methodologies and development of materials. The emphasis was on community involvement and teacher training (CEE Annual Report, 1988-89).

#### 4. Major environmental education problems:

In 1976, the following problems were identified by UNESCO and UNEP:

- At pre-school level: lack of funds;
- At primary and secondary level: shortage of teaching personnel qualified in environmental education and deficiency of teacher-student organizations active in this field (UNESCO-UNEP, 1976).

In the recent years, the main constraints in making environmental education relevant, can be grouped in the following three categories (Saxena, 1987):

##### 1. Resource constraints

Lack of resources is considered as a major constraint in implementing environmental education programs, both in terms of money and trained personnel. With a large pupil-teacher ratio in schools it is difficult to adopt investigative and experimentation approach. Due to a high drop-out rate at primary level, it is necessary to emphasize environmental education at this level in order to reach the largest cross-section of the society.

##### 2. Social constraints

The conclusions of the environmental studies may come in direct conflict with social, religious or political thinking, which leads to conflicts and in some cases to confrontation. Therefore, environmental action should be an important part of environmental education.

##### 3. Constraints related to schools

Environmental education requires a teacher to move from the area of definitive answer to many probable with none of them as final solution. Teachers that are not trained and accustomed for this kind of situation, may feel their position threatened. Problems may also arrive from parents, who may not feel environmental education academic enough, or from politicians feeling that such an approach is too political.

According to Jadhao et al., 1987, a major limitation to getting the teaching through the environment approach operational in schools is the lack of an incentive system. Schools and teachers are not rewarded for being innovative. Also the centralized system of examination makes it difficult to selectively assess children in such a program, which necessarily emphasizes local studies.

Some of the difficulties experienced by teachers are as follows (Bhattacharya, 1989):

- classroom teachers face problems in getting a proper guidance to carry out some of the activities planned;

- supplementary and reference materials are not easily available;
- teachers do not get administrative support unless fellow teachers, headmasters and supervisory staff are also properly oriented for the environmental education program;
- teachers get little time for proper planning of activities;
- teachers loose interest in the new approach in absence of regular follow-up action.

According to Kudeshia et al., 1987, a major constraint on the implementation of conservation measures is a lack of trained personnel. Therefore, environmental training and education for youths is the demand of time.

5. Some institutions engaged in the environmental education (UNESCO, 1983; UNESCO, 1989):

- National Council of Educational Research and Training (NCERT), New Delhi;
- Ministry of Environment and Forests, New Delhi;
- Ministry of Energy, Department of Power, New Delhi;
- Department of Education in Science and Mathematics (DESM), NCERT, New Delhi;
- Directorate of Adult Education, Ministry of Education and Culture, New delhi;
- Department of Agriculture, New Delhi;
- Department of Science and Technology, New Delhi;
- Department of Environment, New Delhi (has established two centers of excellence - in Bangalore and in Ahmedabad),
- National Institute of Educational Planning and Administration (NIEPA), New Delhi;
- National Environmental Engineering Research Institute, Nagpur;
- National Institute of Ecology, New Delhi;
- National Institute of Oceanography, Goa;
- Indian Institute of Science, Bangalore;
- Indian Institute of Technology, Bombay;
- Goa Research Institute for Development, Santa Inez Panjim;
- Indian Institute of Technology, Campus School, Kanpur;
- New Era Development Institute, Panchgani;
- National Council of Science Museum, Calcutta;
- National Museum of Natural History, New Delhi;
- Hingolghadh Nature Conservation Program, Jasdan;
- Humanist International, Delhi;
- Indian Council of Rural Youth;
- Indian National Federation of UNESCO Clubs and Associations, Mangalore;
- Center for Eco-development and Management Research, Amdavad;
- Center for Environment Education, Ahmedabad;
- Population and Environmental Education Center, Velgode;
- Forest Research Center, Banderdewa;
- Social Work Research Center, Village Tilonia, Madangani;
- India International Center, New Delhi;
- Asian Environmental Society, New Delhi;

- Society for Participatory Research in Asia, New Delhi;
- Energy and Environment Group, New Delhi;
- Udaipur Environmental Group, Udaipur, Rajasthan;
- Wildlife and Environment Conservation Society, Tiruchirapalli, Tamil Nadu;
- World Wide Fund for Nature India, Bombay;
- Gujarat Ecological Education and Research Foundation, Gandhinagar;
- Faculty of Science, Jadavpur University, Calcutta;
- Anna University, Center for Environmental Studies, Madras;
- Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu;
- Department of Biological Sciences, Madurai Kamaraj University;
- Bikaner Veterinary College, New Delhi;
- School of Environmental Sciences, Jawaharlal Nehru University, New Delhi;
- Kodai Kanal International School, Kodai Kanal;
- Government Boy's Higher Secondary School, Pachmarhi;
- Delhi Public School, New Delhi;
- Sainik School, Balachadi;
- Vikaram A. Sarabhai Community Service Centre, Ahmedabad;
- Association for Rural Women of India, New Delhi;
- Rural Community Trust, Mugaiyur Village, Tamil Nadu;
- Youth and Family Planning Program Council, New Delhi;
- Indian Council of Writers for Children, New Delhi;
- Organization for Young Scientific and Technical Talents, New Delhi;
- Young Learners's Association, Howrah;
- Star Youth Association, Velgode, Andhra Pradesh;
- World Vision of India, Madras;
- Lokanayak Club, Via Banki, Cuttack;
- Zoo Outreach Organization, Coimbatore, Tamil Nadu;
- Sankat Mochan Foundation - Swatcha-Ganga, Varanasi;
- Gujarat Vidyapith, Ahmedabad;

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- Krishna V. Sane, Director, Low Cost Equipment for Chemical Education, An IUPAC/UNESCO Project, Department of Chemistry, University of Delhi, Delhi-110007, (Tel. 2521521/Extn.260).
- Sarabhai K.V., Director, Centre for Environmental Education, Nehru Foundation for Development, Ahmedabad, (Tel. 442642, 442651; Telex: 121-6779 CEE IN).
- S.G. Sreekanteswara Swamy, Project Scientist, Karnatka Rajya Vijnana Parishat, Indian Institute of Science Campus, Bangalore-560012, (tel. 340509; Telex: 084508952 KCST-IN; Telegram: KRVP Science).

**Country: INDONESIA****Basic indicators (The World Bank, 1990; Aime, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 178.0  
 Area (thousands of square kilometers): 1,905  
 GNP per capita, 1988: \$440  
 Average annual growth rate, 1965-88 (percent): 4.3  
 Adult illiteracy, 1985 (percent): total 26 (female 35)  
 Percentage of age group enrolled in education (1987):  
     Primary: 115  
     Secondary: 46  
     Tertiary (1984): 6.5  
 Primary net enrollment, 1975 (percent): 72  
 Primary level pupil-teacher ratio (1986): 28  
 Total expenditure on education as % of GNP (1981): 2.0

**Major environmental problems (Sinambela, 1981; Soeharto, 1985; UNESCO, 1990):**

- reduction of agricultural land for industrial expansion and developing residential areas,
- destruction of forests (cutting down trees for firewood and building houses, forest clearing for agriculture),
- an increasing number of uncultivated fields,
- increasing soil erosion,
- the accumulation of mud (siltng), rivers become shallower, thus stimulating overflow and flooding,
- reduced availability of water,
- population growth,
- population migration from villages to the cities - overpopulated cities, especially on Java island,
- problems of sanitation, hygiene, garbage disposal, solid wastes from domestic and industrial activities,
- water and air pollution resulting from industrial activities,
- ocean pollution resulting from mining exploration and overfishing,
- decrease of plant and animal life,
- deterioration of human health.

Because of the seriousness of these environmental problems, in 1982 the government set forth a policy for environmental control in the Law of Republic of Indonesia No.14 (Soeharto, 1985).

The Third Five-Year Plan 1978 - 1983 (Repelita III) established the following four working programs for the protection of environment (Sinambela, 1981; Soerjani, 1989):

1. Forest, land and water conservation, such as a "green revolution," reforestation and water flow development areas;
2. Pollution control in the various sectors;
3. Improving human conditions - developing better residential areas;
4. Developing public awareness regarding environmental issues.

Repelita V (The Fifth Plan) includes the goal of having environmental concepts taught at the secondary school level, and includes the establishment of university environmental centers (Aime, 1990).

#### School system:

General education: 12 years (pattern: 6+3+3)  
 Legal requirement: minimum of 6 years.

The general education curriculum is built around nine areas of study: religion, Pancasila, moral education, language, mathematics, social sciences, natural sciences, sports and health, arts and special skills (Ponniah, 1982).

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	19.5	26.4	27.7
Science:	1.5	2.8	3.2
Mathematics:	4.5	4.5	-
Technology:	1.5	3.0	-

Science teaching at the primary level begins in Grade 1. On the secondary level, integrated science is followed to Grade 9. Elective courses in the late secondary school years include biology, chemistry and physics.

#### ENVIRONMENTAL EDUCATION:

Following the conference on the Human Environment (Stockholm, 1972), educational programs for the promotion of environmental awareness were initiated. Serious efforts to promote formal and non-formal environmental education commenced in 1976 and to accomplish the purpose, the Ministry for Development Supervision and Environment was created in 1978.

At the primary and secondary education levels, environmental education pilot projects were carried out, and their findings contributed to revisions in school curricula made in 1984. Additional environmental concepts are now being integrated into relevant subjects. The learning and teaching process begins with the student's immediate surroundings. Modules and unit lessons have been prepared to infuse an environmental approach into the curriculum (UNEP, 1986; Kaligis, 1987).

The Man and Biosphere Program for Indonesia, hosted by the Indonesia Institute for Science (LIPI), launched a project on environmental education in 1978. It consists of two sub-projects: Formal and non-formal environmental education (Sastrapradja, 1982).

The Ministry of Education conducts the following activities in the field of environmental education (UNESCO, 1990):

- preliminary and advanced courses in Environmental Impact Assessment,

- training courses on population and environment,
- training courses in research methodology.

### 1. Formal environmental education:

When the new educational program called "Curriculum 1975" was introduced, the environment was not included as a separate subject. Several subjects were identified on which environmental education could be conveniently grafted, e.g., Religion, Morality (Pancasila), Physical Training and health, Social Sciences and Natural Sciences. For this purpose two educational modules were developed, one for teachers and one for pupils (Sinambela, 1981).

#### Primary School Level:

A UNESCO-UNEP Pilot Project for Primary Schools and General Public (1977-1980) was implemented by the MAB (Man and Biosphere) Committee of Indonesia with the co-operation of the Office for Education and Cultural Research Development, the Municipal Government of Jakarta and the Jakarta Institute of teacher Training Education. Its main activities were the development of a series of education modules on different environmental problems for students and teachers, and the training of a group of teachers on the experimental use of the modules in selected primary schools (UNEP, 1986).

To implement environmental education, a series of meetings and consultations were undertaken with various institutions. There were five phases in this implementation plan (Sinambela, 1981):

1. Preparation:
  - Consultation with principals, headmasters and teachers
  - Preparation and distribution of audio-visual aids and posters
  - Preparation of locally-specific environmental education modules for children
2. Experimental introduction of environmental education programs in five selected schools
3. Mid-term evaluation after two months
4. Final evaluation
5. Preparation of evaluative reports
  - Preparation of a five-year plan for environmental education.

Following is a concept sequence of instructional materials for grades 4 to 6 (Sinambela, 1981):

#### Grade IV:

##### First term:

##### Social sciences:

##### Home, school and community:

Conditions and situations around the house, school and village community, their topography, the soils, water, plants and animals around them, understanding that the whole represents a single ecological system.

##### The physical geography of the province:

The topography, plant life, vegetation, animal life, the river system, understanding that all components are interrelated.

Arable land within the province:  
Land utilization, agricultural systems, rice fields, upland agriculture, estate crops, fishery and animal husbandry.

Forests within the province:  
The forest types, condition and utilization within the region.

The wealth of sea around the province:  
The situation and utilization of the sea for fisheries, salt industry and aquaculture.

**Natural sciences:**

Water cycles in nature:  
The types and kinds of water cycles and their role in sustaining living processes.

Living things require water and air:  
The role of sufficient (and pure) water and air for living processes and for ensuring the perpetuation of life on Earth.

**Second term:**

**Natural sciences:**

Erosion and its after effects:  
The meaning of erosion and its direct effect on the environment, the loss of soil fertility, landslides, the siltation of lakes, rivers and harbors.

**Third term:**

**Natural sciences:**

The importance of forests in sustaining life on earth:  
The role of forests in minimizing erosion, regulating water systems, as habitat for wildlife, and as a source for raw materials for building and industry.

**Grade V:**

**First term:**

**Natural sciences:**

Natural resources:  
A description of types and kinds of natural resources such as soil, water, solar energy, minerals and renewable resources (plants and animals).

Plants as friends and foes:  
The usefulness and the harmful effects of various species to humans.

Wild and domesticated animals:  
Each species of animals has a role in the web of life.

Humans, animals and plants require water:  
The kinds of water required by man, other animals and plants. Water polluted by detergents, pesticides and waste products of chemical factories has adverse effects on living beings.

Humans, animals and plants require air:  
The kinds of air required by man, animals and plants. The danger of using air polluted by factories, poisonous gases excreted by decomposing litter, dust and other.

Nature conservation:  
In order to sustain life on Earth, all natural resources should be wisely utilized, managed and conserved.

The deforestation of mountains, and floods:  
The effect of deforestation of mountains on water regulation in nature, which causes floods.

The protection of endangered animals in nature reserves:  
Understanding the role of nature reserves in preventing the extinction of wildlife.

Water and air, importance to plants, animals and man:

The need to maintain a balanced environment to sustain life in an area. Avoid unnecessary deforestation, do not pollute the air and water.

**Social sciences:**

The islands and the altitudes of the Indonesian land mass:  
Variations in the Indonesian islands with respect to altitude and corresponding variations in climatic and living conditions.

The climate, plants and animals of Indonesia:  
The interrelationships between different kinds of climate and corresponding variations of species of flora and fauna.

**Second term:**

**Natural sciences:**

Soil conservation:  
Methods of soil conservation: contours, cover crops, terraces and rice fields.

Nature conservation and erosion:  
The role of nature conservation in preventing erosion through reforestation and maintaining the balance and perpetuation of protected forests.

**Physical training and health:**

The kinds of infectious diseases, their dispersal and prevention:  
Descriptions of kinds and dispersal of infectious diseases and methods of group action to help in preserving them.

Camping, cycling, exploring nature:  
The need to behave correctly when on outings and try not to disturb nature.

**Religion:**

Respect for and utilization of natural resources around us.

Sense of responsibility towards keeping the environment healthy.

**Pancasila (Morality):**

Group action to assist in maintaining the ideal environment around the school:  
Field activities to clean and beautify the school and the surrounding areas.

**Grade VI:**

**First term:**

**Social sciences:**

Non-renewable natural resources:  
A description and the methods of management of non-renewable natural resources to ensure their long term utilization.

Renewable natural resources:  
A description and methods of management of renewable natural resources, by continuous attempts to make them available in sufficient quantity to ensure their perpetuation.

**Natural sciences:**

Useful plants and animals:  
The dependence of man on plants and animals for meeting our basic daily requirements for food, clothing, housing, etc.

The respiration of plants: the producer pattern:  
The role of plants as the foundation of the web of life: the relation of respiration and assimilation and the beneficial side products of these activities.

The respiration of animals: the consumer pattern:  
The dependence of animals on plants for both their respiration and food.

**Physical training and health:**

Camping, cycling, exploring nature:  
The need to behave correctly on outings and not disturb nature unnecessarily.

Unfortunately, few efforts of this project have been sustained. The concepts listed above did not become a part of the primary school system, and the materials developed are not available in schools (Aime, 1990).

#### Secondary school level:

The study of population and environment is not a separate subject, but is integrated into science, biology, chemistry, social science, geography, economics, and morality (UNESCO, 1990).

Study programs with an interdisciplinary focus and dealing more with environmental problem-solving are being carried out (UNEP, 1986).

The new secondary project - MOEC, in cooperation with national bodies, will develop useful teaching units for mass production and will train teachers to change the pattern of past environmental projects (Aime, 1990).

#### University level:

At the tertiary level, the following institutions are offering environmental education and training courses (UNEP, 1986):

- Airlangga University,
- Bandung Institute of Technology,
- Bogor Agricultural University,
- Jember University,
- Lambung Mangkurat University,
- Padjadjaran State University,
- Surabaya Institute of Technology,
- University of North Sumatra,
- Universitas Palangka Raya,
- University of Udayana,
- Universitas Mulawarman.

Several universities and institutes have a department of population and environmental education or a post-graduate program in environmental science education. The Department of Population and Environmental Education of IKIP Jakarta has at present 80 post-graduate students. Bogor Agricultural University has offered a post-graduate degree in management of natural resources and environment since 1980. The University of Indonesia offers a post-graduate program in environmental science, with particular emphasis on human ecology. Gadjah Mada University started a similar program in 1983, followed a year later by the University of North Sumatra and Hasanuddin University. The Faculty of Natural Science and Mathematics and the Faculty of Social and Political Science of the University of Indonesia introduced a compulsory course in introductory environmental science to first semester students in 1980. Bandung Institute of Technology introduced a similar course for all faculties in 1975 (Soerjani, 1989).

**Extension programs** (for government officials, specialized technical training):

Fifteen environmental centers, located throughout the country, provide short-term training courses for government officials in environmental impact assessment, in integrated approaches to resource management, and on specialized topics such as waste disposal, water quality analysis and human ecology (UNEP, 1986).

Environmental Study Centers are the result of an agreement between the Ministry of Education and Culture and the Ministry of State for Development Supervision and Environment. They have been established since 1976, most of them 1979, with the purpose of developing technical and academic expertise and training capacity of the ministry staff (Soerjani, 1989).

## 2. Non-formal environmental education:

### **Biosphere reserves:**

Indonesia has about 200 forest reserves. They cover more than 7,000,000 ha., which is about 5% of Indonesian forests (Soeharto, 1985).

There are six natural reserves in Indonesia designated as biosphere reserves. One of these is Cibodas, which comprises three natural reserve areas (Cibodas, Cimungkat and Situ Gunung), of which the Gunung Gede and Gunung Pangrango volcanoes are the dominant features.

In 1987, teachers from the city of Bogor were invited to assist in the development of an environmental education program based on the reserve. As a result, the following seventeen study guides on various aspects of the biosphere reserve were produced (Kaligis, 1987):

1. The Cibodas Biosphere as an example of a mountain forest.
2. The multiple functions of the Cibodas Biosphere Reserve.
3. The role of the Cibodas Biosphere Reserve as a nature reserve.
4. Biological resources in the Cibodas Biosphere reserve.
5. Cibodas Botanical Garden as a teaching environment.
6. Distribution of plants from the coastal region to the mountain area.
7. Distribution of *Alsophila glauca*.
8. Decomposition of a tree trunk.
9. Litter in the mountain forest.
10. Humus as the component of tropical rain forests.
11. Reproduction of plants.
12. Seed dispersal.
13. Lichens, a biological symbiosis.
14. Flora on the tree trunk.
15. Plant pests, herbivorous animals.
16. Introduced plants in the Cibodas Botanical Garden.
17. Impact of visitors on the Cibodas Biosphere Reserve.

The multiple functions of Cibodas, one of the study guide topics, was chosen to enhance public awareness of the value of preserving Cibodas as a forest for the preservation of human well-being.

### **Out-of-school activities:**

Indonesia Institute of Science (LIPI) has a continuing non-formal environmental education project that involves the use of environmental audio-visual materials in schools and deals with national level (posters, essays poems) aimed at increasing children's awareness on environmental situations (UNEP, 1986).

The Man and Biosphere Team for non-formal education developed various programs of environmental education, for audiences such as:

- housewives, by the Women's District Organization,
- out-of-school people, by the Young People's Organization,
- school children,
- school teachers.

Several pamphlets, brochures and posters were prepared and distributed in schools and villages. Sets of slides, showing many aspects of environmental damage due to exploitation of resources have been prepared for use in lectures and discussion. Weekly lectures were regularly organized for school teachers, youth and women's associations in the villages. In addition to school visits, teachers were invited to attend a 1-day seminar on the Indonesian environment, focusing on natural resources. A minimum of four speakers gave their views on the subject. The examples were selected from the school surroundings, so that the teachers could use them to illustrate their courses (Sinambela, 1981; Sastrapradja, 1982).

**Adult education activities:**

The Directorate General of Non-Formal Education and Sport, Ministry of education and Culture and UNICEF developed a learning package for illiterates, new literates and primary school drop-outs called, "A minimum kit of attitudes, skills and knowledge." The instructional material related to environmental education is an element of the essential basic learning needs in Package A. Of the 100 topics of learning materials in the Package A, the following examples cover environmental issues (Sinambela, 1981):

18. Garbage and its use
21. God, man and nature
29. healthy food
30. Drinking water and clean water
31. healthy houses
32. Plantation and forestry
33. Preservation of nature.

**Mass media:**

Many newspapers and popular magazines carry regular features dealing with science and technology and occasionally, environmental issues. The use of radio as a medium for public education has been well explored since 1945. Various regular programs, each covering a special field of activities, are broadcast daily. The "Village broadcast," for example, concentrates on aspects of rural development. Bogor radio broadcasts contributions from the National Biological Council, which comprise lectures and interviews on various environmental aspects, agriculture, food processing and biology. A television program on popular science is broadcast once every two weeks. A number of posters on, for example, the indigenous fauna, fish resources, and natural environment have been distributed (Sastrapradja, 1982).

**Non-governmental organizations:**

There are about 400 non-governmental organization's participating in awareness programs under the sponsorship of the Indonesian Environmental Forum. About 100 of these organizations are involved, either directly or indirectly, in environmental education and training. The target groups include rural communities, students, youth and women who are reached through community development programs, activities of religious chuntries, women's organizations, nature and youth groups. A number of publications, magazines, posters, films and slide programmes have been produced by non-governmental organizations and disseminated as teaching aids for educational purposes. Some organizations conduct training programmes related to the specific environmental problems of some of the remote islands (UNEP, 1986).

The environmental non-governmental organizations consists of:

- Nature lover groups,
- Professional organizations,
- Hobby groups,
- Community Development Organizations.

Some examples are as follows (Rahardjo, 1982):

South Jakarta Youth Group has coordinated many campaigns of talks and slide-shows about the environment, supplemented by field-trips.

Nature loving groups often combine camping activities with programs such as tree planting and giving talks in villages.

The Biological Science Club has carried out scientific research in several areas.

The Indonesian Bird-watching Association has studied the behavior and distribution of various species of birds, and the best way of protecting them.

The Association for the Conservation of the Indonesian Environment invited several organizations to a meeting in Jakarta in May 1978. At this meeting, the "Group of Ten" was established as a communication forum and as a means of bridging the gap between government and people. There are now 19 member organizations in the Group of Ten although originally only 10. After two years, a coordinating body called, "The Indonesian Environmental Forum" (IEF), was set up that basically, functions in the following three fields:

1. Communication between NGOs and dissemination of information,
2. Complementing formal and non-formal education programs,
3. Helping the NGOs upgrade their own programs.

IEF has put into effect several programs, for example:

- publication of a monthly bulletin,
- collection and dissemination of information from nature lover groups, research expeditions and governmental organizations,
- organization of artistic activities on environmental themes (evenings of songs, poetry and comedy, poster competitions through a popular women's magazine),
- on radio and TV broadcasting,
- organizing workshops, lectures and discussions led by experts or simply between NGOs,
- giving technical advice to the Ministry of State for Development and Supervision and the Environment,
- administration of the Conservation Education Fund,

- involvement in practical programs, such as introducing energy-efficient stoves and biogas plants in rural communities, and waste recycling techniques. (Rahardjo, 1982).

Environmental problems are also discussed in many social organizations, i.e. (Soeharto, 1985):

Family Welfare Organization,  
Wives of Indonesian Civil Servants Organization,  
Wives of Indonesian Army Organization,  
Indonesian Youth National Committee,  
Scouts movement,  
Mosque Foundation,  
Church Foundation,  
Village Community Institution.

### 3. Training of environmental education personnel:

#### Teacher training:

After revisions of the school curricula, environmental education programs were developed for use in teacher training and education. At the tertiary teacher education level, a post-graduate program for popular environmental education was launched in 1980 (Kaligis, 1987).

In the four national teacher-training institutes, environmental education is treated as a part of the population education courses that are compulsory for students of both science and the humanities and include topics such as: the impact of population growth on socio-economic development, land-use, water management, the energy problem, conservation of natural resources, public health, nutrition (Ponniah, 1982).

In the pilot project at the Institute of Teacher Training Education (IKIP) the subject, Environmental Education, was offered, which was taken by all first-level future secondary school teachers. It was planned to introduce the project in the Teacher Training School (SPG) for primary school teachers; unfortunately, the IKIP pilot project was never disseminated (Aime, 1990; Sinambela, 1981).

In-service programs, especially to implement the environmental education pilot project in primary schools, have been undertaken. For example, teachers from 15 selected primary schools in Jakarta took the training. The team, sponsored by the Man and the Biosphere program, produced two books:

1. Teacher Guides in Environmental Education for the Elementary School
2. Module(s) in Environmental Education for the Elementary School (Sinambela, 1981).

### 4. Major environmental education problems:

The following problems were identified (Aime, 1990; Soeharto, 1985; UNESCO-UNEP, 1976):

1. At the pre-school education level:
  - lack of funds;
  - relative shortage of teaching personnel.
2. At the primary and secondary education level:
  - shortage of qualified teaching personnel in the field of environmental education;
  - shortage of materials (teaching units) for effective teaching. Materials for primary schools were developed but were never mass produced. Secondary environmental education materials were never prepared;
  - lack of funds/resources,
  - lack of environment-oriented associations for teachers and students,
  - insufficient collaboration between primary, secondary and tertiary level institutions.
3. At the university level:
  - lack of environmental specialists.
4. At the teacher training level:
  - shortage of teaching personnel,
  - lack of teaching materials.
5. At the out-of-school level activities for youth:
  - shortage of personnel (guides and leaders),
  - insufficiency of instructional materials (audio-visual aids, games, books, guides, and magazines).
6. In implementation of the non-formal environmental program:
  - limited number of environmental experts and science-trained staff for schools and the private sector;
  - difficulties in getting information and communication in certain areas because of their geographical location (thousands of islands);
  - the public is ignorant about the danger of polluting the environment and therefore is unconcerned;
  - because of personal business reasons, many people do not care about polluting the environment.

According to Aime, 1990, sustainability is a key issue that requires attention. Due to scarce investment capital, few of the efforts made during the pilot projects have been sustained. Many of the projects developed good materials, which did not become a part of a regular school system and thus are not available in schools. The pilot projects failed to mass-produce teaching materials and trained personnel. Therefore, future efforts should be linked not only with isolated projects, but should promote the adoption of new concepts and materials by the school system as a whole in order to guarantee their sustainability (Aime, 1990).

5. Some institutions and/or individuals engaged in environmental education (Soerjani, 1989; UNESCO, 1983; UNESCO, 1989; UNESCO, 1990):
  - Ministry of Education and Culture,
  - Ministry of State for Population and Environment,

- Research Institute for Marine Fisheries, Jakarta,
- Biology Research and Development Center, Bogor,
- Center for Research in Biotechnology, Bogor,
- Institute for Human Settlements, Bandung,
- University of Padjadjaran, Institute of Ecology, Bandung,
- University of Indonesia, Center for Research on Human Resources and the Environment, Jakarta Pusat,
- Gadjah Mada University,
- University of North Sumatra,
- Hasanuddin University
- Population Education Development Team, Mando, Propinsi Sulawesi Utara,
- Central Executive of the Islamic Association of University Students, Jakarta Pusat,
- IKIP - Teachers Training Institute, Jakarta (pilot level),
- IKIP - Department of Population and Environmental Education,
- Curriculum Development Center of BP3K, Jakarta,
- Indonesian Institute of Sciences, Jakarta,
- Center for Natural Resources Management and Environmental Studies, Bogor Agricultural University, Bogor,
- National Biological Institute (LBN), Bogor.

**Country: JAPAN****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 122.6  
Area (thousands of square kilometers): 378  
GNP per capita, 1988: \$21,020  
Average annual growth rate, 1965-88 (percent): 4.3  
Adult illiteracy, 1985 (percent): less than 5  
Percentage of age group enrolled in education (1987):  
    Primary: 102  
    Secondary: 96  
    Tertiary: 28  
Primary net enrollment, 1975 (percent): 99  
Primary level pupil-teacher ratio (1986): 23  
Total expenditure on education as % of GNP (1985): 5.1

**Major environmental problems (Koya, 1981, Ui, 1982):**

Concurrent with rapid economic growth of the 1960s, the Japanese environment also rapidly deteriorated. The improvement of living conditions and the development of economic activities affected the environment to an extent that created major social problems. The most notable of these are:

- the spread of environmental pollution by rural and regional development,
- the destruction of the natural environment by the construction of dams,
- the danger resulting from the development of heavy chemical industries,
- the threat to public welfare posed by the concentrated environmental pollution in urban areas,
- the shortage of industrial resources and food,
- the shortage of energy resources,
- housing problems in large cities,
- air pollution, photochemical smog,
- water pollution,
- destruction of animals and plants.

These problems affect people's daily life and frequently result in confrontations between the community and factory management (Koya, 1981).

The damage was not only material, but also affected public health. Many deaths were attributed to pollution-related diseases in the 1960s, such as Minamata disease (mercury poisoning) and Itai-itai disease (cadmium poisoning), asthma, etc. Many of these became the subject of legal actions to clarify the cause-effect relationship, to determine the polluter's responsibility, and to specify compensation for damages (Ui, 1982).

Recognizing the need for suitable remedial action, in 1964 the Government established a Committee for the Formulation of Counter Measures against Pollution. The fundamental Law of Counter Measures

against Environmental Pollution was passed in 1967. In 1971, an Environmental Agency that would coordinate environmental administration with respect to pollution prevention and preservation of the natural environment was established. In conjunction with the Environmental Agency, the Ministry of Education, Science and Culture took steps to provide suitable environmental education programs to the schools (UNESCO, 1985).

All environmental problems are labeled "kogai" in Japan. Kogai is defined in Article Two of the Anti-Pollution Law: "It refers to harmful effects to human health or damage to the living environment caused by pollution of air, water and soil, noise, vibration, submersion of the ground, noxious odors, the above conditions of which are caused by enterprise activities and by individual persons on a large scale, both in space and intensity. The living environment includes the properties, and animals and plants, and their ecological systems which are closely bound to the livelihood of people." (Nakayama, 1987)

#### School system:

General education: 12 years (pattern: 6+3+3)

Legal requirement: at least 9 years.

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	17.6	19.5	22.5
Science:	1.5	2.2	2.7
Mathematics:	3.3	3.7	3.0
Technology:	-	-	2.1

Science teaching on the primary level begins in Grade 1.

On the secondary level (Grades 7 to 10), two science courses are followed: one in the physical sciences and one that combines biology and geology. During the late secondary school years, physics, chemistry, biology, geology and science II (specific themes) are offered as optional courses.

Curriculum standards for schools are issued by the Ministry of Education, Science and Culture as the National Course of Study. The National Course of Study is revised about every ten years in accordance with proposals submitted by the Curriculum Council (Koya, 1981).

The Ministry of Education decided to revise the curriculum; the new version will be in force by 1993. There are few changes in the Science Courses at the primary and lower secondary levels. The science course in the first and second grades of the primary school has been changed to an integrated course called Domestic, in which pupils are asked to look at their living situations, and to consider their surroundings from social and scientific viewpoints. At the high school level, each science subject (physics, chemistry, biology, earth science, integrated science) has been divided into three courses, with different credits for science and non-science majors (Shimozawa, 1989).

**ENVIRONMENTAL EDUCATION:**

Environmental education in the broad modern sense developed relatively late in Japan. After the Second World War, the immediate concern was nature protection and conservation education, taught mainly in biology studies at the upper secondary school level. The "Kogai" stage followed from 1960 to 1975, due to intensive industrialization. Kogai teaching was added to social studies in primary and secondary schools in 1970 textbooks. The beginning of environmental education as such dates from 1974, when a special research project on environmental education was conducted under auspices of the Ministry of Education with the aim of establishing the needs, objectives, guidelines and main themes of environmental education. In the course of the project, an International Symposium on Environmental Education was held, which concluded with the "Tokyo Declaration of 1974". The need of introducing environmental education and the interdisciplinary approach in this field was strongly emphasized (UNESCO, 1983 and 1985).

In 1985, a Committee on Environmental Education was established in Science Council of Japan (Japan Science Academy). The committee is composed of university scholars, researchers from various research institutes and representatives of nature conservation societies. Its main functions are (Nakayama, 1987):

- coordination of environmental education research in Japan,
- collection and distribution of related materials,
- enlightenment and promotion of environmental education,
- organization of seminars and study meetings,
- implementation of projects such as:  
Development of training programs of teachers for environmental education,  
Development of environmental education curriculum for schools.

**1. Formal environmental education:**

School texts and tools for environmental education have been produced by various institutions. Some texts were developed as module systems. Government and local administrations developed texts for students, teachers, and citizens. In some provinces, research projects on environmental education are practiced, using experimental schools for environmental education (Bum-ki, 1990).

**Primary school level:**

Environmental education is not treated as an independent subject. Its essential contents are included in the areas of social studies, science, physical education and moral education at the primary level (Nakayama, 1987; Ponniah, 1982).

From Grade III to Grade VI, the teaching of Science is subdivided into three parts:

- Living Things and their Environment,
- Substance and Energy,
- The Earth and the Universe.

Environmental education is included in the first part (Koya, 1981).

Examples of environmental content that fall within the subjects of Social Studies and Science are listed below (Koya, 1981; UNESCO, 1985):

**Social Studies:**

**Grade 1:**

- environment of the school, home and neighboring areas,
- equipment and facilities in the schools and parks, safety equipment on the roads,
- significance of water, electricity and gas,

**Grade 2:**

- the relationship between the lives of people in the school district and their occupations
- environment and situations in shops, factories, stations and post offices,
- food production and processing of raw materials.

**Grade 3:**

- natural environment, productive activities, consumer life and characteristics of changes in life patterns of the areas where pupils live, and the characteristics of life in other areas,
- natural environment, production and consumption changes,
- utilization of raw materials and resources, main materials for the industries of the town.

**Grade 4:**

- the ways of adapting to the environment (to understand the way in which people are making their living),
- preservation of the natural environment, maintenance of public safety,
- development of the environment in the pupil's community, environmental development projects in the present and past,
- acquisition of drinking water, irrigation water, electricity and gas, and acquisition of resources by ancestors.

**Grade 5:**

- characteristics of food and industrial production in Japan,
- efforts to preserve fishing ponds,
- development of fishing resources,
- protection of health and living environment of people from various public nuisances,
- distribution of resources and population,
- characteristics of the land as a geographical environment.

**Grade 6:**

- Characteristics of the history, politics and international relations of Japan:
- import of resources.

**Science (UNESCO, 1985):**

**Grade 1:**

- special features in terms of color, shapes, etc. of plants and materials.

**Grade 2:**

- the growth of plants under different conditions.

**Grade 4:**

- the functions of running water.

**Grade 5:**

- germination and growth.

**Grade 6:**

- the functions of water and sunlight,
- natural phenomena.

**Secondary school level:**

Environmental education is not a separate subject in the curriculum. Some environmental aspects are included in science, social studies, health and moral education.

In science, fundamental understanding of the natural environment is regarded as a central theme at the lower secondary level, and development of a comprehensive view of nature as represented by the balance of nature at the upper secondary level. This point is specially stressed in Science I, which is a compulsory course in first year of upper secondary school.

In health and hygiene, understanding the relationships between health and the environment is regarded as a fundamental theme.

In social studies, the importance of the environment and natural resources, based on respect for human dignity, is stressed (Nakayama, 1987; Ponniah, 1982).

Examples of the environmental content of the subjects of Social Studies, Science, Health and Moral Education are given below (Koya, 1981; Ondo, 1985; UNESCO, 1985):

**Lower secondary level:**

Social Studies encompass geography, history and civics. Geography and civics are taught in grades I and II and civics in grade III. Environmental education is included in geography and civics. The following are some examples:

- the earth as the arena of life,
- population and habitation, distribution, movements,
- development of cities,
- problems of food, resources, industry and urbanization,
- rational utilization and preservation of the national land for the purpose of stabilizing and improving national life,
- prevention of pollution,
- energy resources and their effective use,
- role of local and national governments and the responsibilities of individuals and enterprises.

**Science:**

- water in the atmosphere, wind, changes in weather, rocks,
- nature of living things,
- kinds and structures of plants and animals and their connection with the environment,
- human beings and nature,
- balance in nature and preservation of the natural environment,
- conservation of the environment by preserving and regulating nature.

**Health:**

- concentration of carbon dioxide in the room, imperfect combustion, carbon monoxide, acceptable limits,
- value of sunlight,
- hygienic management of wastes produced by human and industrial activities.

**Moral education:**

- the relationship between nature and man (love nature and things that are beautiful).

Some environmental aspects also are included in physical education, handicrafts/home making, and special co-curricular activities.

**Upper secondary level:**

**Social Studies:**

- basic problems of contemporary society, human beings and the environment, prevention of pollution,
- human beings and the earth, natural and social environments,
- population, natural resources and industries, regional development and preservation of the environment,
- urbanization and problems in cities,
- development of science and technology, use of resources and energy.

**Science:**

- evolution of living things, balance in the natural world, ecosystems and circulation of substances,
- man and nature, resources, solar energy, atomic energy, preservation of natural resources, influence of natural resources on human beings, influence of human activities on nature,
- surveys of the natural environment, field work concerning biology and earth sciences, various problems related to the natural environment,
- organization of and changes in biotic communities.

**Health:**

- health and the environment, injury to health due to environmental pollution and preventing the pollution of the natural environment.
- legal measures for pollution prevention.

In 1993, a new curriculum will be in force. A new course for non-science majors is designed to give pupils a good understanding of scientific principles, applications and improvement of science and technology and also to emphasize the relationship between science and human beings. The items to be taught are selected from phenomena and/or materials encountered in daily life. The contents of Science course for non-science majors are given below (Shimozawa, 1989):

**Physics:**

1. Light and sound:
  - light and eye,
  - sound and ear.
2. Motion:
  - presentation of motion,
  - friction and collision.
3. Energy and daily life:
  - temperature and heat,
  - electronic energy,
  - transferability of energy,
  - solar energy and nuclear power.
4. Information and data processing:
  - transformation,
  - processing,
  - memorization.
5. Influences of physics:
  - on daily life changes,
  - on observation of matter and phenomena.

**Chemistry:**

1. Materials found in nature and their changes:
  - elements found in natural materials,
  - air,
  - water.
2. Chemistry of daily life:
  - food chemistry,
  - chemistry of clothing,
  - dye and detergent chemistry.
3. Manual materials:
  - plastics,
  - metals,
  - ceramics.
4. Production of materials found in our daily life:
  - materials produced from the air,

- materials produced from minerals,
- products from petroleum.
- 5. Applications of chemistry and human life:
  - progress of chemistry and its roles,
  - environmental science.

#### Biology:

1. Human life and biology:
  - daily life and biology,
  - human beings in nature.
2. Human beings as living things:
  - specificity of human beings,
  - actions of human beings.
3. Mechanism of vital power:
  - foods and metabolism,
  - body control.
4. Successiveness of life:
  - the whole life of the human being,
  - heredity of the human being.
5. Progress of biology and human life:
  - application of microorganisms,
  - improvement of breeds.

#### Earth Science:

1. Earth Science surrounding us:
  - landscape of nature,
  - buildings and rocks,
  - mineral matter around us.
2. Movement of heavenly bodies and human life:
  - time and hour,
  - seasons and calendar.
3. Natural resources and human life:
  - energy resources,
  - underground resources,
  - oceanic resources,
  - investigation of resources in the universe.
4. Functions of earth disasters:
  - weather and disasters,
  - volcanos and calamity,
  - earthquakes and calamity,
  - other disasters.
5. Earth and human beings:
  - environment and human beings,
  - environmental changes and preservation.

There is another subject in the new curriculum called Integrated Science, which was introduced as the science course for general pupils. The aim of the course is to cultivate persons who have integrated viewpoints and understanding of nature through observations, experiments and investigation that will enable them to recognize the importance of the relationship between nature and human beings. The content of the course are as follows (Shimozawa, 1989):

1. Investigation of nature:
  - recognition of nature,
  - planning of observations and experiments.
  - how to arrange report, the results of observation and experiments.
2. Nature and its changes:
  - variety and common features in nature,
  - changes, equilibrium and interactions appearing in nature,
  - energy and its conversion,
3. Human beings and nature:
  - natural resources and/or energy and their usages,
  - environment and its protection,
  - progress of technology and its benefits.
4. Training in special topics:
  - observations and/or experiments,
  - investigation of the environment,
  - reinvestigation of experiments in the context of the history of science.

One of the important aims of the new science curriculum at the secondary school level is to develop attitudes and concerns towards nature. Students should see, understand and research the connections between human life and natural phenomena and should develop an interest in natural materials (Shimono, 1990).

In order to popularize these new subjects, which is the main objective of the curriculum revision, two difficulties have to be resolved before implementation in schools in 1993:

- a) teacher training, both in-service and pre-service,
- b) these subjects should be added to the university entrance examination (Shimozawa, 1989).

#### University level:

There are 22 national universities in Japan whose undergraduate faculties have the word "environment" or "environmental" in their titles. Graduate courses in environmental science are given at four national universities, including Hokkaido University, University of Tsukuba, Tokyo Institute of Technology and Hiroshima University (Nakayama, 1987).

The following tertiary level institutions offer environmental education and training courses in Japan (UNEP, 1986):

- Chiba University, Chibashi,
- Hiroshima University, Faculty of Integrated Arts and Sciences, Graduate School of Biosphere Sciences, Hiroshima,
- Hokkaido University, Graduate School of Environmental Science, Sapporo,
- Kumamoto University, Environmental Construction Engineering, Faculty of Graduate School of Engineering, Kumamoto,
- Kyoto University, Department of Environmental and Sanitary Engineering, Faculty of Engineering, Kyoto,
- Mie University, Research Laboratory of Environmental Science, Kamihama-cho, Fsu-shi, Mien-ken,
- Miyazaki University, Department of Civil Engineering, Kirishima, Miyazaki,
- Nagoya Institute of Technology, Nagoya,
- Obihiro University of Agriculture and Veterinary Medicine, Department of Agro-Environmental Science, Inada, Obihiro, Hokkaido,
- Shiga University, Faculty of Education, Institute of Lake Sciences, Otsu, Shiga,
- Shizuoka University, Bureau of Facilities, Headquarters, Oya, Shizuoka,
- Tohoku University, Department of Civil Engineering, Aoba, Sendai,
- Tokyo Institute of Technology, Department of Environmental Chemistry and Engineering, Yokohama,
- Tokyo University of Agriculture and Technology, Tokyo,
- Tokyo University of Fisheries, Tokyo,
- Toyama University, Program of Environmental Science, Faculty of Liberal Arts, Toyama,
- University of Tokyo, Department of Urban Engineering, Tokyo,

- The University of Tsukuba, The Masters Course in Environmental Sciences, Niihari-gun, Ibaragi-ken.

Effluent from research laboratories in the universities have been regulated under the law, with the limits the same as those for industrial effluents. Thus, almost all of the national universities in Japan have treatment facilities on their own campuses. Students are trained to store laboratory wastes in their laboratories, and to treat them at the facilities. This training is recognized as an important and most effective approach to the environmental education in the university, since students can learn in practice how to protect the environment from pollution with hazardous chemicals, and also by what chemical reactions hazardous chemicals are treated.

In some universities, a lecture on the treatment of wastewater is given to students in the general chemistry laboratory. This lecture includes a visit to the treatment facility, where students can see how wastewater is treated and how the treated water is analyzed (Tamaura et al., 1989).

#### **Programs in the industry:**

There are two categories of environmental education in industry:

- a) Training of engineers for the certification of pollution prevention, by individual industries or groups of them.  
By law, each factory larger than a specified size must employ an engineer with a certificate of pollution prevention, which is issued through a national examination. The training for the certificate is largely technical, with a small component of social and historical science.
- b) Public relations activities of industries for neighboring local residents emphasize the care and attention given to environmental protection by the industry. Large sums of money are spent to prepare books, pamphlets and films for this purpose (Ui, 1987).

#### **Extension programs for government officials:**

Training of government officials and technical staff is provided by the Training Institute for Environmental Pollution Control, which was created by the Environmental Agency specifically for this kind of training. Examples of courses include air, water and noise pollution control, air and water quality analysis, soil and odor analysis (UNEP, 1986).

## **2. Non-formal environmental education:**

#### **Out-of-school activities:**

In the out-of school programs for youth, the following facilities and media are available for science education, which also include some aspects of environmental education:

- a) Science museums, e.g.:
  - The National Science museum, which comprises of four institutions:  
National Science Museum at Ueno,  
Natural History Institute,  
Tsukuba Botanical Gardens,  
National Park for Nature Study;

- **Museums of Natural History:**

There are 76 museums of natural history, which have zoos, botanical gardens, aquariums, outdoor museums and indoors exhibitions;

- **Specialized museums:**

There are nearly 80 specialized museums of science in technology, some of them dealing with energy, natural resources, marine environments, fisheries, agriculture, industrial safety measures and hazards.

- Children's museums with exhibition rooms, workshops, experience corners, planetariums and observatory auditoriums, are promoted to enrich the ideas that come forth from the free activities of the children.

The main activities of science museums include museum classes, seminars, lecture meetings, observations, and publication of periodicals.

b) Educational facilities for youth:

- Children's Nature Study Centers,
- Youth Houses,
- Science Clubs,
- Nature Observation Clubs.

c) Television and radio educational broadcasting and educational films.

d) Printed media:

- books, magazines, newspapers (Ohashi, 1982).

Since 1985, The Ministry of Education, Science and Culture has sponsored a project called "Nature Class," designed for upper primary and lower secondary grade school children, aimed at understanding of nature through outdoor activities and observation. Pupils spend four days in Nature Houses or Youth Houses located in various parts of Japan. The content of the program is not restricted by a course of study, and it provides an opportunity to carry out ideas on environmental education (Nakayama, 1987).

Various projects and activities are carried out in the secondary level schools, for example (UNESCO, 1985):

- A junior secondary level project "Let Us Introduce Nature into Our School":

Pupils and teachers of a city school decided to study a forest. Since the forest was not available in the neighborhood, they set up a forest in the school ground. In this project they collected about 100 different species of trees growing in forests and planted them in the school garden. Later, the forest was used to study ecological systems.

- A senior secondary level project "Effect of Industrial Development on Environmental Pollution":

The Bika lake near Osaka is the source of drinking water for about 13 million people. With industrial development in the area, the lake water was getting polluted. A project was designed to:

- assess the extent of pollution,
- examine the effect of pollution on life in the lake,
- understand the cause of pollution,
- discuss ways of preventing pollution.

In the course of this project, students carried out experiments in quantitative analysis, studied similar problems in other countries and gathered valuable practical experience in the investigation of environmental problems.

**Activities for the general public:**

In order to promote better public understanding of nature conservation, efforts are made by the Environment Agency to organize visits to national parks. Opportunities are also provided to enable the public to participate in environmental conservation activities (UNEP, 1986).

**Mass media:**

Extensive use is made of television, motion pictures and the press in developing general awareness to environmental issues.

Many movie films on environmental issues have been produced by the Japan Environment Association. The Japan Economic Education Center also produces environmental films, which are provided free of charge to each Prefectural Board of Education.

The major newspapers and publishing companies in Japan issue yearbooks in which important data and materials pertaining to environmental issues are included (UNEP, 1986).

Nippon Hoso Kyokai, the nation-wide non-commercial public service broadcasting system, broadcasts programs for environmental education on educational television. Since 1975, a program, "The Green Earth," has been broadcast to lower secondary school students. In 1980, The Green Earth was a series of programs dealing with three aspects:

- Man and nature,
- Environment and daily life,
- Methods for studying local environment.

The Green Earth is broadcast every fortnight. It consists of 20 programs per year, each repeated three times. In recent years, many schools record the programs on video tape for use in conjunction with classroom instruction (Ohno, 1981).

Environmental education through motion pictures has become popular in Japan. Mt. Fuji produced several films, such as:

- Green Partners,
- Forests and Man,
- Mechanism of Nature;

these are distributed free of charge to each prefectural board of education in the country (Ohno, 1981).

The position of the mass media is a more or less delicate and complicated one, situated between public opinion and commercialism. Governmental public relations cannot be ignored because of its large funding. There are always hidden struggles: the balance of power between the humanistic effort of reporters on the one hand and the commercial will of the media management on the other hand are in continuous conflict in most Japanese media (Ui, 1982).

**Governmental and voluntary organizations:**

Government-sponsored public service organizations work in the same fields as industry. They usually enjoy generous funding, but their activity is limited since they cannot criticize either government or industry. Many teaching materials are prepared by these organizations for the government's public relations policies (Ui, 1987).

In order to promote better understanding of environmental problems in Japan, the Environmental Agency has entrusted the Japan Environment Association with various activities, including (UNEP, 1986):

- producing and televising programmes on various environmental themes,
- preparing and distributing teaching materials on the environment,
- producing and distributing environmental education films,
- organizing environmental education lectures/meetings,
- organizing symposia on environmental amenities.

Perhaps the major part of Japanese environmental education, both in quality and quantity, is informal education in non-governmental and voluntary activities.

One of the most successful examples is the anti-pollution movement of Mishima and Numazu against a petrochemical complex project. The movement was supported by the scientific study of local conditions by inhabitants, led by local high school teachers, and it ended in success. The relationship between the operation of the petrochemical complex and pollution was carefully studied and an environmental impact assessment was prepared by the local people. The people studied micro-meteorological surveys of the area. More than 300 study meetings were held by them for learning about pollution and exchanging knowledge before the final rejection of the project. Ever since the success outcome of this movement, informal environmental self-education has been a necessary condition for the success of the environmental movement, and most of such movements are led by local school teachers (UI, 1987).

Jishu-Koza, an environmental education movement in the University of Tokyo, was started in 1970 as a night class for citizens to study the basic principles of Japanese pollution and to find ways to stop or reduce pollution. The first lecturers were volunteer university professors and assistants, and additional volunteers came out of the audience to help with the preparation and the management of the lectures. They recorded the lectures, which were published in ten volumes of books, which sold in more than 200,000 copies. These materials became the textbooks for anti-pollution movements all over Japan. In 15 years, more than 300 lectures were held, sometimes inviting the victims, researchers, administrators, journalists, politicians, and others concerned about pollution. Several thousand people attended these lectures. Jishu-Koza was closed in 1985, but many of its activities became independent movements (Ui, 1987).

The Wild Bird Society of Japan and the Nature Conservation Society of Japan carry out their activities on a national level. With the ultimate objective of nature conservation, both organizations hold programs for general public that center around nature observation. The number of

participants in such programs is rapidly increasing. Both organizations have established moratorium areas with publicly donated funds (Nakayama, 1987).

### 3. Training of environmental education personnel:

#### Teacher training:

Systematic training of specialists in environmental education has so far not been done, except for the brief reference to environmental education given as a part of such courses as Introduction to Science Education and Introduction to Social Sciences Education. However, in 1979, a well-organized course, "Principles of Environmental Education," (the first and the last of its kind in Japan) was offered at the Graduate School of Environmental Sciences, University of Tsukuba. Since 1980, several University of Tsukuba students have been granted the degree of Masters of Arts in environmental education. After graduating, they become teachers in primary, lower and upper secondary schools, teaching environmental education. (Nakayama, 1987).

In order to ensure appropriate classroom teaching on the environment, the following measures have been taken in addition to the pre-service teacher training:

- all primary and secondary school teachers are required to undergo in-service teacher education courses,
- teachers' manuals have been prepared for the teaching of each subject area in lower secondary school (Koya, 1981; UNESCO, 1985).

The Ministry of Education, Science and Culture grants Science Research Aid Funds to university researchers and school teachers for research and curriculum development in environmental education. The results, in most cases, are reported on at academic conventions and published in academic journals (Nakayama, 1987).

### 4. Major environmental education problems:

During the past century, the national government always regarded pollution issues as security problems, which attitude was reflected in formal education. Under strict government censorship rules, descriptions of war and pollution were very critical areas where the Ministry of Education most frequently tried to rewrite the draft textbooks. The treatment of environmental problems in textbooks is superficial, and it is difficult to get a general picture of the Japanese environment from them.

In spite of such stringent regulation of educational content, there have been many active cases of true environmental education by primary, secondary and high school teachers (U1, 1987).

### 5. Some institutions engaged in environmental education

(UNESCO, 1983; UNESCO, 1989):

- Ministry of Education and Science, Tokyo,
- National Institute for Educational Research, Tokyo,

- Elementary School Education Division, Elementary and Secondary Education Bureau, Ministry of Education, Tokyo.
- Chiba University, Faculty of Science, Laboratory of Ecology, Chiba,
- Ehime University, Department of Environmental Conservation, Matsuyama, Ehime,
- Japan International Cooperation Agency, Shinjuku-ku,
- Kyushi University, Faculty of Agriculture, Department of Forestry, Fukuoka,
- Naruto University of Education, Takashima,
- Shinshu University, Faculty of Science, Suwa Hydrobiological Station, Suwa,
- The Nature Conservation Society of Japan, Tokyo,
- Tokyo University of Agriculture, Tokyo,
- Tottori University, Faculty of Agriculture, Department of Environmental Science, Tottori.

**Contact person:**

- Hiroshi Shimono, Head of Earth Science Education Section, Science Education Research Center, National Institute for Educational Research of Japan, 6-5-22 Shimomeguro, Meguro-ku, Tokyo 153.

**Country: KAMPUCHEA, Democratic**

**Basic indicators (The World Bank, 1990):**

Population, mid-1988 (millions): ?  
Area (thousands of square kilometers): 181  
Adult illiteracy, 1985 (percent): ?  
Percentage of age group enrolled in education (1965):  
    Primary: 77  
    Secondary: 9  
    Tertiary: 1  
Primary level pupil-teacher ratio (1965): 48

**ENVIRONMENTAL EDUCATION:**

(No data available.)

**Country: KOREA Democratic People's Republic of**

**Basic indicators (The World Bank, 1990):**

Population, mid-1988 (millions): 21  
Area (thousands of square kilometers): 121  
GNP per capita, 1988: ?  
Average annual growth rate, 1965-88 (percent): ?  
Adult illiteracy, 1985 (percent): ?

**ENVIRONMENTAL EDUCATION:**

(No data available.)

**Country: KOREA, Republic of****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 42.0  
 Area (thousands of square kilometers): 99  
 GNP per capita, 1988: \$3,600  
 Average annual growth rate, 1965-88 (percent): 6.8  
 Adult illiteracy, 1985 (percent): ?  
 Percentage of age group enrolled in education (1987):  
     Primary: 101  
     Secondary: 88  
     Tertiary: 36  
 Primary net enrollment, 1987 (percent): 99  
 Primary level pupil-teacher ratio (1987): 37  
 Total expenditure on education as % of GNP (1986): 4.5

**Major Environmental Problems:**

The main environmental problems are as follows (Charn, 1981):

- Industrial pollution  
     Factory workers have been poisoned by heavy metals such as mercury. Aquaculture beds along the seashore are damaged by industrial sewage.
- Municipal sewage  
     Due to imperfect disposal of municipal sewage, problems have arisen concerning pollution of the drinking water supply.
- Pollution of soil  
     Crops and farmlands are damaged or contaminated by the use of chemical insecticides and fertilizers containing heavy metals (mercury, cadmium).
- Water pollution  
     Wastes from mines and municipal sewage contaminate rivers and reservoirs, killing fish and other aquatic life. Pollution of the sea by oil discharges from ships has been reported. People have been poisoned by seafood contaminated by industrial sewage.
- Air pollution  
     As the amount of fossil fuel used for industry increases, air pollution by sulfur dioxide, hydrocarbons and nitrogen oxides has taken place. Inhabitants near industrial complexes are occasionally reported to get skin and respiratory diseases.

Major forces which contributed to the present environmental problems are (Hwang, 1990; Kim, 1990):

- rapidly increasing population,
- urbanization,
- technical development and industrialization,
- consumption of energy resources at an unprecedented rate,
- the increasing affluence of a growing number of people and development of an aggressive attitude toward nature,
- selfishness, materialism, immorality.

During the 1960's, environmental issues were neglected because of other national priorities such as the escape from poverty and unemployment. Environmental problems began to be recognized in the 1970's with the development of the heavy and chemical industries. Because of the emphasis on economic development, environmental policies during that period were limited to reactive control of the contaminations. From the 1980's, social agreement on environment issue began to emerge, which led to enactment of environmental rights in the Constitution. Both environmental deterioration and public concern about it are increasing in the 1990's (Kim, 1990).

An Environmental Preservation Law was introduced in 1977. Next year the Office of the Environment, a governmental organization, was established. It has three bureaux: for Planning and Adjustment, for Preserving Water and for Preserving the Atmosphere (Charn, 1981).

### School system:

General education: 12 years (pattern: 6+3+3)  
Legal requirement: at least 6 years.

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9	
Total time (hrs):		15.6	19.0	24.6
Science:		3.1	2.5	2.7
Mathematics:		2.3	3.0	2.6
Technology:		0	0.9	2.0

Science teaching on the primary level starts in Grade 1. On the secondary level, integrated science is followed to Grade 9. Optional courses during the late secondary school years include physics, chemistry, biology, earth and space sciences. Students in Grades 9 to 12 are required to select one or two subjects from a list that includes agriculture, industry, commerce, marine and fisheries, and domestic affairs (UNESCO, 1986).

### ENVIRONMENTAL EDUCATION:

#### 1. Formal environmental education:

##### Primary and secondary school level:

The curricula for primary and secondary schools have been revised five times. In the fourth revision, the environmental education appeared in the curricula, and in the fifth revision (1987), environmental education received special emphasis. The content included in the fifth school curricula are not limited to certain subjects but are spread over the natural sciences subjects, such as biology, chemistry, and earth science, and the social sciences, such as geography, civics, national ethics, industry, Korean language and others. The main points of environmental education are (Choi, et al., 1990):

- natural environments,
- artificial environments,

- destruction of environment caused by natural and artificial causes,
- preservation of nature and environments,
- industrial pollution.

By 1989, there were four environmental modeling primary and four junior high schools, and 252 schools where environmental education was emphasised (Choi et al., 1990).

#### Primary school level:

The elementary school courses that deal with environmental education are social studies, natural science, moral education, practical skills, Korean language, and the integrated curriculum courses for first through third grades. Among these, social studies and natural science are the two major courses of study in which systematic environmental education is possible. Until now, environmental education has been presented by the "infusion method" in the elementary school courses of study. It has been pointed out in the infusion method, environmental education becomes unintentional and unsystematic since it lacks its own intensive goals and instruction in this approach (Kim, 1990).

Examples of environmental content from the primary level textbooks are given below (Choi, et al., 1990):

#### Social Life (2nd semester of 5th grade):

##### Unit 1: Application of national territory

- Problems of territory and population,
- Problems of nature and environments,
- Territorial development.

#### Science (2nd semester of the 6th grade):

##### Unit 1: Pollution of environments and protection of nature

- Pollution of environments,
- Protection of nature.

The environmental education kit, "Human and Environments," for primary and junior high schools was developed by the Korean Educational Development Institute (KEDI) during 1988-89, with the support of the Ministry of Environment. The Kit includes student texts, teacher's guide, video tapes, kit manual, and research report for the program development. Another program for high schools is currently under development (Choi, 1990).

#### Secondary school level:

In secondary schools, the realm of environmental education can be divided into ten major themes:

- natural environment,
- artificial environment,
- natural resources,
- population,
- industrialization,
- environmental pollution,
- nature conservation,
- environmental purification,
- environmental preservation,
- enhancement of environmental quality.

Most of these themes are dealt with in social and natural science classes (Chung, 1990).

Representative titles from secondary school textbooks dealing with pollution are as follows (Choi, et al., 1990):

Social life (3rd grade in the middle school):

Unit VII: Application and protection of natural territory:

- Pollution problem and protection of nature.

Science (3rd grade in middle school):

Unit V: Natural environments and human life:

- Composition of natural environments,
- Environmental pollution and urban life.

Korean geography (1st year of the senior high school):

Unit IV: Population and life space:

- Local development,
- Rise of environmental problems,
- Natural calamities,
- Environmental pollution,
- Protection of environments.

World geography (2nd and 3rd year of senior high school and one of the elective courses in liberal arts colleges and universities):

Unit VII: Problems faced by human beings:

- Problems of population and cities,
- Industrial and environmental problems.

Science I:

Unit V: Biology and the environment:

- Ecosystems,
- Pollution of nature,
- Human beings and nature:
  - Position of human beings in nature,
  - Utilization of biological nature resources,
  - Protection of nature.

**University level:**

Environmental education courses are offered in junior technical colleges and in Environmental Engineering Departments of universities (UNEP, 1986).

Current conditions of environmental education in higher education are as follows:

There are approximately

- 20 two-year vocational colleges,
- 30 four year colleges,
- 25 graduate schools,

which have environmental departments. In addition, a number of colleges and universities offer environmental courses such as hygienics or environmental engineering (Chung, 1990).

Twenty-nine universities offer courses in:

- Environmental science,

- Environmental technology,
- Environmental landscape,
- Science of environments,
- Protection of environments,
- Sea environmental science,
- Sea technology, etc.

and produce 1,500 graduates each year. On the graduate school level, institutions like the School of Environmental Studies, Graduate School of Hygienic Studies, Graduate School of Industrial Studies produce about 870 graduates per year. In these schools such courses as

- Environmental hygiene,
- Environmental planning,
- Environmental landscaping,
- Environmental pollution,
- Environmental engineering

are given (Choi et al., 1990).

Examples of the tertiary level institutions offering environmental education and training courses are given below (UNEP, 1986):

- Chungbuk National University, Department of Environmental Engineering, Cheongju,
- Dankook University, Department of Regional Development, Seoul,
- Dong-A University, Department of Environmental Engineering, Pusan City,
- Dong Guk University, The Institute of Regional Environment, Seoul,
- Hanyang University, Graduate School of Environmental Science, Seoul,
- Korea Advanced Institute of Science and Technology, Civil and Environment Department, Seoul,
- Kyungpook National University, Department of Environmental and Industrial Health, School of Public Health, Taegu,
- Pusan National University, Research Institute of Environmental Pollution, Pusan,
- Seoul National University, Department of Environmental Planning, Graduate School of Environmental Studies, Seoul,
- Won Kwang University, Department of City Planning, Iri City.

Extension programs (for government officials, specialized technical training):

Companies and industries are required by the environmental preservation law to hire technicians and experts to control air, water, noise, vibration, and proper discharge of pollutants. However, the number of government-certified environmental specialists and technicians is much smaller than the demand (Chung, 1990).

Several institutions are engaged in the environmental training for technicians, engineers, and public officials at their working places.

Representative of such offices are:

- Environmental Preservation Association, and
- National Institute of Environmental Research (Choi et al., 1990).

The National Environmental Protection Institute (NEPI) conducts training courses for government officials (UNEP, 1986).

## 2. Non-formal environmental education:

### Out-of-school activities:

Environmental education activities are also carried out through extracurricular activities, such as

- Science Museum system (exhibitions, films, science classrooms, experiments, visits to the zoo and botanical garden),
- National Science Fairs,
- Nature Protection Clubs,
- New Community Movement and
- other campaigns for protection of natural environments.

Some schools are carrying out environmental protection programs of research on environmental problems and guidance for educating local communities (Choi et al., 1990; Han, 1982).

There is an Environmental Monitoring Program for senior secondary school students, in which volunteer students can monitor environmental parameters in their own locales (UNEP, 1986).

### Activities for the general public:

Films and slides on environmental protection have been prepared for the general public. Essay and environmental song writing competitions are encouraged (UNEP, 1986).

The following governmental and civic organizations are undertaking nationwide campaigns for the preservation of nature:

- National Council for Nature Preservation,
- National Association for Protection of Wild Animals,
- Korean Alpinists Association.

For example, the Saemaul Undong (New Community Movement) was a nationwide campaign to improve living conditions and standards in both rural and urban areas, and for environmental preservation (Charn, 1981).

### Mass media:

The Ministry of the Environment and the Environmental Preservation Association make use various means such as mass media, audio-visual education materials, booklets and posters to educate the public on social and environmental matters (Choi, et al., 1990).

There are several science education radio programs. The following 15-minute programs are broadcast by KBS network for sixth grade students (Han, 1982):

- Kinds of plants,
- Kinds of animals,
- Photosynthesis,
- Food chains,
- Structure of human body,
- Nutrition,
- Natural resources to be preserved,
- Pollution,
- Electricity,
- Universe,
- Crust of the Earth,
- The inner side of the Earth,
- Transfer of energy,

- Use of nuclear power,
- Development of science and technology,
- etc.

In addition, KBS provides people with everyday scientific and technological information, including the following topics:

- New technologies of farming,
- New ideas of fishing,
- Sciences in everyday life,
- Nature preservation,
- Kingdom of animals,
- Health,
- Easy science.

Warnings and reports of pollution damage are also given by the mass media (Charn, 1981).

**Governmental and voluntary organizations:**

In 1989, 60 institutions were engaged in studies on the education of environmental professionals and the general public, including the

- Korean Educational Development Institute and
  - National Institute of Environmental Research,
- which receive government financing. Forty research institutions are connected to universities and thirty to private institutions, including the
- Environmental Preservation Association,
  - Korea Research Council on Environmental Sciences and the
  - Korean Society for Environmental Education (Choi et al., 1990).

There is a movement, supported by the non-governmental Korean Environmental Preservation Association, which is comprised of prominent leaders and businessmen. It regularly disseminates information to the general public via the mass media to stimulate regional activities on environmental preservation (UNEP, 1986).

The Nature Preservation Movement began in 1979 as a national campaign to show the public the vital importance of environmental preservation and to encourage action to protect the natural environment from hazards and pollution. It was formed through the joint efforts of various government and civic organizations. The movement's objectives are to:

- carry out activities for preserving the environment,
- clean the natural environment,
- offer education and guidance in environmental preservation,
- establish and manage facilities for environmental preservation,
- find and report damage to the environment.

People throughout the nation, especially those in the civil service and all schools, are asked to participate in the project (Charn, 1981).

The Consumer Associations of Korea announced a "Consumer Behavior Resolution" for environmental preservation in 1988. Three main principles of the resolution for environmental preservation include:

1. minimization of consumption of natural resources and general products,
2. improvement of mode of life for reduction of environmental contamination,
3. vigilance and accusation of environmental contamination offenders.

The Association suggested searching for, and implementing concrete methods for reducing environmental problems in the home, e.g., to prevent water contamination, control waste of the water-resource, reduce wastes, and prevent air pollution. Educational activities identifying companies that produce contamination, and recommendations for administrators and government officers are also included in the Resolution (Chung, 1990).

The Korean Women's Association conducts activities related to food, agriculture, atmosphere and the climate. Its principal target groups are workers, out-of-school youth, teachers and the general public (UNESCO, 1989).

### 3. Training of environmental education personnel:

#### Teacher training:

In every primary and secondary school, one teacher is assigned to take charge of environmental education. These teachers receive special training from the National Council for Natural Preservation to instill in their pupils a love for nature and the urgent necessity of preserving the environment. All primary and secondary school teachers are required to be trained to give instructions while teaching subjects related to environmental preservation. Government-commissioned academic bodies prepare and provide teachers with various educational materials suitable for environmental education (Charn, 1981).

The National Seminar on Developing Strategies and Action Plans for Development of Environmental Education in Korea (April 1990) stressed the following (Kim, 1990):

- Teachers should receive environmental education before and during recruitment.
- Both general and specific environmental programs are needed.
- An environmental education component should be included in every teacher re-education program.
- Schools should send their teachers to college and graduate programs in environmental education to develop teacher-specialists in that area.

### 4. Major environmental education problems:

In 1976, the principal obstacle confronted by environmental education programs at all school levels was the lack of teachers, guides and leaders qualified in the field of the environment. Another problem of lesser importance was the shortage of educational materials, such as audio-visual aids, games, guides, books and magazines (UNESCO-UNEP, 1976).

The following are recent problems in environmental education (Choi, 1990; Kim, 1990):

- shortage of educational materials,
- shortage of teachers trained in environmental education,
- shortage of environmental specialists,

- lack of variety,
- unsystematic,
- weak interconnection between subjects and levels,
- low quality,
- difficulties for convenient use,
- lack of enthusiasm and knowledge by users.

The reasons why systematic and practical environmental education is not a reality in Korea are as follows (Kim, 1990):

- Environmental policies by the government emphasize only the prevention of environmental contamination while neglecting environmental education.
- A systematic approach to environmental education is difficult because the content of environmental education is scattered over several courses of study.
- Most school teachers lack a clear and systematic recognition of environmental education, which presents difficulties for systematic instruction in it.

**5. Some institutions engaged in environmental education**  
(Choi, 1990; UNESCO, 1989):

- Ministry of Environment,
- Korean Educational Development Institute (KEDI),
- The National Environment Research Institute,
- Korean Environment Preservation Association,
- Korean Educational Development Institute,
- Korean Women's Association.

**Contact person:**

- Dr. Suk-Min Chang, Director, Korean Educational Development Institute (KEDI), 92-6 Umyeon-dong, Seocho-gu, Seoul, 137-791, Korea, (tel. 02-572-5021-9; 02-572-5121-7; Cable: INSTKOREDI SEUL; Fax: 02-572-7261).

**Country: LAO, Poeples Democratic Republic****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 3.9  
 Area (thousands of square kilometers): 237  
 GNP per capita, 1988: \$180  
 Adult illiteracy, 1985 (percent): total 16 (female 24)  
 Percentage of age group enrolled in education (1987):  
     Primary: 111  
     Secondary: 23  
     Tertiary: 2  
 Primary level pupil-teacher ratio (1985): 25  
 Total expenditure on education as % of GNP (1985): 1.0

**School system:**

**General education: 11 years**  
**Legal requirements: at least 8 years.**

**Distribution of school time (Unesco, 1986):**

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	19.5	20.7	27.6
Science:	0	1.0	6.3
Mathematics:	3.5	5.2	6.0
Technology:	0	0	0

Science teaching on the primary level starts in Grade 4.  
 On the secondary level, science is compulsory, taught as separate sciences:

Grade 6: biology  
 Grade 7: biology, physics  
 Grade 8 to 11: biology, chemistry, physics.

**ENVIRONMENTAL EDUCATION:**

(No data available.)

**Country: MALAYSIA****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 16.9  
 Area (thousands of square kilometers): 330  
 GNP per capita, 1988: \$1,940  
 Average annual growth rate, 1965-88 (percent): 4.0  
 Adult illiteracy, 1985 (percent): female 34, male 27  
 Percentage of age group enrolled in education (1987):  
     Primary: 102  
     Secondary: 59  
     Tertiary: 7  
 Primary level pupil-teacher ratio (1987): 22  
 Total expenditure on education as % of GNP (1986): 7.8

**Major environmental problems (Heang, 1985; Soerjani, 1989; UNESCO, 1990):**

- forest clearing for agriculture and other development purposes at a rate faster than reforestation; this has brought adverse effects on wildlife and caused soil erosion,
- air and noise pollution in major cities (Kuala Lumpur, the Penang/Prai area, Johor Baru and Ipoh),
- water pollution mainly caused by sewage waste from rubber processing factories, oil palm mills and other agriculture-based industries, domestic waste discharge, and pig farms),
- silting of rivers, floods (soil erosion caused by logging, land clearance, mining, housing),
- with population increase, disposal of solid waste (currently by land-fill method) is becoming a serious problem,
- with rapid industrialization, toxic waste production is increasing,
- depletion of fishing grounds due to oil drilling exploration.

Government of Malaysia has introduced the following acts, policies and institutions in order to control and improve the environment (UNESCO, 1990):

- Environmental Quality Act (1974),
- Division of the Environment - Under the Ministry of Local Government and Environment,
- Department of Environment - under the Ministry of Science, Technology and Environment (1976),
- Environmental Quality Council (1977),
- Amendments to the Environmental Quality Act (1985),
- Restructuring of Department of Environment (1986),
- Environmental Impact Assessment Studies (1988),
- Regulation on the Treatment of Toxic Wastes (1989),
- Environmental Quality (Scheduled Wastes) Regulations (1989).

**School system:**

General education: 13 years (pattern: 6+3+2+2)  
 Legal requirement: at least 9 years.

## Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	23.0	26.5	29.6
Science:	1.5	1.8	3.3
Mathematics:	3.5	2.8	3.3
Technology:	0	0	0

In the primary schools, science as a separate subject was formerly taught from the grade 1 through six years. However, beginning in 1982, a new curriculum was introduced into the first year in all the primary schools. There is no more science, history, geography, civics and health as distinct subjects in the new primary curriculum - instead a new subject called, "Man and the Environment," was introduced in the fourth year (Ali, 1988).

At the secondary level, integrated science is followed to Grade 10 as a compulsory course. In the upper secondary school years, students are either streamed into the pure sciences of physics, chemistry and biology together with mathematics, or are diverted into an arts stream where general science of human and social biology may be offered (Ali, 1988).

The government is trying to improve the economic, social and cultural conditions of rural communities through education, both formal and informal. Following are some examples (Prabhakar, 1981):

- The Ministry of Education is strengthening agricultural science education, which was introduced as a subject in lower secondary schools in 1965.
- In 1968 the Ministry of Education and the Ministry of Health launched a joint school health program.
- The National Applied Food and Nutrition Project aims at improving nutrition and living conditions in the rural areas. The Ministry of Education plays a major part in the project.
- The experimental Pahang Tenggara Curriculum Project tries to reflect and incorporate the social, economic and cultural changes in this area into the curriculum to make it more relevant to the pupil's environment and educational needs. The program calls for the possible integration of primary schools with lower secondary schools for cooperation between the school and the community in formal and non-formal education from the fourth grade on. The program combines formal education with vocational training, to help school-leavers find a job. Pupils from lower secondary schools go out to industry for part-time job training.

**ENVIRONMENTAL EDUCATION:**

Awareness of environmental education as an integral part of the Malaysian educational process is a fairly recent development. In the first and second Malaysian Plans (1966-1970, 1971-1975), the absence of environmental concerns was evident. In 1974, the first environmental legislation (Environmental Quality Act) was enacted, followed by other regulations on environmental problems and pollution control. The Third Malaysian Plan outlined a National Environmental Policy, which reflected the increasing official concern and commitment to environment. The plan mentioned the value of environmental education as an aspect of government policy. Curriculum renewal followed the recommendations of the third development plan (Chelliah, 1982).

The Department of Environment, established in 1975, is responsible for environmental protection and management activities. An Environmental Information and Education Unit was established in the Department to coordinate environmental education and training (UNEP, 1986).

### 1. Formal environmental education:

Environmental education is not a separate subject in the formal school curriculum, but the science and social studies disciplines at different grade levels have environmental objectives in their syllabuses. Two techniques are used to introduce environmental concepts into different subjects:

1. Infusion approach - identification of relevant environment-related concepts, selection of appropriate learning units, preparation of textual and audio-visual materials for use by classroom teachers.
2. Integration approach - the relevant environmental topics are integrated into syllabuses as and when they are revised (Prabhakar, 1981).

#### Primary school level:

With the introduction of a new primary curriculum in 1983, science is incorporated as part of the subject, "Man and His Environment" (UNESCO-UNEP, 1984), which is aimed at providing environmental knowledge and developing desirable attitudes in children (UNEP, 1986). This is an interdisciplinary subject which includes elements of health science, science, social studies, and civics (Soerjani, 1989). It uses environmental resources and themes to teach history, geography and science. It is taught in the national language, Bahasa Malaysia, at primary school level to children between 10 and 12 years old (Liew, 1990). The starting point for the study may be any object, simple or complex - a social event, a process or a problem about which the children may be naturally curious. Children study through personal observation and involvement, with the teacher acting as a guide in helping to make the observations comprehensive and imaginative (Prabhakar, 1981). The entire curriculum is built around the following themes, which are extended in scope and depth from year to year (Ponniah, 1982):

- man (child) and his environment (awareness of surroundings),
- interactions among people (human relations),
- interactions of man with his environment,
- interactions of the elements in the environment,
- issues related to man and the environment.

The main objectives are to assist students to:

- know and understand some aspects of man and his environment in general,
- know and understand interactions between man, environment, and various elements and components of the environment,
- build understanding, awareness and sensitivity towards causes and effects of the changes that continuously take place in society and the world around us,
- build and develop skills in thinking, reasoning, inquiring, evaluating and making decisions concerning man and the world around him,
- develop positive attitudes in using the knowledge and skills towards solving problems and issues relating to individuals, society and the environment,
- build positive values and attitudes towards the need and necessity to live together in harmony in the context of multiple society in Malaysia (Ali, 1988).

Special efforts are being made to introduce aspects of the environment into existing disciplines, such as languages and mathematics (UNESCO-UNEP, 1984).

The World Wide Fund For Nature Malaysia (WWF Malaysia) works with the Ministry of Education to promote the use of local resources for teaching and learning processes. The focus is on the primary schools. Environmental topics include investigation of the various natural resources that are important to man, linkages and interdependence of the elements in the environment, effects of man's activities in the environment, etc. With the assistance of selected teachers, they are preparing an activity packet for the Man and Environment subject at primary level. The packet includes a teacher's guide and activity sheets for school children (Jip, 1990).

#### Secondary school level:

In the old secondary school curriculum environmental education was not given much emphasis. The only environmental issues were in the ecology section of biology. Under the new integrated secondary school curriculum more emphasis is put on environmental education, mainly in science and geography subjects (UNESCO, 1990).

The "infusional method" has been used for injecting population and environmental topics into disciplines like home science, human biology and geography (Chelliah, 1982; Ponniah, 1982; Prabhakar, 1981).

At the lower secondary level, the integrated science course attempts to link science education with practical applications and the use of environmental resource elements as well as the introduction of human concerns. Scientific knowledge and skills are emphasized.

Environmental topics are discussed, such as:

- Effects of air pollution on man.

At the upper secondary level, pupils are encouraged to adopt a scientific approach and desirable attitudes towards the environment and its problems. Study programs with an interdisciplinary focus and dealing more with environmental problem-solving have also been introduced.

The general science syllabus deals with issues such as:

- The difficult disposal of radioactive waste,
- The relationship between smoking and cancer and
- The threat to the nitrogen cycle posed by intensive farming.

Physics, Chemistry and Biology, although specialized and academic, emphasize understanding of scientific concepts in relation to the pupil's environment and applications to daily life. Examples of environment-related topics include:

- The effects of atmospheric impurities on lungs,
- Hydro-electric power,
- Nuclear fission and fusion,
- Pollution and depletion of natural resources,
- World energy sources,
- The circumstances of the energy shortage and its possible effects on our life,
- The efficient use and conservation of energy,

- Air pollution and the world's climate change,
- Water pollution and its effects on plants and animals,
- The transportation of fuels and wastes,
- The world's expanding population,
- Effects of the noise and pollution brought by industrialization on human health,
- Food production through efficient agricultural practices,
- The need for change in eating habits,
- Control of urban sprawl.

(Prabhakar, 1981; UNESCO-UNEP, 1984; UNESCO 1985; UNEP, 1986).

The new integrated secondary school curriculum was launched partially in 1988 and fully in 1989. The science syllabus is formulated with the following three guidelines (UNESCO, 1990):

- science for the understanding of the environment,
- science for the well being of mankind,
- science for self development.

The interrelated areas are taught on an integrated basis in line with Malaysia's national educational philosophy. The new science curriculum for secondary schools has four themes:

1. Human beings and other living things,
2. Earth resources and their management,
3. Energy for living,
4. Human beings and harmony in the environment.

The following aspects are especially stressed in the new curriculum:

- studies on the environment and efforts of human beings to improve the quality of the environment,
- quality of life and man's responsibilities in the proper management of the environment,
- appreciation of the environment, its many wonders and the moral values concerning environment,
- pollution, conservation of wildlife, careful usage of resources, conservation of the environment.

(Soerjani, 1989; UNESCO, 1990).

#### University level:

At the National University of Malaysia (Universiti Kebangsaan Malaysia), University of Malaya (Universiti Malaya) and Education Faculty of the Agricultural University of Malaysia (Universiti Pertanian Malaysia), environmental education is offered as an optional subject for the Diploma in Education courses (UNESCO, 1990).

The School of Biological Sciences, University of Malaya, offers education in pure ecology. Students may take options, honors programs, or graduate studies in ecology (Romm, 1979).

The Universiti Sains Malaysia has offered environmental education and training courses since 1984 (UNEP, 1986).

The Fisheries Faculty at Agricultural University of Malaysia has an environmental engineering department which offers courses concerning water quality management, waste water treatment, solid waste management and environmental quality control systems (UNESCO, 1990).

The Agriculture University of Malaysia in Serdang offers a Bachelor's Degree in Environmental Science at the end of a four-year undergraduate

program, designed to produce environmental managers and planners. The program includes (Romm, 1979; UNEP, 1986):

- foundation (fundamental biology, physics, chemistry, etc.)
- supporting studies (applied statistics, micro- and macro-economics, introduction to computer science, etc.),
- core (environmental health, planning, management, pollution control, etc.), and
- special elective courses (meteorology, biochemistry, microbiology, etc.)

Universiti Pertanian Malaya is the home of a WHO unit "Western Pacific Regional Center for the Promotion of Environmental Planning and Applied Studies", which has organized various training courses, e.g.:

- solid waste disposal,
- food safety,
- air and water quality,
- chemical safety,
- noise pollution.

The center is also involved in the Global Environmental Monitoring System (Soerjani, 1989).

The Institute for Advanced Studies at the University of Malaya has a number of environment-oriented projects. These include (IPT, 1990):

- Biochemical engineering studies in microbial utilization of agro-industrial waste,
- Environmental assessment and management studies,
- Kuala Lumpur Ecoville,
- All integrated biological farming system,
- Multi-disciplinary studies on coastal and marine ecosystems in Malaysia,
- Ecology of Wood-borers,
- Pollution studies with reference to toxicity testing of pesticides, organic chemicals, and heavy metals on fish and other aquatic life,
- Applied research and projects related to wetland ecosystems (in cooperation with the Asian Wetland Bureau),
- Freshwater and marine algae of Malaysia,
- Treatment and utilization of agro-industrial wastes using algae,
- Utilization of Agro-industrial waste using composting.

**Extension programs (for government officials, specialized technical training):**

The Department of Environment cooperates with other government agencies and non-governmental organizations in conducting lectures, seminars, workshops and environmental training activities for technical personnel (UNEP, 1986).

## 2. Non-formal environmental education:

### Out-of-school activities:

Out-of school environmental education programs have been developed for young people and adults. Some examples include (Prabhakar, 1981; Prabhakar, 1982):

#### a) Science exhibitions

Schools are encouraged to undertake short- and long-term projects through informal activities aimed at solving local community problems or improving upon existing practices in:

- agriculture,
- small-scale manufacture,
- personal hygiene,
- community health,
- management of energy resources,

- environment.

The projects are exhibited at regular science exhibitions that are organized for secondary schools. In many of the student projects in chemistry, physics and biology, an environmental component is dominant. Examples of project titles are given below:

- Utilization of cars and exhaust gases,
- Solar energy converter,
- Removal and prevention of spilled oil on water,
- Utilization of agricultural wastes,
- Making soft-board from pineapple skins,
- Manufacture of phosphate fertilizer from cockles,
- Cultivation of freshwater fish in pre-treated effluent ponds of rubber processing factories,
- Sound pollution,
- An example of biological control of pests,
- Pollution: its effect on living organisms,
- The pond: an ecosystem.

b) Science clubs

Long-term investigative projects in- and out-of-school are popular with school science clubs.

c) The "live-in" Nature Study Center for students in Taman Negara was set up by the Department of Wildlife and National Parks, in cooperation with the Ministry of Education. The center conducts special programs for students during school holidays. It also permits teachers, college lecturers and university staff to conduct their own programs. Special activities include map-reading and jungle orientation by compass.

d) Group training programs in nature reserves

The Wildlife and Nature Protection Department organizes group environmental training programs in the Templer Park Reserve Forest in the state of Selangor.

The Pasoh Forestry Research Center stands on 2,000 ha of forest reserve. The reserve exhibits typical rain forest ecosystem of Malaysia. Part of the forest is set aside for educational services for the school children, university students and the general public.

e) The Zoo Negara Education Center

provides interpretative services for zoo visitors, conducts educational programs for school groups, and maintains a permanent educational display.

f) The University of Malaya Field Study Center at Ulu Gombak Selangor offers its facilities and services to schools and other organized groups. Its program includes the following:

1. To help research in field studies, particularly in ecology, biology and wildlife;
2. To help the teaching of techniques for ecological studies through programs organized by the center staff, who are university lecturers;
3. To help school teachers to organize ecology classes and environmental field trips;
4. To create interest and awareness in the natural environment, especially forest resources, among public.

g) The National Museum (Muzium Negara) offers a comprehensive program to the general public. The Educational Services and Information Sections of the National Museum caters particularly to school children.

**Governmental organizations:**

The Division of the Environment, under the Ministry of Science and Technology, is considered the most active government agency in non-formal environmental education. It publishes the bilingual magazine "Sekiar", which is distributed free of charge to all government departments and organizations, schools, libraries and relevant agencies abroad. It also distributes guidelines and explanatory notes relating to specific legislation and holds exhibitions. In addition, it produces supplementary reading materials on the environment for school children, and various other materials for the general public, organizes out-of-school activities around the annual World Environment Day (June 5), seminars, tree-planting campaigns, TV documentaries, lectures and talks, etc. (Chelliah, 1982; UNESCO-UNEP, 1984).

The Federal Land Development Authority (FELDA) conducts training programs in agriculture and population education, provides basic facilities such as housing, transportation, water supply, health services and education (Prabhakar, 1982).

**Non-governmental / volunteer organizations:**

Non-formal environmental education is largely carried out by non-governmental organizations. A number of them each year have their own education program within their own area of interest, for example (Heang, 1985):

- The Malaysian Zoological Society, which runs Zoo Negara has a Zoo Education Service which teaches children about animals, their needs and environment. It produces magazines and other printed matter in addition to being involved in television education services.
- World Wildlife Fund Malaysia is active in public education. It has a mobile education unit that goes to the schools, providing pamphlets, film and slide shows on wildlife and conservation. It also publishes the quarterly newsletter, "Conservation Malaysia."
- Environmental Protection Society Malaysia organizes forums, water pollution campaigns, talks and slide shows for pupils and the general public, regular seminars and symposiums on environmental issues, and publishes a magazine on the environment.
- Sahabat Alam Malaysia (SAM), a citizen's group campaigning against the deterioration of the environment, organizes seminars, talks and exhibitions. Its topics range from the depletion of water and fish resources to wildlife extinction, soil erosion and pollution.
- The Malayan Nature Society (with a membership of about 3000) organizes monthly excursions to areas of interest besides holding indoor meetings with guest speakers on nature-related topics and the environment. The society aims to promote interest in natural history, conservation of wildlife and natural resources in Malaysia and the surrounding region, giving talks to schools and public organizations on request. It has a special education program on the rain forest in Endau-Rompin for school children during school

holidays and runs special field courses for small children at the University of Malaya Field Studies Center at Ulu Gombak. It publishes books on natural history, a quarterly scientific journal, "The Malayan Nature Journal," and a quarterly newsletter, "Malayan Naturalist," about nature and environmental interests. The Society also organizes seminars and symposiums on nature and the environment. With financial support from Esso, The Malayan Nature Society decided to produce a magazine on nature and the environment for schools, called Alam Pelangi (Rainbow World), which is available free of charge to school children for a year (Chelliah, 1982; Heang, 1985).

- Friends of the Earth, Malaysia, formed in 1977, acts as a concerned citizens's group campaigning against environmental deterioration of and taking up environment-related issues like the problems of water and fish resource depletion, destruction of forests, extinction of wildlife, effects of drought, the continuing occurrence of floods, the wide spread use of pesticides, pollution from mining activities, indiscriminate disposal of sewage and industrial effluents. Since its inception, several work programs have been implemented, information documented on various issues affecting the environment, studies and research have been conducted, statements and memoranda released. Several public exhibitions, talks and seminars have been conducted, and many newspaper columns on environmental issues in Malay, English and Chinese have been initiated (Chelliah, 1982).
- The Asian Wetland Bureau (AWB) is an international non-profit organization which aims to promote protection and sustainable utilization of wetland resources in Asia. To date, AWB has worked for or with agencies in Indonesia, Malaysia, Philippines, Thailand, Vietnam, Hong Kong, China, Taiwan, South Korea, Bangladesh, Pakistan and India. Staff expertise ranges from ecology, aquaculture, fisheries, limnology, water chemistry, ornithology, forestry and remote sensing to training, conservation planning and resource management. The Malaysian office acts both as the regional coordination center, and runs a Malaysian national program in conjunction with the Institute of Advanced Studies, University of Malaya (AWB, 1990).
- Consumers Association of Penang (CAP) publishes monthly "Utusan Konsumer" providing information on the environment for consumers. Its activities also include exhibitions and talks (UNEP, 1986).
- Universities have taken positive steps in order to reach the public, especially youth, on issues such as resource conservation, anti-pollution measures, wildlife protection, environmental protection and population education.  
In this field, the most active are (Prabhakar, 1982):
  - University of Malaya,
  - University of Science, Malaya, Pulau Pinang and
  - University of Agriculture, Serdang.

**Mass media:**

Television, radio and newspapers are very important media for non-formal environmental education.

Radio, through its several language channels, not only has news bulletins, but also talks and discussions. The regional Asia-Pacific Institute for Broadcasting Development, for example, ventured into the field of environmental education through a Malaysian project on energy education via radio broadcasting.

Each channel on television has weekly broadcasts related to nature and the environment. The "Young Scientist" television series highlights selected projects of the science clubs.

The press covers a wide range of topics on environmental issues, conservation and legislation. Newspapers carry regular features on the environment under the heading of out-door or science articles. Periodicals on environmental education for the public are growing in number, and various organizations and pressure groups publish newsletters and articles.  
(Prabhakar, 1981; Chelliah, 1982; Heang, 1985; UNESCO-UNEP, 1984).

**3. Training of environmental education personnel:****Teacher training:**

Teacher education in Malaysia is mostly conducted in two ways:

- graduates with BSc and Diploma in Education,
- graduates with BSc and Certificate in Teaching.

The Institutes of Education in Malaysia are conducting formal education for a diploma or training courses for a certificate in teaching. They are also conducting in-service training of teachers (Soerjani, 1989).

There are 27 teacher training colleges throughout the country. Most of them have programs for the training of primary school teachers (Ali, 1988).

In planning for the change from a two-year to a three-year teacher training program, implemented in 1980, curriculum planners took the opportunity to include at every opportunity environment-related concepts (Chelliah, 1982).

The teacher education syllabuses are based on the school curricula. Hence, environmental education concepts in the school curricula are dealt with in the teacher education curriculum in those subject areas. The possible inclusion of environmental education as a separate subject is also under consideration (UNESCO, 1985).

According to the Deputy Director-General of Education, Environmental Studies will be included in the curriculum at teachers training colleges and schools. The key personnel under the Ministry's Man and Environment program are making preparations for the inclusion. They are now training teaching staff at teachers training colleges and schools on the subject (New Straits Times, 1990).

A special syllabus has been drawn up for the use of the trainees in the colleges to inculcate the necessary knowledge, skills and attitudes for teaching the new primary school subject, "Man and the Environment." The main problem at the moment is the rigid specialization of the lecturers who are either science or arts based. Many do not feel competent enough to handle everything at once.

For the training of curriculum developers, teacher educators and planners the following strategies have been adopted:

- selected key people were sent abroad for short periods to acquire specific skills and knowledge,
- seminars, holiday or week-end in-service courses and special training are provided for key personnel and lecturers who have not been exposed to Environmental Studies,
- collaborative research in the field of environmental education and problems may be launched (Ali, 1988).

Environmental education is an optional subject in the Bachelor of Education program of the University of Agriculture and the University of Malaya, while for students in the School of Educational Studies of the Sains University, the environment is a major study area in the course on contemporary educational problems and issues (Ponniah, 1982).

At the Faculty of Education, University of Malaya, a course is run specifically to teach environmental education (Chelliah, 1982).

At the same faculty, a 20-hour optional interdisciplinary course in environmental education for teachers with a background in humanities is offered. The main objectives of the course are given below (Chelliah, 1981; UNESCO, 1985):

- to give the students a clear perspective of the environment,
- to enable understanding of the fundamental problems of the environment in relation to development and society,
- to discuss what science and scientists can do about the environment,
- to illustrate how the sciences, humanities, environment and society interact.

The lectures and discussions include the following main topics:

1. The organism and its environment - understanding basic ecological principles;
2. Development and the environment - understanding relationships between all aspects of development and its impact on the environment;
3. The nature and scope of environmental education;
4. The need for environmental education and the genesis of environmental consciousness in Malaysia;
5. Identification of environmental problems and selection of themes suitable for use in school;
6. Identification of topics in the various school subjects appropriate for the integration of environmental concepts;
7. The integration technique - approaches to the incorporation of environmental concepts into existing topics;
8. Methodology and approaches to the teaching of environmental education;
9. Resources for teaching of environmental education;
10. Laboratory outdoor activities for environmental education.

The course evaluation is carried out through written assignments and projects. The teacher trainees work in pairs. Reports are presented orally to the course participants before being submitted for evaluation. The following are examples of projects carried out by students:

1. Development of curriculum materials:

- a) Selection of topics that are suitable for the integration of environmental education concepts.
- b) Identification of the concepts, principles and skills that are involved in the topics identified.
- c) Formulation of sequences and structuring of facts, concepts and principles;
- d) Detailed discussion of plans for laboratory activities or field experiences related to the topic.
- e) Suggestions of appropriate audio-visual materials.

This assignment proved to be a favorite among the geography, economics, civics and commerce students since related topics and environmental indicators are abundant in these subjects, for example:

- soil erosion,
- agricultural development,
- deforestation,
- trade, technology and industry,
- food,
- forestry,
- mining,
- individual and social rights,
- population,
- health and disease,
- land forms,
- air, water and soil,
- weather,
- natural resources,
- energy sources.

## 2. Instructional resources for environmental education:

Students choose a topic or problem of current interest and prepare:

- a) An interdisciplinary action-oriented instructional module for primary, secondary or adult education.
- b) Suggest teaching materials and audio-visual aids.

Students prefer to select specialized themes such as:

- the proposed atomic research station in Malaysia,
- water pollution,
- deforestation,
- nature conservation.

## 3. The role of mass media:

Students make a list of recent environmental education programs and campaigns in the country and discuss their objectives, implementation and results. They make proposals on how to use this information in teaching their subjects.

The campaigns were studied on issues like:

- litter,
- national parks,
- forests,
- ecological sites,
- historical sites and monuments.

## 4. School environment:

Students are asked to examine the environments in schools, to report on shortcomings and to suggest improvements. They visit rural and urban schools to study the impact of environmental factors and to draw conclusions about the sort of conditions that ought to prevail in the school environment.

## 5. Methodologies for environmental education:

Taking the environment as a natural resource for learning, students select a topic and discuss how to use it to teach specific content in their subject areas.

In-service courses conducted at the national and regional levels are directed towards re-orienting teachers and giving them competencies to teach in the new environment-oriented context. The different forms of in-service training include (Prabhakar, 1981; UNESCO, 1985):

## a) Face-to-face courses

The courses organized by the Schools Divisions of the Ministry of Education, which take place on a regional or national level, are conducted by staff trained by the Curriculum Development Center and by local experts. The objective of such one-week courses is usually to demonstrate new approaches, methods and new programs.

## b) Self-instruction programs

The Population Education Unit of the Curriculum Development Center prepared seven self-learning modules for teachers:

Population change - its determinants and consequences,  
The population situation in the world and in Malaysia,  
Population Programs in Malaysia,  
Population and environment,  
Population and resources,  
Population and social services,  
Population and the quality of life.

## c) In-service training linked to community and national development

Agricultural science teachers are trained by a mobile in-service unit that is an extension of a teacher training project of Temenggong Ibrahim Teachers College in Johor Baru.

## d) Innovative efforts at in-service science training

A Research-Development-Training model has been used in an in-service teacher training course for studying habitats such as:

A clean, undisturbed stream,  
A highly silted river,  
A primary forest,  
A secondary of early successional forest.

The Teacher Training Division in the Ministry of education is embarking on a large-scale program to train teachers as a part of in-service courses to fulfill entry requirements into a new-tiered salary scheme for teachers and this may include environmental education (UNESCO, 1990).

The World Wide Fund For Nature Malaysia (WWF Malaysia) is working with a teacher training college on a pilot program for training teachers. The activities include:

- preparing and conducting training programs at the college,
- nature orientation course for trainee teachers,
- practical field activities conducted by the trainee teachers.

The WWF Malaysia is establishing a field training center for environmental education. Their target group includes lecturers of teacher training colleges (Jip, 1990).

In January 1990, WWF and the Ministry of Education organized a workshop "The use of the environment in teaching and learning - Man and the environment". The session resulted in (Liew, 1990):

- the creation of short-and long term action plans,
- the formulation of environment-related training methods and courses for teachers of Man and the Environment,
- the preparation of guides with suggestions about how best to learn Man and the Environment.

**Organizers of non-formal education training:**

Training for the Division of the Environment staff, under the Ministry of Science and Technology, is provided mainly through national and international environmental education workshops. In addition, senior staff members and guest lecturers from local universities and specialized agencies give lectures (UNESCO-UNEP, 1984).

**4. Major environmental education problems and future plans:**

In the past, the main obstacle at all school levels was a shortage of personnel trained in environmental education (teachers, university professors, environmental specialists) and the relative lack of associations for teacher training. The shortage of educational facilities such as libraries, laboratories and specialized centers was a secondary problem (UNESCO-UNEP, 1976).

Recent priorities in the field of environmental education focus on incorporating environmental education in the entire secondary school curriculum. More emphasis will be placed on the philosophy of "education for all." It is expected that the environmental study started in the primary schools will influence the higher classes as well (Ali, 1988).

**5. Some institutions engaged in environmental education are (UNESCO, 1983; UNESCO, 1989):**

- Curriculum Development Center, Ministry of Education, Kuala Lumpur;
- Southeast Asia Regional Center for Education in Science and Mathematics, Penang;
- WHO Western Pacific Regional Center for the Promotion of Environmental Planning and Applied Studies, Kuala Lumpur;
- Ministry of Science, Technology and Environment, Department of Environment (Jabatan Alam Sekitar), Kuala Lumpur;
- Ministry of Health, Kuala Lumpur;
- Education Department, Johore;
- Geological Survey Department, Kuala Lumpur;
- Forestry Department, Kuala Lumpur;
- Center for Environment, Technology and Development, Selangor;
- Environmental Protection Agency, Selangor;
- University of Malaya, Kuala Lumpur:
  - Department of Zoology,
  - Department of Botany,
  - Department of Geography,
  - Department of Genetics and Cellular Biology,
  - Department of Ecology,
  - Department of Civil Engineering,
  - Faculty of Education;
- University of Agriculture Malaysia, Serdang, Selangor:
  - Department of Environmental Science,
  - Faculty of Science and Environmental Studies,
  - Faculty of Forestry,
  - Faculty of Economics and Management;

- University of Science Malaysia, Minden, Penang:  
School of Biological Sciences,  
School of Physics;
- Natural Forest Branch, Forest Research Institute, Kepong, Selangor;
- Public Health Institute (Institut Kesihatan Umum), Kuala Lumpur;
- Mara Institute of Technology, Selangor;
- International Organization of Consumers Unions, Regional Office for Asia and the Pacific, Penang;
- Malayan Nature Society, Kuala Lumpur;
- Friends of the Earth Malaysia (Sahabat Alam Malaysia), Penang;
- World Wide Fund for Nature Malaysia (WWF Malaysia), Kuala Lumpur.

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**Country: MALDIVES****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (thousands): 202  
 Area (square kilometers): less than 500  
 GNP per capita, 1988: \$410  
 Average annual growth rate, 1965-88 (percent): 2.3  
 Total expenditure on education as % of GNP (1978): 0.6

**School system:**

**General education: 12 years**

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	5.0	20.8	24.5
Science:	-	1.6	6.3
Mathematics:	2.0	3.4	3.8
Technology:	0	0	0

**ENVIRONMENTAL EDUCATION:**

The Educational Development Center, (Sosun Magu, Henveiru, Male 20-25) is a national governmental organization responsible for the formal education system and curriculum development. Its main fields of interest relating to environmental education, are the following:

- environmental study in general,
- atmosphere and climate,
- water: oceans, seas, estuaries, fresh water,
- land use and misuse,
- food and agriculture,
- transportation,
- pollution,
- wastes,
- population,
- health and human well being.

The center is developing and evaluating instructional materials for students, teachers, out-of-school youth and the general public. Its activities also include provision of guides and textbooks, advisory services and organization of meetings, workshops and conferences (UNESCO, 1989).

(No other data available.)

**Country: MYANMAR (BURMA)****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 40.0  
Area (thousands of square kilometers): 677  
Adult illiteracy, 1985 (percent): ?  
Percentage of age group enrolled in education (1983):  
    Primary: 102  
    Secondary: 24  
    Tertiary (1981): 5.1  
Primary pupil-teacher ratio (1983): 45  
Total expenditure on education as % of GNP (1977): 1.6

**ENVIRONMENTAL EDUCATION:****1. Formal environmental education:****Primary school level:**

The "Surroundings" ("Patwinkyn") program has been introduced at the primary level. It uses the out-of-doors as a means of developing environmental sensitivity, love for nature and an optimistic view of the environment. Children are encouraged to learn directly from the environment, there are no textbooks for the pupils (Ponniah, 1982; UNEP, 1986).

(No other data available.)

**Country: NEPAL****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 18.0  
Area (thousands of square kilometers): 141  
GNP per capita, 1988: \$180  
Adult illiteracy, 1985 (percent): total 74 (female 88)  
Percentage of age group enrolled in education (1987):  
    Primary: 82  
    Secondary: 26  
    Tertiary: 5  
Primary level pupil-teacher ratio (1985): 38  
Total expenditure on education as % of GNP (1985): 3.0

**Major environmental problems:**

Nepal is faced with the following environmental problems (Lohani, 1981; NCERT, 1987):

1. Extremely heavy deforestation, especially in the Himalayan foothills, and its adverse effects on the plains, creating floods. The main reasons for deforestation are:
  - Wood is a principal fuel and a huge part of the forest land has been cleared for firewood.
  - The forest has been cleared to plant crops.
2. Heavy soil erosion:  
Every year millions of tons of topsoil are washed down into the sea. The problem is very serious in the heavily settled midland hills of the country.
3. Population imbalance, heavy pressure on land, and new human settlements resulting from the large-scale migration of population of the heavily settled midland hills to the plains.
4. Water and air pollution, noise and health risks in towns.

The Government has taken some corrective measures to prevent further deterioration of environmental conditions. Legislation has been passed relating to afforestation, soil and water conservation, and preservation of the cultural heritage and wildlife. The country's efforts have been directed at total development which encompasses social, cultural, educational and environmental aspects (Lohani, 1981; UNESCO, 1985).

Environmental units will be set up in every ministry and department according to the 7th five year plan - 1985/90 (NCERT, 1987).

**School system:**

Nepal remained unaffected by the development of modern science and technology until around 1920. Higher education formally began in 1918 and included some social science. Until 1945, there were only three schools in entire country, and by 1956 only one science college. By 1972, there were more than 1,000 science graduates. A revolutionary

change came with the launching of the National Education System Plan (NESP) in 1970. The goal of education was to develop, preserve, expand and extend science and technology education and the skills necessary for the development of the country. Since 1970, there has been rapid expansion in the application of science and technology (Mali, 1982).

**General education:** 10 years (pattern: 5-year primary schooling, 2-year lower secondary schooling, 3-year secondary schooling)

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9	
Total time (hrs):		22.5	29.3	29.3
Science:		(2.3)	-	-
Mathematics:		6.8	5.2	4.0
Technology:		-	-	-

Science integrates with hygiene and with social studies in the first three years.

Integrated science teaching is followed to Grade 10.

Higher education has four levels: Proficiency Certificate, Bachelor's Degree, Master's Degree and Ph.D. Degree in certain areas. All the institutes of higher education are under the Tribhuvan University (Mallik, 1988).

#### **ENVIRONMENTAL EDUCATION:**

In recent years, certain efforts have been made to raise environmental awareness in Nepal, such as occasional publication of articles and pamphlets, celebration of World Environmental Day and establishment of some agencies and units for environmental conservation in the governmental and non-governmental sectors. Certain environmental inputs have also been introduced into the curricula of higher education. Although any clear inclusion of environmental education components in the school curricula is not yet seen, the current trend is towards the provision of environmental studies at different levels of school education. At present, environmental education does not constitute a separate subject of study at any school level (Mallik, 1988).

#### **1. Formal environmental education:**

The Ministry of Education is responsible for introducing environmental education to the formal school system (UNESCO, 1985).

##### **Primary school level:**

The first level of education, grades I-V, is designed to prepare the child to understand and appreciate the importance of the environment. The following topics in the primary curriculum are relevant to environmental education (UNESCO, 1985):

- geographical features of Nepal,
- life and culture of the people,
- ecological aspects,
- home and home gardens,
- animals and pets,

- preservation of nature,
- use of natural resources,
- adaptation of life to the environment,
- comparison of the life and environment of people in different parts of the country.

These topics are found in Social Studies and Health and Sanitation subjects in the primary curriculum. Activities and field projects such as tree planting campaigns are also included.

#### Secondary school level:

At the secondary level, environmental education is integrated into Science, Health and Social Studies curricula. The following topics relevant to environmental education are found in the secondary curriculum (UNESCO, 1985):

- preservation of forests,
- wild animals,
- mountain life,
- cities, air pollution in cities,
- ecology and natural resources,
- interdependence of life,
- cycles of nature,
- population,
- natural resources and their exploitation for economic benefit.

Since science is not a compulsory subject at the secondary level, only students in the science stream get information about environmental issues, and no alternative subject with environmental aspects is offered to the non-science stream students (Mallik, 1988).

#### University level:

There is no doubt that environmental education has been given more room in the curricula of higher education than in the curricula of school level education, particularly in the course of science and technology. At the Proficiency Certification, Bachelor's and Master's levels, environmental and ecological components are given in the courses of Biology, Ecology, Hydrology and Meteorology (Mallik, 1988).

The following tertiary level institutions are involved in environmental education, training and research (UNEP, 1986; UNESCO, 1983):

- Tribhuvan University, Curriculum Development Center, Kathmandu (undergraduate courses),
- Tribhuvan University, Institute of Science, Kathmandu,
- Tribhuvan University, Botany Department, Kathmandu.

At the tertiary level, the National Development Service Program has been introduced. The main objectives of the program are (Lohani, 1981):

- to allow the students to experience the realities of rural life,
- to offer students an opportunity to help in meeting the country's development needs during their academic careers.

The program is an integral part of the degree-level course. During service, the students work as teachers in local schools and participate in rural development activities such as:

- afforestation,
- health and adult education,
- agricultural extension,
- family welfare,

- small construction works including water supplies, roads and bridges.

## 2. Non-formal environmental education:

### Out-of-school activities:

The regular part of the secondary school extra-curricular activities is tree planting as a support to the National Afforestation Program (Lohani, 1981; UNESCO, 1985).

In 1969 the Science Club was founded, which has organized several science fairs, field trips, lectures, discussions, quiz contests and cultural exchanges. Science fairs, held each year, aims at popularizing science and technology. Some of the exhibits are related to the environment, e.g.:

- solar water heaters,
- solar water distillation plant,
- cow-dung gas plant,
- collections of insects, plants, birds from different parts of the country.

The Science Club publishes a monthly journal, "The Science Magazine" (Mali, 1982).

The Natural History Museum, established in 1975, plays a prominent role in out-of school education in the natural history and related sciences of the country. Its activities include (Mali, 1982):

- collection, preservation and study of specimens of flora and fauna,
- ecological studies,
- education of people regarding country's natural wealth,
- documentation of literature and specimens relating to the natural history of Nepal,
- publication of materials designed for the general public.

Environmental education is included in adult education programs (Lohani, 1981).

### Mass media:

Since the launching of the National Education System Plan, Radio Nepal has emerged as one of the more effective media for out-of-school dissemination of knowledge. The Departments of Agriculture, Health, Education, Forestry, Hydro Electricity and Tourism have been using Radio Nepal not only to popularize their programs, but also to educate the people and prepare them technically for development programs. Every day, about an hour is devoted to the rural development program (Mali, 1982).

Radio Nepal broadcasts a regular weekly program on ecology, the consequences of environmental degradation and the protection and preservation of forests and wildlife (Lohani, 1981; NCERT, 1987; UNEP, 1986).

Newspapers keep parallel activities with radio Nepal in informing people of developments in science and technology (Mali, 1982).

### Non-governmental organizations:

Several non-governmental organizations play an active role in the country's afforestation program. The Youth Activities Coordinating

Committee (YACC) together with some 250 youth clubs have planted hundreds of thousands of seedlings in the country's afforestation action.

Nepal Environment Conservation Group, comprised of young volunteers of various professions, promotes environmental awareness among the general public through exhibitions, talks, field trips, film shows, pamphlets and other materials (UNEP, 1986).

### 3. Training of environmental education personnel:

The history of teacher education dates back to 1947, when the Basic Teacher Training center was established in Kathmandu. The College of Education was established in 1956. Presently, the Institute of Education under the Tribhuvan University with its several campuses handles teacher training education in the country. Since there is no separate provision for environmental education in the school curricula, no special environmental education courses are offered to teachers (Malik, 1988).

In 1982, a National Workshop on Environmental Problems of Nepal was organized. 30 participants - school supervisors, teacher educators and curriculum experts attended the workshop (UNESCO-UNEP, 1987).

### 4. Major environmental education problems and future plans:

In 1976, the following problems were identified in the field of environmental education:

- At the primary and secondary level the principal obstacle is shortage of teaching personnel qualified in the environmental education.
- At the tertiary level the main problem is the shortage of specialists in environmental fields and professionals with complementary environmental training, and to a lesser extent, a lack of educational facilities and equipment such as buildings, libraries, laboratories and specialized centers.
- At the out-of-school of environmental education, the main obstacle is a shortage of trained guides and leaders (UNESCO-UNEP, 1976).

The following priority actions have been suggested to improve environmental education in the country (Malik, 1988):

- cataloguing the problems related to environmental deterioration in different parts of the country,
- identifying the remedies for the environmental problems,
- distributing consciousness-raising curricular activities and programs to all educational levels in organized and systematic ways,
- introducing environment education at the teacher education level, especially the methodology of teaching and the conducting activities related to it.

### 5. Some institutions engaged in the environmental activities:

The following government departments and tertiary level institutions are being involved in environmental activities (Lohani, 1981; UNESCO, UNEP, 1986; UNESCO, 1983, 1985, 1989):

1. Ministry of Forests with the following departments:
  - Department of Soil Conservation and Watershed Management (projects for the conservation of soil and water resources),
  - Department of Archeology (taking care of temples),
  - Department of Local Development (maintaining and renovating temples, monasteries and other monuments of historical and cultural importance),
  - Department of National Parks and Wildlife Protection (management of parks and wildlife reserves).
2. Ministry of Education and Culture:
  - Curriculum Textbook and Supervision Development Center, Lalitpur (formal environmental education),
  - Department of Non-Formal Education, Lalitpur (non-formal environmental education).
3. Institute of Education, Bhaktapur.
4. National Curriculum Development Center, Kathmandu.
5. Tribhuvan University, Kathmandu:
  - Botany Department,
  - Institute of Science.
6. Nepal National Committee for Man and the Biosphere.

**Country: PAKISTAN****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 106.3  
 Area (thousands of square kilometers): 796  
 GNP per capita, 1988: \$350  
 Average annual growth rate, 1965-88 (percent): 2.5  
 Adult illiteracy, 1985 (percent): total 70 (female 81)  
 Percentage of age group enrolled in education (1987):  
     Primary: 52  
     Secondary: 19  
     Tertiary: 5  
 Primary level pupil-teacher ratio (1986): 39  
 Total expenditure on education as % of GNP (1985): 3.0

**Major Environmental Problems (Khan, 1987; Tirmizi, 1987):**

- rapid population growth, unbalanced distribution of population,
- mismanagement of natural ecosystems due to short-term interests in agricultural and industrial development,
- deforestation, soil erosion,
- soil pollution, waterlogging, salinity,
- water pollution, siltation,
- air pollution,
- poverty, ignorance, lack of resources.

During the period 1947 to 1960, environmental problems were almost totally neglected.

The following period, 1960 to 1972, is marked by an expansion of the country's industrial sector, introduction of the green revolution in agriculture, and the launching of big irrigation projects. Some remedial actions, though not in a concerned and systematic manner, were undertaken to combat the growing problem of soil erosion and pollution, waterlogging and salinity. A large family planning program was also started. In large cities some studies and actions started in physical planning. However, these still remained isolated actions.

The period 1972-85 marks a major break-through in the attitude of both people and government of Pakistan towards environmental preservation. A new Environmental and Urban Affairs Division was created within the Ministry of Housing, Works and Urban Development in 1975 and the responsibilities for all general environmental matters were shifted to this division. The efforts of this division helped in the strengthening of Environmental Legislation of Pakistan in December 1983. Legislation resulted in the creation of an Environmental Council of Pakistan, which supervises the efforts of environmental improvement and approves environmental policies (Khan, 1987).

**School system:**

**General education: 12 years (pattern: 5+3+2+2)**  
 School attendance is not, in law, compulsory.

## Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	26.0	27.0	30.0
Science:	3.3	3.1	4.0
Mathematics:	4.0	3.5	2.4
Technology:	3.3	3.1	6.7

Science teaching on primary level starts in Grade 1.

On secondary level integrated science teaching is followed from Grades 6 to 10.

**ENVIRONMENTAL EDUCATION:**

The concept of environmental education has undergone great change in Pakistan during the last few years. From hygiene and health education to biological ecology it has moved in the right direction by accepting the totality of environment. Today the accepted definition of environmental education in Pakistan encompasses natural, man-made, ecological, political, economic, technological, social, legislative, and cultural, as well as aesthetic, aspects of the environment. However, the shift of emphasis is not yet reflected fully in the curricula. Furthermore, courses in formal environmental education have not been integrated at various levels, nor have micro associations been developed to properly show the linkages that exist between local, national and global environments (Khan, 1987).

There is a great urgency to impart environmental education at all levels of education and to make full use of mass media. The Population and Welfare Division in collaboration with the Ministry of Education, is preparing an environmental studies curriculum. The following main objectives are to be kept in view while formulating policies for the purpose (Tirmizi, 1987):

1. **Awareness:**  
to help individuals and social groups acquire an awareness of and sensitivity to the total environment and its problems.
2. **Knowledge:**  
to help individuals and social groups acquire basic understanding of the total environment, its associated problems and humanity's responsible role and presence in it.
3. **Attitude:**  
to help individuals and social groups acquire social values, strong feelings, commitment for the environment and the motivation for actively participating in its protection and improvement.
4. **Skills:**  
to help individuals and social groups acquire the skills for solving environmental problems.
5. **Evaluation ability:**  
to help individuals and social groups develop a sense of responsibility and urgency regarding environmental problems to ensure appropriate participation which will ensure individual and collective action for the solution of these problems.

## 1. Formal environmental education:

Planning and development of environmental education at the undergraduate level is the responsibility of the Directorates of Education, Textbook Boards, and Boards of Intermediate and Secondary Education. The Ministry of Education and Provincial Education Departments provide guidelines and technical expertise if required. They coordinate activities at provincial and federal levels (Khan, 1987).

The Ministry of Education, Government of Pakistan, Curriculum Wing, and Ministry of Housing and Works, Environmental and Urban Affairs Division, jointly prepared the Coordinated Environmental Education Program (CEEP) for 1985-1990, which introduced environmental education in the country through the formal education system. The project identified curricular concepts and incorporated environmental topics into textbooks. Charts and teacher's guides have already been developed (1000 sets distributed) and in-service courses for teachers arranged. The environmental kits and audio-visual aids for students will be sent to selected schools in the near future (Murad, 1990; Popalzai, 1990).

The current CEEP Project has created environmental awareness on a limited scale. A follow-up program for environmental protection, particularly in the mass areas, is expected to be launched in collaboration with the World Bank. The project's proposal "Development of Mass Awareness of Environmental Protection and Resource Conservation Education Project" includes the following components (Murad, 1990):

1. Orientation workshops for senior education personnel, planners and decision makers.
2. Development and distribution of a journal "Environment" to all secondary schools.
3. Development of environmental awareness in students and in masses.

### Primary and secondary school level:

The subject of environmental studies is not taught as a separate discipline in elementary or higher education levels. The "infusion approach" has been used to integrate some environmental education issues within the existing subjects in the school curriculum, e.g. with language, Islamiyat, Pakistan Studies, Social studies, Science, General Science, Biology, Chemistry, Geography, Home Economics, etc. (Khan, 1987; Popalzai, 1990).

However, materials on the environment as a part of the learning package at school level will be reviewed to create familiarity with the basic concepts of family, home, school and neighborhood. The linkages of broad components of environments and their importance in the local, national and global perspective will also be emphasized (Khan, 1987).

The following program has been conceived for the improvement of environmental education at secondary school level:

1. Review of curriculum to include two or three chapters on environment within appropriate subjects in each class.
2. Development of relevant teaching/learning material.
3. Pre-service and in-service training of teachers (Khan, 1987).

Concepts of environmental education have been incorporated in the textbooks and teacher's guides. Guides for primary, middle and secondary school teachers have been prepared and training programs have been arranged (Popalzai, 1990).

According to the Coordinated Environment Education Program, the following topics related to environmental education have been introduced to selected middle and secondary level schools (Murad, 1990):

**General Science at middle level:**

1. Habitat and environment of living things:
  - living place of an animal is its habitat,
  - environment of living things and its important features,
  - some living things, their habitat and seasonal variations,
  - environment can be natural or artificial,
  - certain actions of man can disturb the environmental balance,
  - living things are affected by their own environment,
  - living things in an environment form a community,
  - animals and plants try to protect themselves from their enemies.
2. Factors covering survival:
  - living things require suitable amounts of water and food for their existence,
  - living things must have adequate space and place to live,
  - light and air are essential for life,
  - living things must be protected against enemies and diseases.

**Social Studies at middle level:**

1. Natural environment and its effects on human life.

**General Science at secondary level:**

1. Air pollution:
  - how to prevent air pollution.

**University level:**

Planning and development of curricula for graduate education falls under the purview of the Universities. University Grants Commission acts as a national coordinator at this level.

The need for an interdisciplinary course in environmental studies has been realized as an ideal situation, but limited job opportunities in the existing framework have prevented the establishment of a separate graduate program in the field. Environmental science is therefore taught as an elective course in Biological or Natural Sciences (Khan, 1987).

The University Grants Commission recently constituted a group to develop a model interdisciplinary course in Environmental Studies at the graduate level. In addition, the group recommended the following three activities:

- environmental studies as a diploma program,
- a learning course in the Open University,
- a subject coordinated elective course in the Master's program of Universities (Khan, 1987).

The following tertiary institutions offer environmental training courses (UNEP, 1986):

- Bahauddin Zakariya University, Multan;
- Gomal University, Faculty of Agriculture, Dikhan;
- Quaid-i-Azam University, Department of Biological Science, Islamabad;

- University of Karachi, Microbiology Department, Institute of Environmental Studies, Karachi.

## 2. Non-formal environmental education:

The situation in non-formal education is the least satisfactory. In a country where only a little more than a quarter of the population is literate, the environmental or ecological education in the past had a narrow range of strategies. These included agricultural extension programs and wider outreach techniques through the use of mass media. The biggest drawback has been the lack of infusion of environmental education into the adult literacy programs. Likewise no effort was made to foster environmental awareness through national campaigns (Khan, 1987).

Universities and smaller institutions are traditionally much better equipped than schools. They can select students for instruction in science subjects from a great number of applicants. As an extra curricular activity, science clubs of various kinds exist in most of these institutions. The activities include experimental work, lectures and seminars. Some science clubs promote interest in others through open house exhibitions and science and technology film shows (Akmal, 1982).

Non-formal education is handled primarily by the Literacy and Mass Education Commission, the Environment Division, Government of Pakistan, although not involved directly in curriculum planning for either formal or informal education, plays an important role in the diffusion of basic concepts through its guide books (Khan, 1987).

Realizing the importance of non-formal education, the Environment Division makes special efforts to develop materials for use by the mass media (Khan, 1987).

## 3. Training of environmental education personnel:

### Teacher training:

The Environment Division has been working on an in-service training program in environmental education (Khan, 1987).

Environmental concepts have been incorporated in the teacher education curricula. Lectures on environmental themes are being conducted during teacher training. In-service courses and workshops on environmental issues are arranged from time to time at national and provincial levels (Popalzai, 1990).

During the implementation of the Coordinated Environmental Education Program (CEEP), six training workshops on environmental education were held in Islamabad, Punjab, Sindh, Baluchistan, NWFP and Azad Jammu, and in Kashmir. About 300 teacher trainers, subject specialists, planners, instructors, teachers and supervisors from Colleges of Education, College of Elementary Teachers, Curriculum Bureaux, and Education Extension Centers, were given training on environmental education.

By the completion of the project in December 1990, six mobile workshops on environmental education are planned for the training and orientation of school teachers, students and the community (Murad, 1990).

#### 4. Major environmental education problems:

There are numerous problems in the implementation of strategies for the improvement of environmental education. The most important is the deficiency of experts and training materials, relevant to local conditions, especially for non-formal environmental education (Khan, 1987).

In 1976, the following problems were identified by UNESCO and UNEP:

- at the pre-school level: insufficiency of necessary funds;
- at the primary level: shortage of qualified teaching personnel in the field of environmental education and teacher/students organizations;
- at the secondary level: relative shortage of teaching personnel;
- at tertiary level: shortage of specialists in different sub-areas of environment, and insufficiency of educational facilities such as buildings, laboratories, specialized centers and libraries;
- at the out-of school education for youth: lack of trained personnel and relevant educational materials, such as audio-visual aids, games, guides and magazines.

(UNESCO-UNEP, 1976).

#### 5. Some institutions active in the field of environmental education

(Murad, 1990; UNESCO, 1989);

- Curriculum Wing, Ministry of Education;
- Environmental and Urban Affairs Division, Ministry of Housing and Works;
- Government Pilot Secondary School, Sialkot, Panjab.

##### Contact persons:

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**Country: PAPUA NEW GUINEA****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 3.7  
 Area (thousands of square kilometers): 463  
 GNP per capita, 1988: \$810  
 Average annual growth rate, 1965-88 (percent): 0.5  
 Adult illiteracy, 1985 (percent): total 55 (female 65)  
 Percentage of age group enrolled in education (1987):  
   Primary: 70  
   Secondary: 12  
   Tertiary: 2  
 Primary level pupil-teacher ratio (1987): 31  
 Total expenditure on education as % of GNP (1979): 4.7

**Major environmental problems (Bryant, 1989):**

- soil degradation and soil erosion,
- reduction of forest cover,
- endangered species,
- damage to productive coastal resources and fisheries,
- pesticide pollution,
- lack of safe domestic waste, solid waste, and toxic chemicals disposal,
- water shortage.

Papua New Guinea has comprehensive and general legislation for the protection and conservation of the environment.

**General education: 12 years (pattern: 6+4+2)**

School attendance is not, in law, compulsory.

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	26.8	27.5	26.6
Science:	0.5	0.8	3.3
Mathematics:	3.5	3.5	3.3
Technology:	0	0	0

Science teaching on primary level starts in Grade 1.

Integrated science teaching is followed from Grades 7 to 10. Optional courses during the late secondary school years include physics, chemistry, biology, agriculture and community life, and science and society (Grade 12).

Total time spent on mathematics and science is 48.2 percent.

**ENVIRONMENTAL EDUCATION:**

Environmental education has a low priority in the plans of the government. However, the formal educational institutions are funded to

an extent which enables them to enact and maintain long-term environmental training and educational programs (Bryant, 1989).

#### 1. Formal environmental education:

##### Primary and secondary school level:

Children attend primary or junior school from five or six years until they are about twelve years old. In the basic science courses the principles of environmental science are taught in an indirect manner, e.g. the students are instructed on the role of health and taking care of their homes, and are taught to recognize some plants and to understand the environmental significance of trees (Bryant, 1989).

Papua New Guinea has its own high school system which also includes materials on environmental awareness and management (Bryant, 1989).

The secondary science project, including biology, chemistry and physics, started in 1971. The main objective was to develop a secondary science curriculum relevant to Papua New Guinea, to be taught to a large extent by local teachers to whom English is a second language. The target population were 12-15 year old students, whose the native language is not English. During the project, Teacher's Guides and Pupils Readers Forms were produced, as well as sets of slides (Lockard, 1977).

In 1979, the South Pacific Commission produced a set of Environmental Mini-Lessons for use in primary and secondary schools throughout the Pacific. They can be used either as a complete course of short units on the environment, or as supplementary material for existing courses (Bryant, 1989).

The Papua New Guinea's Secondary Schools Community Extension Project (SSCEP) began as a pilot project in five secondary schools in 1978 - 1983. It attempted to adapt the secondary school science curriculum to make it more relevant to environmental and community concerns and to rural development, with examples also from mathematics and agriculture. After encouraging evaluations, the project has now entered a trial dissemination phase in more schools (Vulliamy, 1987).

In 1985, the Preliminary Annotated Bibliography of Pacific Islands Environmental Education Materials, and five fact sheets (on soils, forests, conservation, coral reefs and pesticides) were published. The South Pacific Regional Environment Program (SPREP) is now producing environmental kits for use in schools which include fact sheets, games, student workbooks, and slide and tape sets (Bryant, 1989).

##### University level:

There is a well-developed interest in environmental education and training at the university level. The University of Papua New Guinea in Port Moresby has environmental courses and degree programs straddling the arts and science disciplines (Bryant, 1989).

The Biology Department, University of Papua New Guinea, is working on the field of animal and plant wildlife, water (oceans and fresh water), and renewable/non-renewable resources. It offers advisory services and conducts training of teachers, leaders and environmental specialists (UNESCO, 1989).

Besides the above, environmental education and training courses are also offered at the Papua New Guinea University of Technology (UNEP, 1986).

The Papua New Guinea Forestry College conducts activities related to the supply and use of energy, renewable and non-renewable resources, wildlife, and general environmental studies (UNESCO, 1989).

Environmental research is carried out in association with organizations such as South Pacific Regional Environmental Program (SPREP) and the United Nations Environment Program (UNEP). Student fieldwork in geography at the University of Papua New Guinea has been funded by SPREP as part of its environmental training responsibility (Bryant, 1989).

## 2. Non-formal environmental education:

Informal community environmental education barely exists, except traditionally (Bryant, 1989).

### Mass media:

There is a weekly environmental column in one of the newspapers (Bryan, 1989).

### Non-governmental organizations:

There are very few organizations in the South Pacific which emphasize public or community environmental education.

The Melanesian Environmental Foundation, a non-secular, community-based, non-government organization in Papua New Guinea, commenced activity in 1986. The organization aims to prepare and distribute environmental education kits and is funded by SPREP (Bryant, 1989).

## 3. Training of environmental education personnel:

The South Pacific Regional Environment Program (SPREP) has been involved in conducting training courses for environmental educators and managers in the past few years (Bryant, 1989).

## 4. Major environmental education problems:

The dependence on fluctuating and declining foreign aid, the shortage of equipment, and the frequent absence of maintenance skills makes the environmental education and dissemination of information difficult (Bryant, 1989).

**5. Some institutions involved in the field of environmental education (UNESCO, 1989):**

- University of Papua New Guinea, Biology Department, National Capital District;
- Papua New Guinea Forestry College, Bulolo.

**Country: PHILIPPINES****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 59.9  
Area (thousands of square kilometers): 300  
GNP per capita, 1988: \$630  
Average annual growth rate, 1965-88 (percent): 1.6  
Adult illiteracy, 1985 (percent): total 14 (female 15)  
Percentage of age group enrolled in education (1987):  
    Primary: 106  
    Secondary: 68  
    Tertiary: 38  
Primary net enrollment, 1975 (percent): 95  
Primary level pupil-teacher ratio (1986): 31  
Total expenditure on education as % of GNP (1986): 1.7

**Major environmental problems (Diezmos, 1981; Porferio et al., 1985; Soerjani, 1989; UNESCO, 1990):**

- rapid population increase,
- deforestation and soil erosion,
- soil pollution: high levels of fertilizers, insecticides, fungicides and herbicides,
- increasing water pollution: municipal wastes, industrial wastes (food and chemical industry), heavy metals, fertilizers, pesticides,
- air pollution in highly populated areas, especially in Metro-Manila: from car exhaust, oil-fired electric generators, industrial emissions,
- noise pollution in urban areas: road traffic, construction activities, industries, aircraft,
- improper garbage disposal,
- unregulated import of technology and hazardous materials,
- lack of interest to invest in pollution management,
- poor environmental health and sanitation,
- weak implementation of environmental laws and policies,
- endangered animal and plant species,
- conflicts between environmental protection efforts and economic goals, e.g. the nuclear power plant dilemma (50 megawatt nuclear power plant in Morong, Bataan).

There is a trend to preserve the environment, resulting in stricter environmental regulations. Foremost among these are the anti-pollution laws and the requirement of environmental-impact assessments for almost all major projects (Diezmos, 1981).

There are four major legal documents which form the nucleus of environmental law. These are (UNESCO, 1990):

- Philippine Environment Policy,
- Philippine Environment Code,
- Pollution Central Law,

- Environmental Impact Laws.

**School system:**

The Philippines educational system has undergone a continuous process of transformation, brought by the political and socio-economic history of the country, and has now more American influence (Soerjani, 1989).

**General education: 10 years (pattern: 6+2+2)**

**Primary school level:**

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6
Total time (hrs):	19.1	28.3
Science:	-	3.3
Mathematics:	3.3	3.3
Technology:	-	-

Science teaching on the primary level starts in Grade 3.

**Secondary school level:**

On a secondary level, over one-third of secondary students are in private schools.

Science is a compulsory subject. Some special science high schools exist, such as Manila Science High School or the Philippines Science High School.

To enroll in a four year or longer college program, high school seniors must pass the National College Entrance Examination, which does not include science (Thulstrup, 1990).

**University level:**

At the tertiary level, private institutions dominate the picture: of around 1,200 colleges and universities more than 800 are private. Only very few universities offer undergraduate degrees in natural science and mathematics. (Thulstrup, 1990).

**ENVIRONMENTAL EDUCATION:**

A Workshop on Environmental Education and Training Needs for Philippine Environmental Programs, conducted under the joint sponsorship of the National Science Development Board and the National Academy of Sciences of the United States, held in Manila in May 1974, recommended the teaching of environmental education from primary school through university, and in both public and private schools (Diezmos, 1981).

Since 1979, environmental education topics have been integrated into the school curricula at all levels (UNEP, 1986).

## 1. Formal environmental education:

At the primary and secondary levels, textbooks and supplementary materials on the environment have been produced. A number of environmental education materials for teachers have been prepared (UNEP, 1986).

In the curriculum, following are the main objectives of environmental education (Diezmos, 1981):

### General objectives:

- To educate the people in the prevention of pollution as a means of improving environmental quality.
- To adopt practical measures in order to combat diseases and prevent deaths caused by pollution.

### Specific objectives:

- To train a staff of teachers in environmental education.
- To adopt practical strategies to control and prevent pollution of air, water and soil.
- To create a system for educating students in the community.

A conceptual scheme for environmental education includes the five major themes:

1. Living things are interdependent with one another and with their environment.
2. Organisms (or populations of organisms) are the product of their heredity and environment.
3. Organisms and environments are in constant change.
4. When matter changes from one form to another, the amount of matter remains unchanged.
5. The economy of a region depends on the utilization of its resources and technology.

With these concepts as tools, teachers may guide their students to discover what is in their surroundings, and to place their discoveries in a perspective that will encourage awareness and imaginative problem-solving and develop an understanding of their relationships with the environment (Diezmos, 1981).

### Primary school level:

In primary school, emphasis is on developing understanding which will contribute to the children's behavior as trustees of natural resources and as future decision-makers and participants in development.

Environmental education concepts are integrated into existing subject areas. Examples of learning sequences are given below by grade (Diezmos, 1981):

#### Grade 1:.

##### A. Living things are interdependent with one another and with their environment:

1. Around the school are many different kinds of plants and animals.
2. Plants provide clothing, shelter and recreation.
3. Animals are important to man because they help to serve many of our needs.
4. Plants remove essential elements from the soil.
5. Living things require water.
6. Plants, animals, soil and water are related to one another.

##### B. Organisms (or populations of organisms) are the product of their heredity and environment:

1. Each kind of plant and animal has certain needs. It can live only in places where these needs are met.

2. Animals have a habit of living in a kind of place where they are able to satisfy their needs.
3. Plant growth depends in part on the amount of radiant energy received from the sun.
4. Each kind of tree has a shape, bark, wood, leaves, flowers and fruits that are different from other trees.
5. Animals and plants fit the place where they live.

C. Organisms and environments are in constant change:

1. The air we breathe is the same on the entire surface of the earth.
2. Air contains water. Air receives water through evaporation.
3. Air supports combustion.

D. When matter changes from one form to another the total amount remains unchanged:

1. Water dissolves many substances.
2. Water expands when frozen. Warm water rises.
3. Wind is moving air.

Grade II:

A. Living things are interdependent with one another and with their environment:

1. Food is stored in leaves, stems, roots and seeds in plants.
2. Plants are the source of all food: animals use, convert and store this food.
3. Animals need food, water, cover and space.
4. Plants and animals live together and depend on each other for some of their needs.
5. Water is made available to living things by a cycle of evaporation and condensation.
6. Most living things depend on oxygen in the air.

B. Organisms (or populations of organisms) are the product of their heredity and environment:

1. Living things are linked by their food habits.
2. Green plants differ from other living things in that they make food for the living world.
3. Plants respond to light, gravity and water.
4. Plants are adapted to a wide range of environmental factors.
5. Special surroundings make things behave to suit these surroundings.

C. Organisms and environments are in constant change:

1. Nature and man shape the earth surface.
2. The weather causes constant changes on the earth.
3. The water on the earth is in constant change.
4. Soil holds water.

D. When matter changes from one form to another the total amount remains unchanged:

1. Water evaporates to become a gas (water vapor) and freezes to become solid (ice or snow).
2. Physical changes in matter can be both helpful and unhelpful.

Grade III:

A. Living things are interdependent with one another and with their environment:

1. Energy sources involved in weather include the sun and the rotating earth.
2. Green plants get matter from the environment for growth.
3. Plants provide the soil with cover and protection.
4. Trees help in keeping water where we need it.
5. All living things finally depend on green plants for food.
6. Humans need the wilderness and natural areas for play as well as for their practical value.

B. Organisms (or populations of organisms) are the product of their heredity and environment:

1. Different types of animals vary in their organic needs.
2. Living things are organized in form and function to carry on activities that sustain life.
3. The sun's elements are all found on the earth.
4. Space on earth is limited. All living things occupy space.
5. Competition is the foremost of all relationships between living things.

C. Organisms and environments are in constant change:

1. Chemical and physical changes in the earth's crust change rocks into soil.
2. Soil erosion by water, wind, and gravity are examples of the constant change occurring on the earth's crust.
3. Mountains are formed by folding and faulting in the earth's crust, by volcanic action and by erosion of plateaux.

D. When matter changes from one form to another the total amount remains unchanged:

1. Properties of a substance affect its reaction with other substances.
2. Through the process of decay or decomposition, organic matter is broken down to form soil humus.
3. In chemical or physical changes, the total amount remains constant.
4. The sun's energy striking a surface is absorbed, reflected and/or transmitted.

**Grade IV:**

A. Living things are interdependent with one another and with their environment:

1. Plants and animals are dependent on each other and their non-living environment.
2. The interactions of most organisms and their environment are reciprocal.
3. Natural predation is necessary in order to maintain a healthy population or certain species in balance with the environment.
4. Temperature, rainfall and other weather elements are important factors which should help determine our use of the land.
5. Inorganic soil is formed by weathering of rocks, due to the action of water, wind, heat and cold.

B. Organisms (or population of organisms) are the product of their heredity and environment:

1. Animals compete for space, food and shelter.
2. Environment determines the kinds of organisms which live in the community.
3. Living things reproduce and develop themselves in a given environment.
4. Energy from the sun is stored in many forms.
5. The sun is the major source of energy involved in the weather.

C. Organisms and environments are in constant change:

1. Some rocks and minerals have a plant or animal source.
2. Minerals are classified according to origin and physical properties.
3. Air exerts pressure in all directions. Air pressure can do useful work.
4. Air contains dust and other pollution.
5. The topsoil on which life depends is a thin layer of the surface of the earth.
6. A lack of balance in non-living things exists because of changes in the earth.

D. When matter changes from one form to another the total amount remains unchanged:

1. Weather forecasting is based on the knowledge of the weather elements.
2. Chemical changes in matter produce useful products.
3. Matter exists in small units called molecules and atoms.
4. Atoms have weight.

E. The economy of a region depends on the utilization of its resources and technology:

1. Trees and products from trees are vital to the economy of the community, city, nation and the world.
2. Fertile soil was partly responsible for the patterns of development and the speed of development of technology.
3. Careful management practices help to reduce the flood waters and silt that small streams empty into rivers and lakes.
4. Forests are important in helping to protect watersheds from droughts and floods.
5. One phase of wildlife management is the proper control and manipulation of habitats by man through (a) fire, cutting, and spraying, (b) flooding, (c) food and cover planting, (d) lakes and stream improvement and (e) soil conservation practices.

**Grade V:**

A. Living things are interdependent with one another and with their environment:

1. A balance of nature is kept through the interrelationship of plants and animals and their non-living environment.

2. Organisms may suffer and die when an imbalance in nature occurs.
3. Increasing populations require an increase in food production to prevent ecological decline.
4. Trees influence soil, water, wildlife and the landscape.
5. Individual interaction with the environment creates appreciation for the environment.
6. The living world maintains balance through cycles.

B. Organisms (or populations of organisms) are the product of their heredity and environment:

1. A living thing reproduces itself, develops and interacts in a given environment.
2. Living things capture matter from the environment and return it to the environment.
3. A natural habitat has limited capacity for supporting the organisms that live in it.
4. Wildlife must be conserved and controlled to prevent extinction or overpopulation.
5. Continued population expansion in a limited space creates problems with food, clothing, shelter and recreation.

C. Organisms and environments are in constant change:

1. Changing environments affect living things.
2. Living things have changed over the ages.
3. The oceans are a source of minerals.
4. Some mining operations threaten other resources and are threatened by depletion.

D. When matter changes from one form to another the total amount remains unchanged:

1. The constant composition of the atmosphere can be upset by the activities of man.
2. Chemical changes in matter can be destructive or constructive.
3. Knowledge of the concepts underlying combustion enables us to prevent losses by fire.

E. The economy of a region depends on the utilization of its resources and technology:

1. Man uses the resources of the environment.
2. Wise use of community resources tends to assure their availability.
3. A nation's physical foundation is its soil resource, and the nation's success depends much on how well this soil resource is managed.
4. The oceans provide high-quality protein for the diet of man, and minerals for his industries.
5. Planting, experimentation and selective and clear cutting, followed by replanting and fire control are part of the work of managing forests.
6. Carelessness that often results in the destruction of natural resources includes soil erosion, fire, drainage and pollution of water.

#### Grade VI:

A. Living things are interdependent with one another and with their environment:

1. Man's use of streams, lakes and the sea provides him with many of his personal and community needs.
2. Forests have many natural enemies (disease, wild animals, domestic animals, men, fire and weather).
3. Plants growing together form communities. Each member of the community influences its neighbor.
4. Life within a group imposes duties and responsibilities as well as entailing rights and privileges.
5. Responsibility for maintaining an environment for life and fulfillment of needs and interests is the result of interaction between national and local units of government.
6. Living things interchange matter and energy with the environment.

B. Organisms (or populations of organisms) are the product of their heredity and environment:

1. A sense of beauty is essential to the well-being of man.
2. Many adaptations to changes in the environment are necessary from one generation to another.
3. Man is the only organism that can consciously modify its own environment.
4. The participation of citizens in a community ensures the creation of a society in which all individuals can develop fruitfully.
5. Man can alter the environment of organisms in order to destroy or protect them.

C. Organisms and environments are in constant change:

1. Soils are a combination of minerals, living organisms, organic matter, water and air.
2. Water is a self-replenishing and self-depleting resource: it is intermittently replenished by precipitation and is steadily depleted by evaporation, percolation and surface- and underground-runoff.
3. Forests are constantly undergoing change, and as they mature, and are harvested or die, some species of plants and animals may be replaced by others.
4. Wildlife population are decreased by many natural and man-made factors.
5. The erosion and misuse of productive topsoil helped to cause the disappearance of some nations. A shift in fertility of surface soil can cause a shift in human population.

D. When matter changes from one form to another the total amount remains unchanged:

1. Living micro-organisms, fungi and small animals help to decompose the organic matter in the soil.
2. Living things depend upon bacteria in the soil to convert inorganic matter into usable nitrates.
3. Weather management is carried out by smudge pots, trees used as windbreaks and cloud seeding.

E. The economy of a region depends on the utilization of its resources and technology:

1. There are two types of resources: renewable and non-renewable.
2. We hold title to and can, as stewards or trustees, freely use our natural resources.
3. The nature and abundance of a community's resources change during a lifetime.
4. Various kinds of industries will need to depend on the scientific method and scientific practices to solve their problems as polluters of the environment.
5. People cause pollution and destruction of natural resources, and people as citizens have a responsibility to conserve resources and prevent environmental degradation.

Following is an example of experimental activities, undertaken in the elementary school, grade III (Diezmos, 1981):

Area: Foods  
Unit: Utilization of garbage

Part 1: The experiment

1. We want to know:  
Does garbage have value?
2. We use:  
Banana and papaya peelings, eggshells, heads and bones of dried fish, sweet potato leaves, rice husks, chickens.
3. We do:  
Buy two live chickens (chicken A and B) of the same size and weight. Get banana and papaya peelings, eggshells, shrimp shells, heads and bones of fish, sweet potato leaves and rice husks.

Pupils are divided into groups.

Group 1 grinds the heads and bones of the dried fish. Group 2 chops the peelings and sweet potato leaves. Group 3 chops eggshells and shrimp shells. Group 4 mixes rice husks with a small amount of water.

Next, groups 1, 2, and 3 mix all the refuse together. They feed chicken A with the mixed refuse. Group 4 feeds chicken B with rice husks only.

4. We observe:
  - a) Does chicken A like to eat the mixed refuse?
  - b) Compare the weights of chicken A and Chicken B every week for one month. Record your observation in a table.
5. We learn:
  - a) Do chickens like to eat mixed refuse?
  - b) Is mixed refuse better chicken food than rice husks?

6. We propose to do:
  - a) In school: We encourage our friends to place fruit peelings and food scraps and waste in a receptacle and gather these for chicken food.
  - b) In the community: We promote the use of fruit and vegetable peelings, eggshells and other refuse for poultry food.
7. We hope to accomplish:
 

Help people to appreciate the value of food refuse and to use it for poultry food. This should reduce dirty and foul-smelling surroundings.

**Part 2: Implications for other subject areas:**

1. Language arts:
 

Teach such expressions as banana peelings, chop, grid, garbage, feed, refuse, sweet potato (camote) leaves, rice husks (darak), mix together. Write a short paragraph on how garbage can be of value. Read the paragraph and invite discussion.
2. Arithmetic:
 

Weight the chickens using kilos or pounds. Compute how much money was saved when chickens were fed with the mixed refuse.
3. Social studies:
 

How does using waste help the community?

In the early 1980's, discussions were under way at the policy-making level of the Ministry of Education to introduce in Environmental Living as a major subject area in the elementary education curriculum. The subject would be divided into four main components (Diezmos, 1981):

1. Living in a Socio-Economic Environment (incorporating aspects of Sociology, History, Geography, Economics)
2. Living in a Cultural Environment (incorporating aspects of Music, Art)
3. Living in a Physical and Biological Environment (incorporating aspects of Science, Health)
4. Living in a Work Environment (incorporating aspects of work and livelihood).

**Secondary school level:**

Environmental topics are part of the science curricula, and also integrated with social studies, health, communication arts (English), and practical arts (UNESCO, 1989).

The first science course in the lower secondary school is Environmental Science. Examples of learning sequences for the lower secondary stage are given below (Diezmos, 1981):

**A. Living things are interdependent with one another and with their environment:**

1. Green plants capture energy from the sun and combine it with raw materials from soils, water and air.
2. Plants store food in the form of starch, sugars, proteins, vitamins and cellulose.
3. In one of nature's important cycles, nitrogen from the air is made available to plants and animals.
4. In the carbon dioxide cycle, oxygen is freed and returned to the atmosphere.
5. Plants keep the supply of oxygen in the air constant through photo-synthesis.
6. In a biotic community, species tend to interact with one another and modify the conditions of life with which each exists.
7. Species and environmental factors interact to keep animal population in balance in the community.

**B. Organisms (or populations of organisms) are the product of their heredity and environment:**

1. The characteristics of a living thing are laid down in a genetic code.
2. Living things reproduce and develop themselves in a given environment.
3. Special environments require special adaptive behaviors.

4. All organisms have limits of tolerance for environmental variations.
5. Group living requires co-operation within and between groups in order to maintain the best physical, social and cultural environment.

C. Organisms and environments are in constant change:

1. The planet earth has many examples of geologic changes.
2. Fossils are evidence of former plant or animal life.
3. Living things have changed through the ages.
4. Changing environments affect living things.
5. Man influences living things by changing the environment to meet his needs.

D. When matter changes from one form to another the total amount remains unchanged:

1. Matter can be transformed to produce energy.
2. Some minerals are valuable forms of matter which can be converted to usable products of energy.
3. Production of electrical energy is dependent upon natural resources.
4. The use of electricity, synthetic materials and nuclear energy may not reduce the pressure of depletion of scarce resources.

E. The economy of a region depends on the utilization of its resources and technology:

1. Man has learned to conserve and improve soil by using fertilizer and lime, and by erosion control, irrigation, and other conservation practices.
2. Forest management practices will sustain catchment areas and prevent wasteful soil erosion.
3. A continuing and adequate supply of fresh water depends on the wise use and development of water resources.
4. Industrial pollutants can be disposed of with minimum damage to the environment.
5. Recycling of waters can diminish pollution and depletion of resources.
6. Deep concern on everyone's part can lead to the enhancement of the environment.
7. Growing population and increased demands for agricultural and industrial products may cause pollution problems and the depletion of resources.

In the chemistry core textbook for secondary schools (Science and Technology 3) abstract concepts are related to students life by citing familiar technological applications or environmental phenomena. For example (Tan, 1989):

Chemistry topic: Diffusion/Gases in the Atmosphere  
Application: Air Pollution

Energy-Environment Enhancement Concepts:

1. A pollutant once released from its source undergoes three things:
  - a) travel through air, scattered by temperature differences and the wind,
  - b) reacts with itself or other substance both chemically and physically,
  - c) reaches a sink such as oceans or soils or a receptor such as a person or a plant.
2. The degree of harmfulness of an pollutant is determined by its quantity, residence time, interaction with other pollutants, and tolerance level.
3. Some meteorological and topographical factors favor rapid spreading and transformation of pollutants in the air.
4. Carbon monoxide from exhaust of motor vehicles due to incomplete combustion is harmful even in small amounts.
5. An increase in atmospheric CO<sub>2</sub> can increase atmospheric temperature. This may cause the melting of ice caps and inundation of coastal areas.
6. Prevention of air pollution should occur at the source, e.g. use of a cleaner energy source and change in industrial process. Greater effort should be upon prevention rather than controlling air pollution.
7. There is equipment that prevents or controls air pollution, e.g. a Cottrell precipitator for the electro-deposition of smoke and dust in factories.
8. Air quality standards are legal limits placed on levels of pollutants in ambient air.
9. There are laws to protect the environment from degradation and pollution.
10. Every individual has the responsibility for improving the air quality of the community.

Chemistry topic: Carbon compounds  
Application: Plastics/Pesticides/CFC's  
Energy - Environment Enhancement concepts:

1. Plastics do not decompose. Their improper disposal clogs waterways which cause urban flooding, provides breeding grounds for pests, and degrades the landscape.
2. Biodegradable plastics should be developed.
3. Burning of plastics produces air pollutants, such as toxic HCl from polyvinyl chloride (PVC). Waste plastics can be recycled to reduce consumption of fossil fuels.
4. The use of fertilizers and pesticides has increased crop yield. Pesticides contain toxic substances that affect living organisms. Increased fertilizer run-off has caused eutrophication.
5. CFC's are believed to destroy the ozone layer, increasing the exposure to ultraviolet rays of life forms on earth causing genetic defects, skin cancers, low agricultural yield, etc.

Chemistry topic: Energy and Change

Application: Energy Crisis

Energy- Environment Enhancement Concepts:

1. Any energy crisis that we face is not a shortage of energy taking the view that energy can never be destroyed. More accurately, it is a shortage of useful forms of energy.
2. Fossil fuel formation is a slow geologic process, and these materials are non-renewable or are not recyclable.
3. Whenever we attempt to order a part of nature, the disorder created in our environment exceeds the order created in the system.
4. A steam generator power plant creates disorder by producing air pollution and emitting heat.
5. Exploring, processing and transporting large amounts of fuel have undesirable impacts on the environment.

Chemistry Topic: Solutions/Solubility of Gases

Application: Acid Rain/Water Pollution

Energy - Environment Enhancement Concepts:

1. Rain dissolves the different oxides (particularly of sulfur and nitrogen from the burning of fossil fuels) in air, forming "acid rain" which eventually affect the soil, water and the life in them.
2. Thermal pollution of bodies of water is caused by discharge of hot water from industrial and power plants.
3. Less oxygen is dissolved in bodies of water with higher than normal temperatures.

Following is an example of experimental activities undertaken in the high school, which combine physics and environmental education (Diezmos, 1981):

Unit 2: How man controls liquids and gases

Topic A: Pressure of liquids

Experiment 2: Downward pressure of water

Phase 1:

We want to:  
analyze and compare downward pressures of water of different depths. Which has a greater downward pressure, deeper water or shallower water?

Phase 2:

We use:  
a two-foot high can, water, two-foot-high supporting stand, corks, meter stick.

Phase 3:

We do:  
Bore five holes in the side of the can, which should be four inches (10 cm) apart from each other from the upper part of the can going downward. Place the can on the supporting stand. Close the holes with corks. Fill the can with water. Then start removing the corks from the holes starting from the highest hole to the lowest. Measure the distances of the places where the water falls from the foot of the supporting stand.

We observe:  
Which of the five holes pours water farthest from the foot of the supporting stand?  
Which of the five holes pours water nearest to the foot of the supporting stand?  
What are the downward pressures of water at the different depths as indicated by the distances of the holes from the upper part of the can or from the bottom?

Create a table.

We learn:

- Why the water from the holes falls on different places at different distances?
- Why the water coming from the lowest hole falls farthest from the foot of the stand?
- Why the water coming from the highest hole falls nearest the foot of the stand?
- What can we therefore conclude?

Phase 4:

We apply:

- How do we use water pressure in our homes?
- How does the Water Authority construct water main pipes and secondary pipes to the homes?
- How much water do homes far from the water source of the reservoir get?
- How much water do homes nearest the source get?
- How can the principles of water pressure be applied to irrigation of lands?

Phase 5:

Moral and ethical implications:

- What problems confront farmers in using an irrigation system?
- Why do two families living in a two-storied building compete regarding the use of water faucets?
- Do the homes receive an equal amounts and pressure of water from the central system?
- How must the water main and secondary pipes be constructed so that the consumers will not quarrel?
- Do the lands of the farmers getting water from the irrigation system receive equal amounts and pressure of water?

For biology teaching, the University of Philippines, Science Education Center (UPSEC) initiated a project entitled "Using the environment as a Teaching Resource", and developed a folio of environmental biology materials to be used in studying ecosystems. The first folio, "Grassland Ecology", for example, contains the following materials (Gregorio, 1979):

1. Handbook of Common Methods Used in Studying the Grassland:

- identification of the physical and chemical composition of a grassland,
  - determination of the physical and chemical compositions affecting the grassland ecosystem,
  - morphometric study of a grassland habitat,
  - estimation of the biological productivity in a grassland environment,
  - uses of grassland for pasture, agriculture, settlement and agriculture.
- Two reference guidebooks accompany the handbook.

2. Guidebook to Common Plants in the Grassland:

- descriptions of plants in the grasslands and waterlands,
- their habitats,
- their economic use:
  - Plants for forage (animal food),
  - Plants with medicinal uses,
  - Plants with various economic uses (as land cover and green manure, as food, as source of fibers, as ornamentals, as source of essential oils),
  - Lower plant species associated with grasslands (mosses, ferns, fungi).
  - Plants with no known economic uses.

3. Guidebook to Common Animals in the Grassland:

- groups of animals for ease of identification,
- structure of animals, parts of the body,
- economic uses.

Not all topics of an environmental problem are discussed in the core textbooks. They may be irrelevant to science concept being developed. To overcome this limitation and to give an interested reader a holistic view of the environmental phenomenon, self-contained supplementary

materials have been developed, that expose students to activities at work experiences that are useful, productive and relevant to any setting - urban or rural. Some examples of supplementary materials are given below (Tan, 1989; Gregorio, 1979):

1. Environmental Series: Air, Water and Soil
2. Potable Water from Sea Water by Solar Distillation
3. Geothermal Energy: Its Chemical and Thermal Effects
4. Which Energy Source for Your Community?
5. Plastics in Our Lives
6. Laundry Soap from Used Oil
7. Global Warming
8. Charcoal Making with Less Air Pollution
9. Waste Not, Want Not
10. Natural Pesticides: An Alternative To Synthetics
11. Plants of the Philippines.
12. Philippines Birds and Animals.

Environmental science was taught as an elective subject in many secondary schools, both private and public. Unfortunately, in 1989 electives were removed with the introduction of the New Secondary Education Curriculum. Thus, environmental science will no longer be offered as a separate elective upon the full implementation of the new curriculum (UNESCO, 1990).

#### University level:

At the tertiary level, even non-science students are required to take one environmental science related subject (Tan, 1989).

Environmental education is an integral part of Natural Science courses for non-science students during a general college education. Science students, on the other hand, are exposed to the basic environmental education in biology courses and more extensively in ecology course. At the tertiary level, environmentalism is integrated in all disciplines (UNESCO, 1990).

Some universities are offering special courses on the environment at undergraduate and postgraduate levels while other universities are offering environmental subjects as a part of the general education program or as elective courses (UNEP, 1986).

University of the Philippines at Diliman has a doctoral program in environmental sciences, with various combinations of study among the biological and earth sciences possible (Romm, 1979), and a Ph.D. program in environmental engineering (Thulstrup, 1990).

The following institutions are offering environmental education and training courses at the tertiary level (UNEP, 1986):

- Central Luzon State University,
- Central Mindanao University,
- Centro Escolar University,
- De La Salle University,
- Divine Word University of Tacloban,
- Maryknoll College Foundation, Inc.,
- Pamantasan ng Lungsod ng Maynila,
- The Philippine Women's University,

- St. Louis University,
- Silliman University,
- University of the East,
- University of the Philippines,
- University of San Agustin.

**Extension programs** (for government officials, specialized technical training):

Environmental education is a continuing process in academic institutions and in-service training programs of agencies with planning responsibilities (Diezmos, 1981).

The National Environmental Protection Council (NEPC) conducts training courses for technical manpower on environmental impact assessment, soil erosion control, coastal zone management, solid waste management and environmental planning (UNEP, 1986).

## 2. Non-formal environmental education:

The non-formal environmental education program is subsumed under the Non-Formal Education Program of the Ministry of Education, Culture and Sports (MECS). The main objectives are as follows (Basilio 1985):

1. To help out-of school youth and adults attain a functional level of environmental literacy.
2. To guide them in acquiring the optimum skills necessary for study of the total environment.
3. To help them identify environmental problems and their underlying causes, and formulate ways and means of solving them.
4. To help them acquire positive social values and deep concerns for the sustenance of good environmental quality.
5. To develop in them the feeling of satisfaction and joy in participating actively in protecting and improving the environment.
6. To help them be conversant about the nature of environmental issues.
7. To provide them with opportunities to be actively involved in finding solutions and making decisions for the solution of environmental problems.

### Out-of-school activities:

Out-of school science, technology and environment education is independent of, but in coordination with, the school system and other youth institutions. Examples of successful programs include (Unesco, 1982) :

- The Science Foundation Program,
- The Science Club Movement, which include two big organizations: Philippine Society of Youth Science Clubs and Science Club Advisers Association of the Philippines,
- The Out-of-School Science Education Laboratory,
- Science Camps,
- Science Quiz,
- Youth Research Apprenticeship Action Program,
- The Philippine Science and Technology Museum Development Program.

Every year, there is a competitive youth science fair, which begins at the local level and culminates at the national level with the selection of "Ten Outstanding Young Science Researchers". On the average, about

1,000 investigatory projects are entered annually, some of which include environmental topics (UNEP, 1986).

The Science Centrum in Manila deals with environmental problems. It expects to be supplemented in a few years with an environmental pavilion, illustrating local environmental issues (Thulstrup, 1990).

**Adult education activities:**

The International Regenerative Agriculture Training Program, conducted since 1986 by the International Institute of Rural Reconstruction, Philippines, assists villagers in adopting regenerative agricultural strategies to improve food security, preserve the environment, and conserve genetic seed stocks. Strategies were developed, tested, and refined with the participation of local farmers. Using workshops and training kits adapted to each local environment, slide sets and videos, the Institute has reached an estimated 100,000 families (Gonsalves, 1990).

**Activities for the general public:**

The National Environmental Protection Council coordinates promotion of public information programs with other interested government agencies (UNEP, 1986).

**Non-governmental organizations:**

Many of the activities of the non-governmental organizations are aimed at preserving and/or conserving specific flora and fauna in the Philippines. Lectures, workshops, slide presentation, films and other nature focus activities are also being organized (UNEP, 1986).

The Haribon Foundation for the Conservation of Natural Resources is the biggest non-governmental organization dedicated to environmental protection, conservation of wildlife, sustainable use of natural resources and the preservation of Filipino tribal culture. Haribon has been working towards these goals by:

1. Undertaking policy studies and scientific research to promote conservation and environmental protection;
2. Funding projects in the fields of environment protection, natural resources conservation, wildlife and parks management, and tribal ethnic preservation;
3. Establishing professorial chairs and scholarships in these fields;
4. Providing medical assistance and sustainable livelihood training for tribal, upland and costal communities;
5. Undertaking the publication of newsletters, quarterly bulletins, occasional papers, and white papers on natural resources issues;
6. Conducting and/or underwriting signature campaigns, seminars, symposia, conferences and mass media campaigns dedicated to conservation;
7. Managing conservation projects on behalf of national and international agencies.

The Foundation holds regular monthly membership meetings with lectures, progress reports, film presentations, exhibits and discussions on environmental and conservation issues.

The Haribon Foundation's publications include:

- UPDATE - a newsletter providing members with information on Haribon's activities, projects, new outdoor gear and clothing, and scheduled tours of expeditions and explorations.
- ENVIOSCOPE - a bulletin devoted to articles on natural resources and conservation issues.

- HARIBON OCCASIONAL PAPERS - materials detailing the findings of Foundation-sponsored research for circulation among the scientific and conservation communities.
- HARIBON WHITE PAPERS - materials addressing current environmental and conservation issues.

The Haribon Foundation, through its Board of Scientific Consultants, has drawn up the following R&D Program:

1. To study selected flora, fauna and ecosystems, particularly tropical rain-forests, mangroves, coral reefs, and other endangered ecosystems.
2. To study the dynamics and chemistry of pollution problems and other environmental hazards and their socio-economic impact on communities.
3. To identify and study candidate sites for protected management areas.
4. To preserve and protect Filipino tribal culture.

(The Haribon Foundation, 1990).

### 3. Training of environmental education personnel:

#### Teacher training:

Future elementary school teachers graduate with a Bachelor of Elementary Education Degree (BEED). Mathematics, science and health have been compulsory subjects in the curriculum since 1982, although they are given much less time than languages and social studies. High school teacher training leads to a Bachelor of Science in Education degree (BSE). For future high school science teachers, time spent on science is 12 to 14 percent (this is low compared to requirements in other countries). The backgrounds of high school teachers teaching biology, chemistry and physics are often not suitable (Thulstrup, 1990).

The Science Education Center (UPSEC) has organized several in-service teacher training courses. Through the UPSEC Biology Work Group, for example, a decision was made to offer courses and develop additional materials for environmental biology teaching, such as (Gregorio, 1979):

1. Techniques in ecological study in high school biology,
2. Collection, identification and preservation of plant materials,
3. Use of dissecting instruments, incubator, microscope, drying oven and water bath.
4. Preparation of temporary slides, solutions, culture media, stains.
5. Use of techniques involving paper chromatography, gas collection, handling and storage of chemicals.
6. Isolation and culturing of algae and bacteria.
7. Cultivation of live animals in the laboratory i.e. amphibians, birds, small mammals, reptiles.
8. Set-up and maintenance of an aquarium, terrarium.
9. Preservation of plant and animal specimens.
10. Determining the number of bacteria present per unit volume of solution.

The University of Philippines, Institute of Science and Mathematics Education Development, conducts short-term environmental courses for science teachers and produces curriculum materials with integrated environmental issues for elementary and high school students (UNESCO, 1990).

### 4. Major environmental education problems:

In 1976, the main problem identified by UNESCO-UNEP was the shortage of teaching personnel qualified in the field of environmental activities at the primary, secondary, tertiary levels and for the out-of school activities. Another problem of lesser importance was the insufficiency

of educational facilities such as buildings, laboratories, libraries and specialized centers. (UNESCO-UNEP, 1976).

There also seems to be a confusion of what environmental education should cover, and a resistance of teachers to integrate environmental issues. The main reasons for these are:

- lack of direction and organization of present environmental education,
- lack of moral and financial support from administrators,
- lack of locally-based instructional materials,
- lack of community participation (UNESCO, 1990).

The major problems in high school science education are related to teacher qualifications, physical facilities, and student motivation and ability. The high school curriculum of 1973 has never been fully implemented because of lack of materials, labs, libraries and qualified teachers. A new secondary curriculum is presently under preparation (Thulstrup, 1990).

**5. Some institutions engaged in the environmental education (UNESCO, 1983; UNESCO, 1989):**

- Department of Environment and Natural Resources (Environmental Management Bureau), Quezon City,
- Science Foundation of the Philippines, Manila,
- Environmental Education Program, Ministry of Education, Culture and Sports, Manila,
- Bureau of Elementary Education, Department of Education, Culture and Sports, Metro Manila,
- Colombo Plan Staff College for Technician Education, Metro Manila,
- Tarlac College of Agriculture, Institute of Forestry, Tarlac,
- Institute of Human Ecology, University of the Philippines at Los Banos, Laguna,
- Science Education Center, University of the Philippines, Diliman, Quezon City,
- College of Mass Communication, University of the Philippines, Diliman, Quezon City,
- Institute for Science and Mathematics Education Development, University of the Philippines, Diliman, Quezon City,
- Institute of Environmental Planning, University of Philippines System, Diliman, Quezon City,
- College of Engineering, University of the Philippines, Metro Manila,
- Nueva Vizcaya Institute of Technology, Nueva Vizcaya,
- National Museum, Manila,
- National Environmental Protection Council, Philippine Heart Center for Asia, Quezon City,
- National Social Action Council, Metro Manila,
- The Haribon Foundation for the Conservation of Natural Resources, Metro Manila,
- Man and the Biosphere Philippines, Manila,
- International Rice Research Institute, Manila,

- ASEAN/UNDP/FAO Regional Small Scale Coastal Fisheries Development Project, Makati, Metro Manila.

**Country: SINGAPORE****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 2.6  
 Area (thousands of square kilometers): 1  
 GNP per capita, 1988: \$9,070  
 Average annual growth rate, 1965-88 (percent): 7.2  
 Adult illiteracy, 1985 (percent): female 21, male 14  
 Percentage of age group enrolled in education (1984):  
     Primary: 115  
     Secondary: 71  
     Tertiary: 11.8  
 Primary net enrollment, 1984 (percent): 100  
 Primary level pupil-teacher ratio (1984): 27  
 Total expenditure on education as % of GNP (1982): 4.3

**Major environmental problems (Lim, 1981; Pakiam, 1982; Soerjani, 1989; UNESCO, 1990):**

- high population density,
- limited resources of land and water,
- rapid industrialization and urbanization,
- air pollution (exhaust emissions of motor vehicles),
- noise pollution,
- organic and other solid wastes from small farms and settlements,
- pollution of surface water, particularly with hazardous substances and toxic wastes,
- improperly treated sewage in open and ground water systems,
- marine pollution (from ships and oil tankers),
- problems of waste disposal related to illegal hawkers, food centers and markets.

Singapore spends about 0.6% of GDP on pollution control. This sizeable amount reflects the importance placed on a clean environment.

The formation of the Anti-Pollution Unit (APU) in 1970 was a precursor to passage of the Clean Air Act in 1971, which empowered APU to control air pollution from industrial and trade premises. Other legislation has since then been passed.

Strict anti-pollution measures were necessary to ensure that the raw water drawn from reservoirs is suitable for drinking. Pollution in the drainage network is minimized by controlling all waste water discharges, whether from domestic, industrial or agricultural sources.

In the past, solid waste was disposed of solely by sanitary landfill.

However, the need to conserve the limited land resources and the economics of recycling valuable waste materials led to the construction of a 1,200 tons per day refuse incineration plant at Ulu Padan.

The Ministry of Environment aims to maintain a high standard of environmental public health and cleanliness through preventive and other control measures. Its functions are:

1. Environmental public health control,

2. Sewage and water pollution control,
3. Drainage and flood alleviation.

### School system:

General education: 12 years (pattern: 6+4+2)  
 School attendance is not, in law, compulsory.

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	22.5	24.2	25.5
Science:	-	2.5	5.5
Mathematics:	3.0	3.9	3.1
Technology:	0.0	0.0	2.3

Science teaching on the primary level starts in Grade 3. Integrated science course is taken in Grades 7 and 8. Optional courses during the late secondary school years include physics, chemistry, biology, physical sciences, integrated science, geography, human and social biology. Total time spent on mathematics and science is 68.6 percent.

### ENVIRONMENTAL EDUCATION:

The Singapore environment has undergone rapid and tremendous physical transformation in recent years. Provisions for the formal education and training of adequate manpower in environmental planning and control has been established to ensure an orderly and pleasant environment (Chia et al., 1989).

#### 1. Formal environmental education:

##### Primary and secondary school level:

While the environment per se is not studied as a subject, various aspects are taught in different disciplines, partly in the sciences (botany, zoology, social biology, physics, chemistry) and partly in the arts (geography, civics). Emphasis is placed on an experimental approach to important, every day life aspects. Teaching aids such as slides, charts, film shows, environmental projects, excursions to places of interest and laboratory experiments are used (Pakiam, 1982; UNESCO, 1990).

##### Primary level:

In the new education system, launched in 1981, science is viewed as a study of the environment based on the direct experience of the learner. The theme "Man and his environment" is a conceptual framework. The following issues are emphasized at each grade level (Soerjani, 1989):

- Looking at the environment,
- Roles of the various components of the environment,
- Components of the environment and their interactions,
- Effects of interactions on the environment.

In a more specific context, environmental education is also included in health education (Soerjani, 1989).

Pupils acquire understanding of basic concepts about the environment through direct experiences of the environment and through pupil-centered and activity-centered lessons. In the social studies, innovative strategies are used to enhance children's understanding of the environment, e.g. the Clean Rivers Education Program (UNESCO, 1990).

#### Secondary level:

The primary science theme of man interacting with the environment is continued at the lower secondary level. Environmental Science syllabus aims to (UNESCO, 1990):

- develop ecological concepts and the understanding of physical and biological environments,
- develop the pupil's ability to use the methods of science,
- provide a science course which is both relevant and meaningful in today's technological environment,
- enable pupils to appreciate the humanistic aspects of science.

Topics on environment are as follows (Soerjani, 1989; UNESCO, 1990):

- Habitat,
- Simple concepts of population, community and ecosystem,
- Energy transfer process in the ecosystem,
- Nutrient cycles in the ecosystem,
- Man's impact on the ecosystem (over-population, urbanization, industrialization, pollution, depletion of natural resources, conservation and improvement of the environment).

The lower secondary geography curriculum includes studies on the environment such as:

- man's exploitation and poor management of the land,
- environmental pollution,
- methods of conservation.

The science and geography courses at the upper secondary level comprise similar topics, but are covered in much greater depth (UNESCO, 1990).

At secondary schools, it is compulsory for students in the arts to study one science subject. A popular choice is "Human and Social Biology", in which two sections include population aspects of environment, environmental sanitation and control (Ponniah, 1982).

#### University level:

There was a four year project at the University of Singapore, which consisted of a compulsory introductory "Man and Environment" course at the first year level for some 150 science students. Optional courses were offered in the second and final years. The content of these courses covered the disciplines of hydrology, geology, geomorphology, meteorology, and oceanography.

At the Nanyang University, the syllabus for the upper levels originally consisted of courses in Ecology, Pollution, Public Health and Vector Control, Population Studies and the Urban Environment, Environmental Chemistry, Animal Production and Resources, and Horticulture. The diffuse, multi-disciplinary nature of courses resulted in graduates with broad but superficial knowledge, educated but not trained. More

recently, a trend to incorporate relevant environmental education, planning and control into professional courses has emerged. In 1980, The National University of Singapore (NUS) came into being; it is the incorporation of the former University of Singapore and Nanyang University and consists of eight faculties (Pakiam, 1982).

At present, environmental studies are not taught as a special discipline, although environmental considerations are included in the curricula of the following tertiary level institutions (Chia et al., 1989; UNEP, 1986):

1. National University of Singapore:
  - Department of Civil Engineering,
  - Department of Chemistry,
  - Department of Chemical Engineering,
  - Department of Building Science,
  - Department of Botany,
  - Department of Geography;
2. Nanyang Technological Institute:
  - Division of Water Resources and Transportation, School of Civil and Structural Engineering;
3. Ngee Ann Polytechnic;
4. Singapore Polytechnic.

The National University of Singapore offers compulsory or elective courses related to the environment, e.g.:

- Environmental Management (Geography Department),
  - Physics of Environment (Architecture Department),
  - Environmental Engineering (Civil Engineering Department),
  - Pollution Control (Chemical Engineering Department),
  - Social Medicine and Public Health (Department of Medicine),
  - Environmental Physiology (Zoology/Botany Department),
  - Population/Population Control, Society and Urban Sociology (Sociology Department),
  - Environmental Economics (Economics Department)
- (UNEP, 1986; UNESCO, 1990).

Some examples of courses and their descriptions are given below (Pakiam, 1982):

Faculty of Engineering:

Environmental Engineering I

- water and waste water systems,
- systems capacities,
- water distribution,
- sewers flow,
- water quality management,
- unit operations and treatment kinetics,
- biological treatment processes.

Environmental Engineering II

- introduction to water quality control and management,
- overall view of quality of natural water and quality changes through various uses,
- standards and criteria of water quality, quality needs and beneficial uses,
- eutrophication of surface waters,
- more advanced topics of waste water treatment and disposal,

- water reclamation,
- quality considerations in estuarine waters,
- marine disposal of wastes,
- special industrial waste problems.

#### Environmental Engineering III

##### Special topics in solid waste management:

- solid waste collection system,
- properties of solid wastes,
- disposal systems, including:
  - a) incinerators.
  - b) composting,
  - c) land-fill,
  - d) new trends in solid waste management.

##### Special topics in air pollution:

- air quality management,
- non-viable particles in the air,
- viable particles in the air,
- gaseous pollutants in the atmosphere,
- air-pollution meteorology,
- air pollution control,
- emphasis on the fundamentals of control equipment,
- air pollution from specific sources.

#### Applied Soil Mechanics

#### Soil Dynamics

#### Safety and Operability Studies and Hazard Analysis

#### Pollution Control, Management, Law.

#### Faculty of Architecture:

##### Physics of Environment I

##### Physics of Environment II

##### Physics of Environment III

##### Building Sciences

#### Geology Department:

##### GE309 (soil)

##### GE403 (earth atmosphere system)

##### GE404 (costal geomorphology, littoral processes)

##### GE412 (management of the environment: land, sea and air)

#### Biology Department:

##### BA203 (general principles of ecology and biogeography)

##### BA303 (special aspects of ecology)

##### BA310 (applications of biological knowledge to human society and natural resources)

##### BB206 (experimental methods in the study of tropical environment and their practical applications)

##### BB302 (comparative aspects of organ system physiology; environmental physiology)

Examples of environmental research and development projects at National University of Singapore are listed below (Pakiam, 1982):

#### Faculty of Science:

##### Department of Botany:

- effects of pollutants on plants,
- occurrence and nuisance value of certain algae in reservoirs,

- control of soil erosion by growing selected weeds.

Department of Zoology:

- physical, chemical and biological characteristics of seas,
- physical, chemical and biological characteristics of freshwater reservoirs and lakes,
- mercury pollution in Singapore rivers,
- effect of pollutants on animals,
- tolerance of some aquatic animals to environmental changes,
- freshwater acclimatization,
- effects of environmental parameters on growth,
- waste re-utilization.

Department of Chemistry:

- chemical constituents of flora,
- treatment of industrial effluents,
- air pollution modelling,
- trace analysis of copper in foods,
- free silica in atmospheric dust,
- hazards from UV in the environment.

Department of Mathematics:

- radioactive transfer.

Department of Physics:

- digital acoustic processing with microcomputers,
- glare from high intensity light sources,
- remote sensing for marine pollution and tropical rain forest,
- solar radiation in spectral regions,
- absorption of solar radiation by atmospheric water vapor,
- radioactivity of rock samples using neutron activity,
- movement and residence time of water in a reservoir using radioactive tracers.

Faculty of Engineering:

Department of Civil:

- bioconversion studies,
- noise in industrial plants,
- air pollution in industrial plants,
- water pollution control,
- water quality analysis.

Faculty of Architecture and Building:

Department of Building Science:

- wind environment around buildings,
- wind loading in buildings,
- neighborhood planning in new towns,
- insulation for aircraft noise in residences,
- trees in urban environment,
- effectiveness of trees as car-park shades.

Faculty of Arts:

Department of Geography:

- air pollution meteorology,
- boundary layer meteorology,
- spectral distribution of solar radiation,
- lightning mortality,
- thunderstorm organization and dynamics,
- extreme weather phenomena,
- tracer methods in the atmosphere,
- hydraulic characteristics of surficial materials,
- field plot studies,
- food resources,
- offshore mineral resources,
- runoff estimation methods,
- engineering geology,
- nature and paleo-environment of alluvium,
- efficacy of floods as a geomorphic process.

## Faculty of medicine:

## Department of Social Medical and Public Health:

- environmental factors in heat disorders,
- noise induced deafness,
- impact of industrial growth on health,
- health conditions in small factories.

**Extension programs (for government officials, specialized technical training):**

The Ministry of the Environment conducts training courses on air and water pollution control, mosquito control, food hygiene and fumigation on a regular basis (UNEP, 1986).

There is a unique system for on-the-job training of specialists- environmental engineers, physical scientists and agricultural scientists. Nine government organizations were involved in a number of projects in the areas of environmental engineering, physical science and agricultural science from 1970 to 1979 (Ponniah, 1982).

Some examples of environmental research and development projects conducted by government departments and boards are listed below (Pakiam, 1982):

## Public Works Department:

- geology of subsoil parameters in Singapore,
- traffic management and air quality.

## Ministry of Environment:

- improvement of the operation of sewage treatment works,
- evaluation of the technical and economic feasibility of treating waste water to potable water standards,
- effects of the discharge of waste water on aquatic life,
- clarification of waste waters using chemical additives,
- mechanical sludge dewatering and handling system,
- disposal of radioactive waste,
- sanitary quality and bacteria contamination of water for swimming and recreational purposes,
- bio-assay of fish culture in reclaimed waters,
- poly-aromatic hydrocarbons in water,
- removal of dissolved solids by reverse osmosis and ion-exchange.

## Jurong Town Corporation:

- recovering effluent water for industrial use.

## Primary Production Department:

- monitoring waste and waste water from intensive pig farming estates,
- design of waste water collection, handling, treatment and disposal,
- environmental impact assessment of intensive pig farming on river basins.

## Port of Singapore Authority and Housing and Development Board:

- study of various measures to protect beaches formed along reclaimed land,
- design and protection of the growth and long-term stability of headland bay beaches,
- hydraulic models and full scale prototype models of Singapore.

## Meteorological Service Singapore:

- synoptic conditions accompanying unusual phenomena,
- diagnostic studies of eastward moving disturbances in the S-W monsoon flow,
- development of numerical weather prediction models,

- mathematical analysis of inertia-gravity waves,
- analysis of low level strong wind belt over South China Sea during the N-E monsoon.

Singapore Institute of Standards and Industrial Research:

- design of pollution control systems,
- development of a pocket radiation alarm meter.

Department of Scientific Service:

- background radiation levels in Singapore,
- levels of lead in workers,
- treatment of industrial effluents and design of plants,
- design of exhaust ventilation systems in industry.

Primary production Department:

- crop improvement,
- pesticides,
- chemical weed control,
- improvement of cultivated soils and fertilizer studies,
- pig production research,
- aquaculture.

## 2. Non-formal environmental education:

### Out-of-school activities:

To enrich school science programs, science clubs and science societies have been introduced. Science clubs are found mainly in the primary schools and are organized by the teachers. The activities include:

- performing simple experiments,
- visiting places of interest (e.g. zoo, bird park, science center),
- film shows,
- exhibitions,
- gardening,
- simple projects.

Science societies are found in the secondary and pre-university schools in which each society elects its own officers while the teacher acts in an advisory capacity. The main activities include:

- talks,
- film shows,
- projects,
- visits to places of scientific interest

(Bhathal, 1982).

Science fairs have been organized biennially on a competitive basis since 1969 by the Science Teachers Association of Singapore. The fairs are open to secondary and pre-university students. Students submit the projects (group rather than individual projects) they have been working on in their science clubs or science societies, for example:

- Algae as a source of food,
- Manufacture of paper products from vegetable fibers,
- Solar oven.

Non-competitive science fairs for primary school children have also been held every two years since 1977 (Bhathal, 1982).

Schools have been actively involved in the National environmental Campaigns since these were first launched in 1968. Students take part in competitions such as slogan and poster design, quizzes, debates, oratory

essay, contests, and song writing. Talks are given by guest-speakers, principals and teachers during assemblies and lesson-periods in most subjects, particularly Science, Civics and Education for Living (Lim, 1981).

The Singapore Science Center, opened in 1977, is a contemporary science museum with an institutional membership program. Approximately 330-550 students and teachers visit the Center every day. The services and activities offered include:

- talks,
- lecture demonstrations,
- science (laboratory) courses,
- environmental education courses for teachers,
- exhibit tours (Guided tours),
- film shows,
- workshops,
- science camps,
- science fairs,
- seminars,
- Science Center Bulletin (quarterly publication, distributed in schools, colleges and universities),
- animal and plant slide series,
- guide books.

Among the school-based environmental activities there are the Biennial Ecoweek (Ecology Week) and Energy Week, which highlight the importance of conserving environment and energy. An Ecogarden was started in 1982 and there is also an Ecology Exhibition in the Singapore Science Center (Bhathal, 1982; Chia et al., 1989; Pakiam, 1982; Soerjani, 1989; UNEP, 1986; UNESCO, 1990).

The science camp, initiated in 1978 by the Singapore Science Center, is a field-based biology camp that is conducted twice a year during school holidays, for both pre-university students and selected teachers-in-training (Certificate of Education "A" level teachers). Field studies in ecological systems include:

- freshwater life in the stream and the pond,
- coral reef life,
- the mangrove habitat,
- aspects of land and water resources usage.

The program is supplemented with introductory lectures on ecology, science film shows and discussions on ecological issues (Bhathal, 1982; Lim, 1981).

The educational program for schools at Singapore Zoological Gardens started in 1976. About 90,000 students and teachers use the facility each year. The program includes film shows and a worksheet for students to complete while visiting the various animal enclosures (Pakiam, 1982).

Jurong Bird Park, opened in 1971, is an ornithological center with the world's largest Walk-in-Aviary where visitors and birds mingle freely. Approximately 20-30 classes visit the Park each year. In the program, student visitors are given film and slide shows and talks. A worksheet

is provided for primary school students to complete as they move around the Park (Pakiam, 1982).

**Activities for the general public:**

The first national effort at public participation in an environmental programme was the "Keep Singapore Clean" campaign in 1968, which involved government universities and private organizations. Aimed at the public, it was conducted through live and audiovisual demonstrations, wall posters and the mass media. Litter bins were installed in prominent locations on buses, in parks, on the streets and in many other public places. An economic disincentive in the form of a fine of up to \$500 for littering aided regulation and enforcement. On clean-up days, organizers made the rounds of streets and roads with brooms, shovels and pails (Pakiam, 1982; UNEP, 1986).

The second national campaign was aimed at "Keeping Singapore Green". The planting of trees and flowering shrubs in urban areas and along roads, and the planned provision of parks and "green lungs" have led to shady boulevards. The early measures at environmental education were reinforced by parallel campaigns in public health and vector control. Following are some examples of national education campaigns, usually lasting a month, that have been repeated since 1968:

- Keep Singapore Clean,
- Keep Singapore Clean and Mosquito-Free,
- Keep Singapore Clean and Pollution-Free,
- Keep Singapore Pollution-Free,
- Keep Our Water Clean,
- Food Hygiene,
- Better Food for Better Health,
- Combat Infectious Diseases.

(Lim, 1981; Pakiam, 1982).

The Science Council of Singapore has organized a number of public seminars on water resources, environment and energy, which give a comprehensive and integrated treatment to selected technological topics (Chia et al., 1989).

The Public Affairs Department of the Ministry of Health organizes environmental public health education programs to raise public awareness of, and concern about, environmental public health and pollution problems (Chia, et al., 1989).

**Mass media:**

Mass campaigns usually involve the use of newspapers, radio and television to disseminate the education message. The government-owned radio and television stations in Singapore co-operate and support the ministry by producing news, documentaries, interviews, panel discussions and advertising slogans. The local press provides coverage of campaign activities (Lim, 1981).

**Government and voluntary organizations:**

There are a number of government and non-government organizations and statutory boards which provide non-formal environmental education. These

organizations either provide physical facilities for environmental education and training or are actively engaged in the promotion of environmental education. Target audiences are the general public, school children and professionals (Pakiam, 1982).

The Science Council of Singapore, established in 1967, is involved in the following activities (Pakiam, 1982):

- production of modules for primary school teachers,
- promotion of science and technology through a variety of mass media, such as television and radio programs,
- promotion of research and development activities,
- research and development policy formulation,
- organization of seminars and forums on scientific and technological topics at local, regional and international levels, e.g. industrial, technical, commercial, pollution treatment, waste recycling, safety),
- publishing of books, e.g. a handbook on Environmental Protection in Singapore.

### 3. Training of environmental education personnel:

#### Teacher training:

Teachers-in-training receive instruction on the various aspects of ecological and environmental education through one or both of the following pre-service courses:

1. Teaching of Biology Science (for Diploma of Education students),
2. Teaching of Science (for non-graduate teachers).

Each course includes discussion of how to teach and create in students greater awareness and commitment to the ecological, environmental and social issues that have urgent national and international significance (Lim, 1981).

In-service courses are planned and organized by the Training Branch of the Ministry of Education and Curriculum Development Institute of Singapore, and conducted mainly by the Institute of Education and the National University of Singapore. Other organizations that conduct environmental workshops and field trips for teachers are the Science Teachers Association of Singapore and Singapore Science Center. Most of these in-service courses pertain to the teaching of ecology in schools and the organization of field trips (UNESCO, 1990).

### 4. Some institutions engaged in the environmental education

(Chia et al., 1989; UNESCO, 1983; UNESCO, 1989; UNEP, 1986):

- Ministry of Education;
- Training and Education Department, Ministry of Environment;
- National University of Singapore:
  - Department of Civil Engineering,
  - Department of Chemistry,
  - Department of Chemical Engineering,
  - Department of Building Science,
  - Department of Botany,
  - Department of Geography;
- Nanyang Technological Institute, Division of Water Resources and Transportation, School of Civil and Structural Engineering;
- Ngee Ann Polytechnic;

- Singapore Polytechnic;
- School of Science, Institute of Education;
- Regional Institute of Higher Education and Development (RIHED);
- Singapore Science Center;
- Asian Mass Communication Research and Information Center.

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**Country: SRI LANKA****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 16.6  
Area (thousands of square kilometers) 66:  
GNP per capita, 1988: \$420  
Average annual growth rate, 1965-88 (percent): 9.4  
Adult illiteracy, 1985 (percent): total 13 (female 17)  
Percentage of age group enrolled in education (1987):  
    Primary: 104  
    Secondary: 66  
    Tertiary: 4  
Primary level pupil-teacher ratio (1986): 32  
Total expenditure on education as % of GNP (1986): 3.5

**Major environmental problems (Gunapala, 1985; Hewawasam, 1987; Panamaldeniya, 1981; Seneviratne, 1982):****- Deforestation**

Sri Lanka has lost one million hectares of natural forest during the last three decades. Shifting cultivation, accelerated agricultural development and spread of village settlements have depleted forest cover to almost critical levels. The main reasons of deforestation has been

- a) clearing land for farms, plantations and human settlements,
- b) gathering wood for fuel,
- c) cutting timber for direct industrial use, curring mangroves for firewood.

**- Soil erosion, deterioration of soil fertility and increased salinity due to environmentally unsuitable agricultural practices is one of the most widespread environmental problems in Sri Lanka.****- Depletion of water resources**

has been caused by accelerated development and population increase. The effect of deforestation has obviously been intensified flooding and severe drought. Water shortage is a critical problem in the dry zone while the problem of water logging and damage affects the wet zone.

**- Water pollution**

Pollution of water is the most critical environmental hazard in Sri Lanka. It includes pollution of drinking water sources, ground water, rivers, lakes and reservoirs. The main sources of water pollution are industrial wastes, agricultural chemicals and wastes from human settlements.

**- Discharge of industrial effluents**

Various forms of industrial pollution include discharge of heated effluents, synthetic pollutants, pathogenic microorganisms, oil, insoluble materials and degradable organic matter.

**- Indiscriminate use of agricultural inputs**

Pollution of water and waterways through agriculture is also common. Fertilizers, pesticides and other chemicals applied in the

- cultivation of various crops are often washed into waterways through runoff and seep down to ground water by percolation.
- **Pollution caused by human settlements**  
Improperly treated sewage and garbage dumping have increased the problem of water-borne diseases.
  - **Air pollution**  
is gradually becoming a serious environmental problem in urban areas. It is caused mostly by toxic materials and various gases, acid fumes and fuel emissions discharged by industries.
  - **Marine pollution**  
Rapid coastal development, the tourist industry, coastal settlements, coral mining and polluted rivers have affected the natural environment in the coastal zones. Coastal water is continuously polluted due to the discharge of garbage, untreated industrial effluents, oil and other wastes.
  - **Problems relating to urbanization**  
In Colombo, the largest city in Sri Lanka, almost 50% of the population lives in slums and shanties, creating numerous environmental problems. Pollution caused by the disposal of solid waste is also a critical environmental problem. Garbage is used mainly for filling low-lying areas.
  - **Environmental problems related to mining**  
Major environmental damage can be identified from mining activity for gems, sand and coral.
  - **Desertification**  
Although Sri Lanka does not have serious desertification problems, certain trends can be identified in the dry and the intermediate zones of the island.
  - **Destruction of wildlife** - particularly birds, elephant and deer.

The most important factors leading to environmental problems are:

- pressure of rapid population growth,
- accelerated development,
- modernization of economic and social activities,
- urbanization,
- changing patterns of living standards,
- poverty,
- ignorance of environmental problems.

The efforts taken in the recent past for the protection and management of the environment are as follows (Gunapala, 1985; Hewawasam, 1987):

- a) Formation of a stable national environmental policy,
- b) Strengthening of the legislative framework in the field of environment,
- c) Establishment of an institutional framework for the environmental protection,
- d) Increasing environmental awareness and environmental education,
- e) Launching of intensive programs such as reforestation, prevention of soil erosion, proper use of pesticides, and restrictions in coral mining.

**School system:****General education: 12 years**

Distribution of school time (Unesco, 1986):

	Grade 1-2	Grade 3-6	Grade 7-9
Total time (hrs):	22.5	26.2	27.5
Science:	-	(1.1)	4.7
Mathematics:	-	(1.3)	5.3
Technology:	-	0.5	2.3

The integrated science curriculum on primary level covers 11 themes (Ponniah, 1982):

- houses and the people who live in them,
- things we eat and drink,
- things we wear,
- things which help us work,
- how we live in mixed communities,
- the world around us,
- our school and its neighborhood,
- the people who help us,
- how we travel and communicate,
- our earth and the sky above it,
- things we see and hear.

On secondary level, integrated science teaching is followed from Grades 6 or 7 to 10. Total time spent on science and mathematics is 87.3 percent.

**ENVIRONMENTAL EDUCATION:**

The efforts to improve environmental awareness can be divided into two domains:

- improvement of formal environmental education,
- public awareness programs in various institutions (Hewawasam, 1987).

**1. Formal environmental education:**

Environmental education has been introduced into school curricula from primary school upward. Environment is not taught as a separate subject, but has been integrated with other subjects at different levels through "infusion" approach (Fernando, 1988; Panamaldeniya, 1981; UNEP, 1986).

Emphasis on environmental aspects in the national level public examinations has increased over the years. The questions are designed to test mainly the cognitive skills with considerable stress on application, analysis, synthesis and evaluation (Fernando, 1988).

**Primary school level:**

At the primary school level, an integrated inter-disciplinary curriculum, "Environmental Studies", has been introduced for environmental education. The syllabus provides for learning experiences through activity-based, environment-oriented methods, which offer active child participation in the teaching-learning process and provide

knowledge and understanding of physical, chemical, biological, social and cultural environments (Fernando, 1988).

Environmental concepts are organized in an hierarchical sequence - each step resulting in a deeper understanding of the concepts (UNEP, 1986).

A spiral curriculum encompasses the following topics (Hewawasam, 1987; Panamaldeniya, 1981):

- Location of school and nature of houses around it
- The material of which the houses are made
- Water and its uses
- How water is polluted
- Streams, rivers and lakes
- Soil and soil erosion
- Cultivation found around houses
- Local food, pots and pans
- Local transport.

These topics are introduced by observations which are followed by a series of questions.

New reforms have been introduced recently into the present system of education. The Curriculum Development Center of the Ministry of Education has already undertaken the revision of syllabi and curricula in accordance with the new educational reforms. The environmental education component in the primary school is included as "Environmental Activities". The curriculum is interdisciplinary in nature from years 1 to 5 and the themes are gradually developed in a spiral sequence. From year 4, in addition to "Environmental Studies", a course "Beginning Science" has been introduced which makes use of the environmental resources of the neighborhood to learn basic concepts and acquire attitudes and skills in science (Fernando, 1988; Hawawasam, 1987).

The integrated science curriculum on primary level covers the following 11 themes (Ponniah, 1982; UNESCO, 1985):

- Houses and the people who live in them,
- Things we eat and drink,
- Things we wear,
- Things which help us work,
- How we live in mixed communities,
- The world around us,
- Our school and its neighborhood,
- The people who help us,
- How we travel and communicate,
- Our earth and the sky above it,
- Things we see and hear.

High priority is given to Environmental Activities in the course. Learning takes place through pupil activities which are intended to provide, in addition to factual knowledge, opportunities for analytical and rational thinking, appreciation of the environment, value of life, living in harmony with the environment, etc. Some examples of primary school activities are given below (UNESCO, 1985):

Theme: What we wear (Grade 4)  
Activity: Visit to a weaving mill

In addition to a study of the mill and the production of textiles, pupils study environment around the mill and the effect of the mill on it. They

- study waste waters that leaves the factory,
- study water from the canal above and below the factory,
- observe properties such as color, temperature, turbidity,
- note the pollution caused by the waste water of the mill,
- note that no plants and fish can survive in the canal below the mill.

Theme: Water is an essential item in the home (Grade 1)

Activity on natural water sources and water pollution

The teacher asks questions like:

- What is the source of water in your home?
- What activities at home require water?
- How many buckets or pots of water do you require for a day?
- How do you prepare your drinking water?
- Keep a vessel of water undisturbed for a day or two and observe changes.

A grade 1 class in a school situated near a tire factory by the river did investigations of water and noticed that some water samples contained black particles. Further investigations proved that the black particles were added to the river water by the factory waste water. The information was shared with the neighboring schools and joint investigations were carried out to find out other sources of water pollution in the area and to compare results.

Theme: Our school and its neighborhood

Activity on soil erosion in the school garden

Grade I:

Concept: Flowing water carries small particles of matter.

Pupils collect samples of water when it is raining,

- a) from an open place,
- b) a gutter pipe from the roof,
- c) a stream,

and leave them undisturbed for a day or so.

Then they answer the following questions:

- What changes do you see?
- How can you explain them?

Grade III:

Concept: Flowing water causes erosion and changes the landscape.

Pupils perform the following activities:

- draw a map of the school neighborhood,
- mark the waterways on a rainy day,
- indicate ones that carry much water,
- mark the hills and the slopes,
- design a plan to control damage by erosion in the school garden.

### Secondary school level:

The environmental dimension has been integrated into different subject areas in the school curriculum, e.g.

- at junior secondary level into science, social studies, health, physical education and aesthetic studies and
- at senior secondary level into botany, zoology, chemistry and geography.

The syllabi were designed to provide environment-based activities in the separate disciplines and impart in-depth knowledge and understanding of the nature, and quality of the environment and the importance of conservation of the environment (Fernando, 1988; UNEP, 1986).

In the integrated science curriculum for grades 6-10, several units are devoted to environment. In the early grades, basic science concepts on the

- atmosphere,
- biosphere,
- water and water cycle,
- soil,
- plants,
- animals,
- the carbon cycle,
- the nitrogen cycle,

- energy transformation and energy flow through the biosphere,
- food chain,
- eco-systems and the interdependence of life,
- interactions and agents of change,
- pollution,
- natural resources,

are gradually built up. In the last units of the course, an attempt is made to integrate these basic concepts and establish a deeper understanding of the effect of these various factors on the environment.

The socio-economic and political aspects of the environment are introduced through the social studies. The following topics have direct relevance to environmental studies (Panamaldeniya, 1981; UNESCO, 1985):

- our town: the physical environment, historical background, local inhabitants,
- local geography: geographical nature (rainfall, temperature), natural resources, industries, needs, history of water resources, history of the social life and administration of the island,
- world geography: origin of earth, nature of the earth, origin of life, races of man, civilizations,
- growth, development and consumption, exploitation of natural resources for development, effects on the environment,
- food and agriculture, home gardens, cultivated plants, fisheries, population and health, irrigation,
- population, problems of population growth and its effects on the environment, social responsibilities of the individual,
- urbanization, industrialization, the use of modern technology and its effects on the environment.

At the senior secondary level (grades 11-12) topics related to environmental education are found in the science subjects, e.g. botany, chemistry and zoology (UNESCO, 1985):

**Botany:**

- plants and their environment: ecosystem, soil, climate and natural vegetation of Sri Lanka,
- man's influence on ecosystems: agricultural ecosystems, deforestation, human settlements, pollution.

**Zoology:**

- the animal kingdom: animals in the immediate environment,
- ecology: the major ecological realms of Sri Lanka, principles of conservation,

**Chemistry:**

- natural chemical resources of Sri Lanka,
- non-renewable resources and their uses,
- chemical pollution.

Curriculum revision for the junior and senior secondary levels is in the process of finalization. Here too, the environmental education component is introduced into several disciplines, such as science, social studies, health education, and aesthetic studies, with greater emphasis on the awareness of and sensitivity to the total environment and its allied problems, and on ways and means of solving or minimizing those problems (Fernando, 1988).

**University level:**

At an undergraduate level, general environmental courses are offered in the Zoology and Botany Departments of the universities. At the University of Colombo, the Department of Botany conducts a course "Man and Environment" for third year undergraduates. Most of the Universities

conduct educational programs for first year students, that are designed to provide basic knowledge in the environmental relationships. In post-graduate level education, there are several Universities offering M.Sc. courses in the field of environment, for example (Hewawasam, 1987):

- M.Sc. course in Environmental Sciences - Department of Zoology, University of Colombo;
- M.Sc. course in Forestry - Biology Department, University of Sri Jayewardenepura;
- M.Sc. course in Town and Country Planning - Moratuwa University;
- M.Sc. course in Environmental Geography - Moratuwa University.

Other tertiary level institutions offering environmental education and training courses are (UNEP, 1986):

- University of Peradeniya, Faculty of Arts,
- University of Ruhuna, Department of Community Medicine,
- The Open University of Sri Lanka, Board of Study for Management, Science and Technology.

#### Extension programs :

Environmental dimensions have been introduced into the induction and in-service training programs for public officers at the Sri Lanka Institute of Development Administration - SLIDA. A course in the Diploma in Public Management is offered by SLIDA for middle and senior public officers, which consists of the following topics (Hewawasam, 1987):

##### Module: Environment

- Concept of environment and development,
- Agriculture, forestry and land use,
- Water - its use and misuse,
- Marine ecosystems,
- Impact of tourism on the environment,
- Causes, effects and control of pollution.

At the National Institute of Business Management (NIBM), training modules have been structured into the following sections (Hewawasam, 1987):

- The need for managing the environment - systems approach,
- The environmental dimension in production management,
- The environmental dimension in designing products,
- The environmental dimension in process design,
- The environmental dimension in designing production systems,
- The environmental dimension in designing and controlling human inputs,
- The environmental dimension in managing production systems,
- The use of operations research in planning and developing environmentally sound production systems.

About 3000 participants, consisting of employees in public and private sector enterprises enroll in the NIBM training programs annually.

The Tea Research Institute, Rubber Research Institute, Coconut Research Institute and National Institute of Plantation Management are involved in the dissemination of environmental information through the improvement of cultivation practices in their respective fields of activity, by the inclusion of topics such as:

- soil conservation,

- ecology,
- productivity,
- waste disposal,
- waste recycling,
- use of alternative sources of energy in processing activities.

In-service training at these institutes may take various forms:

- seminars and workshops,
- intensive, short study sessions,
- field demonstrations,
- advisory services to farmers,
- training of extension workers.

(Hewawasam, 1987).

## 2. Non-formal environmental education:

### Out-of-school activities:

Various pictures, magazines, radio and television programs are used as support materials in broadening the pupils' knowledge and understanding of the physico-chemical, biological, social and cultural aspects of environmental factors and conditions prevailing at national, regional and global levels (Fernando, 1988).

Conservation and energy project clubs are planned for all secondary schools using the provision in the advanced-level timetable for eight periods per week in addition to the teaching of four required subjects. The activities of the clubs include (Panamaldeniya, 1981; UNEP, 1986):

- growing trees in the neighborhood,
- helping in reforestation programs,
- participating in recycling projects,
- learning about water-course protection,
- adopting neighborhood forests and groves for environmental studies,
- planting fast-growing fuel-yielding trees such as the ipil ipil,
- designing and building windmills,
- designing and building solar heaters and other solar-powered devices,
- designing and building firewood-saving hearths, and encouraging their use,
- learning about the activities of energy project clubs of other schools through the exchange of papers and participation in study camps and seminars.

The Field Study Center Program (launched by the Ministry of Education) is an environmental study program designed as a teaching and learning resource for developing environmental concepts in advanced-level science students. Field study centers (at present there are seven) are based on natural resources such as forests, lagoons or river banks - with one or more schools providing organizational support. The centers are provided by laboratories and museums and the necessary teaching-learning aids, including television, video recorders and cameras (Fernando, 1988; Panamaldeniya, 1981; UNEP, 1986; UNESCO, 1983).

The Committee for the Popularization of Science of the Sri Lanka Association for the Advancement of Science conducts programs such as the "Nature Diaries Program" and the "Use and Hazards of Agrochemicals Program". These programs have been helpful in developing concepts and skills related to environmental studies among the children who participate in them. However, such programs have been limited so far to the teachers and students of a few selected schools (Fernando, 1988).

**Activities for the general public:**

A program known as 100 Million Trees was launched by the Central Environmental Authority. All kinds of people, young and old, planted trees by the roadsides, and in compounds, gardens and beaches. The campaign included national tree and flower competitions, and a competition to select the best nursery. Many pamphlets, posters and other publicity materials were issued to promote the idea. The campaign yielded important results - not only by having several thousand trees planted, but also by creating massive environmental awareness (Gunapala, 1985).

**Mass media:**

The Central Environmental Authority produces two radio programs a week devoted to environmental issues such as deforestation. Television has not yet reached the poor, but it is an effective medium especially among the middle classes (Gunapala, 1985).

The media campaign of PAPEMAP (Public Awareness Program for Environmental Management and Protection) involved the preparation of an awareness package of media materials. The following areas were recognized as priority sectors:

- deforestation,
- soil erosion,
- water pollution,
- inadequate biomass management and
- solid waste disposal.

Media materials developed for the campaign include videotapes, slide/sound presentations, films, posters, brochures and exhibits (Hewawasam, 1987).

**Non-governmental and voluntary organizations:**

Several non-governmental organizations specializes in a particular segment of environment - forests, trees, water, soil, etc. (Hewawasam, 1987).

The March for Conservation, a university-based non-governmental organization, actively promotes environmental conservation and preservation in its education programs. Among the activities organized by this society are (Gunapala, 1985; UNEP, 1986):

- route marches through cities and towns,
- oratorical contests in schools,
- festivals of wildlife and nature conservation films,
- nature conservation exhibitions.

The Wildlife and Nature Protection Society has established Student Nature Clubs in schools. The society also publishes a popular magazine, Loris (Gunapala, 1985).

Nation Builders is another society that has made a major contribution to the forest planting through public participation. They have had remarkable success in mobilizing unemployed youth for reforestation and mass education programs (Gunapala, 1985).

### 3. Training of environmental education personnel:

#### Teacher training:

The teacher education program in environmental education is still in a formative stage.

At primary level, the teacher education has been revised to include the teaching of the environmental education content in the primary level school integrated curriculum. All teacher-trainees are exposed to some content, learning experiences and methodology in environmental education. An optional minor course in environmental studies was introduced to the teachers college curriculum at one stage, but was discontinued because it was observed that there was much overlapping with the regular courses.

At the secondary level, there is no special course in environmental studies, but the relevant content is included in the science and social studies courses.

In addition, in-service education programs in environmental education are also being carried out (UNESCO, 1985).

There are three Science Education Support Center Programs in the country, which provide residential facilities for about 30 teachers, and organize and conduct seminars and workshops for teachers. The main objectives of these centers are (Fernando, 1988):

- to help teachers plan stimulating lessons,
- to enable teachers to make simple apparatus by improvisation and use them in schools,
- to use the environment as a teaching medium,
- to improve the knowledge of teachers.

### 4. Major environmental education problems and future plans (Fernando, 1988):

#### Formal environmental education:

New reforms have been introduced into the education system at primary and secondary levels. At the moment, no curriculum revision has been undertaken for years 12 and 13. It is hoped that the Curriculum Development Center will undertake this task in the near future.

#### Non-formal environmental education:

There is an urgent need to improve and broaden the activities of already existing non-formal environmental education programs to enable greater participation of students and teachers.

#### Educational planning:

The environmental education program should be planned with multi-agency participation including the expert and the "grass-root" levels in order to identify clearly and include the environmental issues facing the country, in general, and special issues restricted to different parts of the country. The process of educational planning should identify:

- major environmental problems in the country,
- reasons for the existence of such problems,
- effective environmental actions to be taken to minimize or eradicate these problems,
- major objectives to be achieved through environmental education (such as awareness, knowledge and value),
- measures to be applied to achieve these objectives through formal and non-formal environmental education.

The new curriculum should include knowledge of all the disciplines in the social and natural sciences for understanding and solving various environmental problems.

**Teacher training:**

Teacher education is an urgent need. Teacher training programs must be organized in all possible forms: in-service and pre-service training at institutions of higher learning, short-term face-to-face workshops, self-learning modules, correspondence courses, distance education programs via postal communication, radio and television programs, film shows, various forms of literature and newspapers.

**5. Some institutions engaged in environmental education  
(UNESCO, 1983; UNESCO, 1989):**

**Formal environmental education:**

- National Institute of Education, Maharagama,
- Curriculum Development Center, Colombo,
- Educational Planning and Research Branch, Ministry of Education, Colombo,
- Department of Forestry, Colombo,
- Sri Lanka Association for Advancement of Science, Colombo,
- Central Environmental Authority, Colombo,
- Natural Resources, Science and Energy Authority, Colombo,
- University of Moratuwa, Department of Civil Engineering.

**Non-formal environmental education:**

- Field Work Center, Jaffna,
- Central Environmental Authority of Sri Lanka, Colombo,
- National Aquatic Resources Agency,
- March for Conservation, Department of Zoology, University of Colombo,
- Wild Life and Nature Protection Society of Sri Lanka, Colombo,
- Sri Lanka Natural History Society, Colombo,
- Sri Lanka Environmental Federation, Colombo,
- Sri Lanka Association for Total Education, Moratuwa.

**Country: THAILAND****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 54.5  
 Area (thousands of square kilometers): 513  
 GNP per capita, 1988: \$1,000  
 Average annual growth rate, 1965-88 (percent): 4.0  
 Adult illiteracy, 1985 (percent): total 9 (female 12)  
 Percentage of age group enrolled in education (1987):  
     Primary: 95  
     Secondary: 28  
     Tertiary: 20  
 Primary level pupil-teacher ratio (1986): 20  
 Total expenditure on education as % of GNP (1985): 3.9

**Major environmental problems (Choomnoon, 1985; NCERT, 1987; Soerjani, 1989; Vorapipetana et al., 1981; UNESCO, 1990):**

- high population growth rate, population increase, unequal distribution with high population density in Bangkok,
- deforestation occurring at an alarming rate (5% annually, i.e, 1 million hectares of forest land is destroyed every year. The main reasons are high pressures to convert forest land for agricultural purposes, illegal logging and shifting cultivation, and shortage of fire wood for home consumption in rural areas),
- soil erosion, degradation, loss of soil fertility,
- misuse of pesticides,
- water pollution (fertilizers, pesticides, heavy metals, municipal and industrial waste waters, mining),
- water shortage (in certain areas), loss of watershed areas,
- inadequate sanitation facilities,
- solid waste and toxic substances problems
- heavy traffic, air pollution, noise and garbage in the cities.

**School system:**

**General education:** 12 years (pattern: 6+3+3); only the first six years are compulsory.

Thailand underwent a major change in its primary school education curriculum in 1978. The change, which involved the entire six years of compulsory education, affected not only the subject matter but also the teaching process. Primary education is regarded as education for all the people for daily life and should contribute towards national unity with regional variations (Prasarttong-Osoth, 1981).

The new elementary school curriculum is no longer made up of separate subjects but is divided into four integrated areas of child experience, as follows (Prasarttong-Osoth, 1981; UNEP, 1986) :

**Basic Skills,**  
includes Thai language and mathematics;  
**Life Experience,**  
emphasizes the process of solving social problems. The selected content concerns problems and issues such as health, population, politics, government, society, religion, culture, economics, technology, natural environment and communication;

**Character Education,**  
deals with experiences necessary for the development of good character and includes moral education, art, music and rhythmic movement, and physical education;

**Work Education,**  
emphasizes basic practical work experiences. It covers household work, handicrafts, wood-working, agriculture and optional topics relevant to local situation and needs.

The lower-secondary curriculum is divided into five semi-integrated areas with the following structure: (Vorapipetana et al., 1981):

Subject area	Core subjects (periods per week)			Elective subjects (periods per week)				
	Grades:			Grades:				
	VII	VIII	IX	VII	VIII	IX		
1. Languages								
Thai	4	4	4	-	2	6		
Foreign language			-	-	-	6	6	8
2. Science and mathematics								
Science		4	4	4	-	-	-	
Mathematics		4	4	-	-	-	6	
3. Social studies			5	5	5	-	-	4
4. Character development								
Health and physical	3	3	3	3	2	2	4	
Art	2	2	-	2	4	6		
5. Work education								
Work	4	4	4	-	-	-		
Employment		-	-	-	6	6	12	
<b>TOTAL</b>		<b>26</b>	<b>26</b>	<b>20</b>	<b>16</b>	<b>20</b>	<b>46</b>	

## **ENVIRONMENTAL EDUCATION:**

### **1. Formal environmental education:**

The Ministry of Education prepared a comprehensive environmental work-plan that serves as a guideline for the development of environmental curricula at all levels in both formal and non-formal education (UNESCO, 1990).

Environmental components have been integrated into school curricula and university syllabuses. However, lack of trained teachers and teaching materials, including audiovisual aids, have hindered the effective implementation of the new curricula and syllabi (UNEP, 1986).

#### **Pre-school level:**

At Pranakorn College there was a workshop on infant level environmental education, where some environmental activities suitable for infant children were selected, tested in the local school playground, and a teacher's guide was prepared by course participants. It was stressed, that the activities should focus on the school playground or the local

zoo; long and expensive bus excursions to national parks would not achieve the desired aim. According to the workshop proposals, the concrete objects of the local environment can be used to help teach concepts as (Kanhasuwan et al., 1987):

1. living and non-living,
2. texture,
3. shape,
4. size,
5. color,
6. growth,
7. reproduction,
8. variation.

**Primary school level:**

In the primary school, environmental education is taught mainly within the Life Experience program, which is organized into units as follows (Prasarttong-Osoth, 1981):

**Grade I and II:**

- Unit 1: Living organisms
- Unit 2: Family life
- Unit 3: The environment around us
- Unit 4: The Thai nation
- Unit 5: News, events, and important days

**Grades III and IV:**

- Unit 1-4: Same as grades I and II
- Unit 5: Occupations
- Unit 6: Energy and chemical substances
- Unit 7: Universe and space
- Unit 8: News, events, and important days.

**Grades V and VI:**

- Units 1-7: same as grades III and IV
- Unit 8: Neighboring countries
- Unit 9: Transport and Communication
- Unit 10: Population education
- Unit 11: Politics and government
- Unit 12: News, events, and important days

Although the same title is used for units in all grades, the content varies both in detail and scope. In grades I and II the topics will be concerned with the pupils' immediate surroundings, such as the school environment, the quality of life in school and maintaining cleanliness. In grades III and IV the concern is still with community life but the topics also include water and air terms, pollution problems and conservation. Grades V and VI cover environmental topics such as deforestation and forest conservation, water conservation, degradation of the biosphere and its protection. Environmental problems also are mentioned in related units such as Population education, Energy, Chemical substances, Living organisms and Occupation.

Contents relating to environmental concerns in the elementary school curriculum are as follows (Vorapipetana et al., 1981):

**Grades 1 and 2:**

- How to clean the house
- How to dispose of household garbage
- How to help keep the school environment clean, beautiful and healthy
- How to behave according to school rules and regulations
- How to keep our community beautiful

**Grades 3 and 4:**

Proper foods to eat for good health  
 How to use household medicines  
 Consequences of the destruction of plants and animals in our surroundings  
 Some laws and regulations concerning animal conservation, protected areas and national parks  
 How to keep our home clean, tidy and healthful  
 Conservation of natural resources such as earth, water, air and trees in Thailand

**Grades 5 and 6:**

Foods to be avoided  
 Responsibilities as a member of a family and community  
 Conservation methods concerning earth, forests and water  
 How to conserve natural resources in Thailand such as trees, minerals, animals and water  
 Chemicals in our life such as medicines, insecticides, fertilizers, detergents, and how to use them safely and properly

Following are the examples of Life Experience lesson plans developed by the curriculum Development Center (Prasarttong-Osoth, 1981):

**Example A: Grade 1, Unit 3: The environment around us (10 hours)**

**Sub-unit 2:** Our community

**Item 6:** Maintaining the cleanliness and beauty of nature and the environment

**Concept:** The cleanliness and beauty of nature and the environment depend on the cooperation of all members of the community.

**Objectives:** To be able to:

1. Collect litter and rubbish and dispose of them in the proper places;
2. Identify public property in the community
3. Refrain from throwing away rubbish in public places;
4. Help look after and take care of the natural environment of the community;
5. Compare differences of environmental situations, between the well-maintained and the neglected ones;
6. Recall the advantages of keeping places and the natural environment clean and beautiful;
7. Cooperate in keeping the environmental surroundings clean and beautiful;
8. Use and store cleaning tools properly;
9. Draw pictures, make origami, build things from local materials or waste materials;
10. Sing songs about how to clean things and the beauty of the community's natural environment.

**Content:**

1. How to clean things;
2. How to look after the beauty of nature and the environment;
3. The advantages of keeping the environment clean and beautiful;
4. The disadvantages of neglecting the environment.

**Activities 1:** Observe the rubbish disposal method used in the school and discuss the effectiveness of the method in term of its cleanliness, the results of inefficient methods and proper ways of disposing of rubbish. Then do the cleaning.

The pupils should practice in groups. Each group will have to report its performance:

- Group 1:** Clean the classroom and dispose of the rubbish properly.  
**Group 2:** Clean the school playground and dispose of the rubbish properly.  
**Group 3:** Clean the school yard and dispose of the rubbish properly.

**Activities 2:** Study pictures of rivers, canals, roads and bridges and discuss who owns them and who looks after them. The pupils should identify public property in their community.

**Activities 3:** Take the pupils around the school to see public property such as roads, canals, rivers, ponds, bridges and statues, and ask questions like:  
 - Which looks bad to you and why?  
 - Any suggestions for improvement?  
 - How should you behave if you were to use the place?  
 - If all of you use that place and do not take a good care of it, what will the consequences be?

- Should you draw lines or pictures on public properties, and if not, why not?
- Activities 4: Relate a story about how to look after the cleanliness of public places and ask pupils to draw conclusions from the story about the advantages of such practices.
- Activities 5: Study from pictures or real-life such situations as polluted river water, polluted air and littering, and discuss the causes. Compare well-maintained and neglected environmental surroundings and think up ways to prevent environmental problems from arising.
- Activities 6: Assign pupils to plant trees around the school grounds, near the school or at public places and give pupils the responsibility to look after them. The planting should follow discussion about the usefulness of trees (fruit, nuts, shade, wood, sap, water catchment) and how they add beauty to the environment.
- Activities 7: Assign pupils to familiarize themselves with various cleaning tools and also to discuss how to store them after use. Use and store cleaning tools according to the discussions and assign pupils to take turns looking after these tools for the whole year.
- Activities 8: Assign pupils in groups to do the following:
  - draw pictures of clean and littered public places,
  - make paper bags to be used as garbage containers,
  - make brooms from coconut sticks,
  - make rugs from cloth samples,
  - make insect whips from banana leaves,
  - collect pictures to make scrapbooks of public places.
- Activities 9: Sing songs about the cleanliness and beauty of the natural environment and have pupils gesture to the beat of the songs.

**Example B: Grade III, Unit 3: The environment around us**

**Sub-unit 2: Physical environment**

**Item 1: Water (10 hours)**

**Concept:** Water is the most important natural resource in our lives so we must all conserve it.

- Objectives:** To be able to:
1. Name the uses of water;
  2. Make use of water in daily life;
  3. Name substances that are obtained from water or that exist in water;
  4. State the consequences of drinking polluted water;
  5. Describe methods of conserving water;
  6. Carry out methods recommended for the conservation of water;
  7. Draw pictures of plants and animals living in the water.

**Social indicators of values which need to be emphasized:**

unselfishness, generosity, carefulness, observation and thriftiness.

- Content:**
1. Uses of water in daily life:
    - for drinking, bathing, washing and watering plants,
    - for agriculture and industries,
    - as a living medium for plants, animals and fish,
    - for fishing and transportation.
  2. Items obtained from water bodies including fish, marine animals, shells, coral, salt, water chestnuts, reeds, lotus and other plants.
  3. Conservation of natural waters and ways and means of preserving it, by:
    - refraining from dumping rubbish, chemicals or sewage into natural water sources,
    - cooperating in keeping rivers and canals clean,
    - identifying methods to make water clean and safe for drinking.
  4. Consequences of the pollution of water:
    - it becomes a source of infectious diseases,
    - it results in shortages of water for drinking and for household use,
    - it inhibits agricultural production.

**Example C: Grade IV, Unit 3: The environment around us**

**Sub-unit 2: Physical environment**

**Item 1: Water (21 periods or 7 hours)**

- Concepts: 1. There exists in nature a network of water resources which are essential to human lives.  
2. Water is the most important natural resource and we must all try to conserve it.

- Objectives: To be able to:
1. Identify natural water resources;
  2. Name the uses of water in agriculture and fishing;
  3. Explain the nature of water;
  4. State the consequences of water pollution on the environment;
  5. Identify measures to be taken to prevent water from being polluted;
  6. Act rationally in various ways in preventing water from being polluted;
  7. Make water safe for drinking and for daily use in the home;
  8. Draw pictures or write mottos campaigning for the conservation of clean water or draw pictures depicting the uses of clean drinking water.

Social indicators of values and achievements which need to be emphasized:

unselfishness, responsibility, awareness of the importance of natural resources.

- Content:
1. Water resources and water cycle;
    - local natural resources (rivers, canals, ponds, lakes);
    - description of water cycle,
    - conservation of forests and streams.
  2. Uses of water in daily life: (expanded version of those for grade III).
  3. Resources obtained from water: (similar to grade III).
  4. Use of natural water and its conservation:
    - how to use water economically,
    - how to keep water resources clean by not throwing rubbish or sewage into rivers, canals, or ponds,
    - how to make water clean and safe for drinking.
  5. Unfavorable consequences of water pollution (similar to grade III).
  6. Make water safe for household use.

In grades I and II there are no textbooks for the Life Experience area, but starting in grade III there is one Life Experience reader for each grade. These readers are meant to be used as reference materials for pupils. Besides these specific readers there are many other supplementary readers being developed by the Department of Educational Techniques, e.g.:

Life of Plants and Animals,  
The Sun and the Moon,  
The World We Live In,  
Water,  
Our Home,  
Scientific Experiments,  
Forest Resources,  
Tour Around the Zoo,  
Our School.

These are supplied to primary school libraries, and the schools are urged to acquire more. Prototype teaching materials are also under development together with teachers' handbooks on how to make the teaching aids recommended in the lesson plans (Prasarttong-Osoth, 1981).

#### Secondary school level:

For the lower secondary level, an integrated science curricula has been developed by the Institute for the Promotion of Science and Technology (IPST), in which the environment is used as a core theme around which the entire course is developed. It interrelates change, energy and environment (Ponniah, 1982).

IPST has used an integration approach to include environmental education concepts in all science and social studies courses and by

means of supplementary materials such as audio-visual aids (Manilerd, 1990; UNESCO, 1990).

An environmental education elective course, "Conservation of Natural Resources and the Environment" is offered as a separate subject at the lower secondary level (UNESCO, 1990).

Contents relating to environmental concerns in the lower-secondary curriculum are as follows (Vorapipetana et al., 1981; UNESCO 1985):

**Grade 7:**

**Science:**

How to prevent or overcome water pollution  
Utilization and conservation of minerals  
Relationship between humans and their environment

**Social studies:**

Environmental conservation at the provincial level  
Environmental effects on daily life on a regional basis  
Roles and responsibilities towards the community  
Regulations on the conservation of our surroundings

**Grade 8:**

**Science:**

Soils and their conservation

**Social studies:**

Conservation of national resources: forest, animals, water, soil, air, minerals, population  
The role and responsibility of the individual  
Regulations on the preservation of animals

**Grade 9:**

**Science:**

Effects of population increase on the environment  
How to adapt the environment to benefit daily living  
Causes of deterioration of the environment  
Causes of water and air pollution  
Garbage and its disposal  
Soil degradation  
Effects of energy utilization  
Prevention and control of noise pollution  
How to work toward a balance in nature

**Elective courses:**

**Humans and their environment**

Population distribution and peoples' occupations as related to the environment:  
utilization of resources; environmental problems; environmental pollution; prevention  
and revision of laws concerning the environment

**Thai society:**

Various social problems in Thailand and how to solve them: poverty; land holding for  
cultivation; illiteracy; crime; juvenile delinquency; drugs; traffic; migration; food  
deficiency; slums, strikes and national security

A separate environmental course "Energy and Environment" is offered in the elective social studies at the upper secondary level. Environmental issues are integrated in all science courses: biology, chemistry, physics, and physical biological science (UNESCO, 1990).

A modular approach was developed by IPST. The modules are topic-centered and aimed at providing motivation and competency for students to cope with the problems of their environment and to apply science in their daily lives. In the IPST curriculum in biology, for example, the ecosystem, environmental balance and natural resource conservation are

discussed in depth. Industrial chemistry and its impact on the environment are dealt with in the chemistry course (Ponniah, 1982).

In chemistry teaching at the senior high school level, chapter eighteen (the last volume 6 chemistry text) deals exclusively with chemistry and the environment. Similar topics are starting to appear in college laboratory texts. Chemical waste management has not yet been touched upon (Bhanthumavin, 1989).

One major objective of the IPIST science curricula is "to develop an understanding of the consequences of science and technology on man, society and environment". In 1981 a project "The Development of Materials for Environmental Education" was launched. The environmental education project was also included in the Fifth National Economic and social Plan (1982-1987). An outcome of the project was thirteen units for secondary school, each unit consisting of a student book, slide-tape and posters. The topics of the units are as follows (Vongchusiri, 1987):

1. *Electricity is valuable: electricity-saving households will lead to national conservation of electricity and non-renewable resources.*
2. *I love trees: many benefits are obtained from trees, so love and care should be given to them.*
3. *Irritating sounds: sources of noise pollution, its harmful effect, and means of protection.*
4. *The land we live on: land use in Thailand, the effects of farming, forestry and mining on the environment and the way in which man may control environmental impact.*
5. *Transportation and energy: means of transportation and the use of energy, as well as their effects on the environment.*
6. *population and balance of nature: population dynamics, population growth and life style, the causes of problems that impact on the environment and the ways to control population growth.*
7. *Food consumer's guide: how to select the proper kinds of food required to keep healthy, the dangers of certain chemicals that accidentally or intentionally get into the food and are hazardous to health; how to rightfully protect ourselves as consumers.*
8. *Food additives: food additives commonly used in everyday life, the needs for adding them to foods, their long-range effects on our bodies.*
9. *Water: a stream of life: the value of water from sources on earth, the causes and effects of polluted water and the proper ways to clean polluted water.*
10. *Noise and daily life: loud noise has physical and mental effects on people, the cause, and effects, of noise and how to control it.*
11. *Wondering about trees: what a tree can do, what is obtained from it and how to conserve it.*
12. *Air pollution: the importance of clean air, causes and effects of polluted air and ways we can control it.*
13. *Solid waste - our problem: causes and effects of solid waste on the environment and how to control and manage the problems.*

According to the project plan, these materials were suggested for use in schools in 1984. The project went on until 1987.

Source books and teacher's guide manuals:

The subject Conservation of Resources and the Environment, part of the Life Experience subject area, is taught as an elective subject at the low secondary level (grades 7-9). In order to help teachers deal effectively with this new area, a teacher's guide was prepared. The manual emphasizes the problem-solving approach to teaching. It includes various kinds of environmental problems students are likely to meet. The teacher can select problems from the manual that are considered to be the most important for the local community. Teachers are encouraged to raise other problems, which may not be covered in the manual, but match ones existing in the students' own neighborhood, following the teaching and learning techniques in the manual as examples (Vorapipetana et al., 1981).

To supplement the work of IPST, Pranakorn College organized an Environmental Education Development Project for Elementary and Secondary School Levels. The project is designed to give teachers in-service training and to prepare written materials for teachers' use. Several teachers' workshops have been held on methodologies for environmental education at pre-school, elementary, secondary and tertiary levels (Kanhassuwan et al., 1987).

At present, IPIST is working on Environmental Science Education and environmental activities to be used in science camps or in a classroom on a trial basis (Manilerd, 1990).

#### University level:

Following are the tertiary level institutions offering environmental education and training courses in Thailand (UNEP, 1986):

Asian Institute of Technology, Division of Environmental Engineering;  
Chulalongkorn University, Institute of Environmental research;  
Chiangmai University, Department of Environmental Engineering;  
Kasetsart University, Department of Conservation, Environmental Science Program, Faculty of Forestry;  
Khon Kaen University, Department of Sanitary Science;  
King Mongkut's Institute of Technology, Thonburi, Department of Civil Engineering;  
Mahidol University, Faculty of Environment and Resource Studies;  
Prince of Songkla University, Department of Community Medicine;  
Sukothai Thammathirat Open University;  
Thammasat University.

The Faculty of Environment and Resource Studies, Mahidol University, offers a 2-year post-graduate program that covers a wide range of environmental courses supplemented by field studies, e.g.:

Ecological System Analysis,  
Pollution Problems and Control,  
Introduction to Environment and Management,  
Sociology and the Human Environment,  
Environmental Conservation and Natural Resources Management,  
Mathematics Applied to Environmental Systems,  
Systems for Environmental Administration.

The College of Engineering, Chulalongkorn University, has long been interested in environmental education and training of engineers. It has also hosted short training courses in specialized areas of environmental protection in collaboration with UNEP and WHO.

The Division of Environmental Engineering of the Asian Institute of Technology, Bangkok, offers graduate environmental education and training in two fields: Water and Waste-water Engineering and Environmental Technology and Management (Ponniah, 1982).

**Extension programs** (for government officials, specialized technical training):

The National Environment Board provides intensive training courses on environmental sanitation for government officials (UNEP, 1986).

## 2. Non-formal environmental education:

### Biosphere reserves:

There are three biosphere reserves in Thailand (Khemnark, 1987):

1. The Sakaerat Environmental Research Station (SERS), an ecosystem of dry dipterocarp and dry evergreen forests;
2. The Mae Sa-Kog Ma Reserve, two areas of forest ecosystems located in the mountain areas;
3. The Huay Tak Teak Reserve, the teak (*Tectona grandis* L.) plantation. It was a natural teak forest, gradually cleared for agriculture, replanted after 1940, and subsequently enlarged to include abandoned lands.

The biosphere reserves are the site of both formal and non-formal environmental education and training activities organized by universities, colleges, schools and agencies.

### Out-of school activities:

IPIST is developing activities and materials to be used in science camps.

IPIST has published the following supplementary materials and audio-visual aids (Manilerd, 1990; UNESCO, 1990):

#### Slide tapes:

- I Love Trees,
- Noise in Daily Life,
- Solid Wastes: Problem of Everyone's Concern,
- Utilization of Waste Materials,
- Herbs at Hand.

#### Posters:

- Irritating Noise.
- Transportation and Energy,
- The Hazardous Effects of Insecticides,
- Visual Pollution,
- Quality of Life and Its Elements,
- Acid Rain,
- Dam and Ecosystem,
- Environment and Its Impact on Thai Arts.

#### Booklets:

- Price of Electricity,
- Population and Balance of Nature,
- Value of the Land,
- Solid Waste: Our Problem,
- Water: The Stream of Life,
- Shopping for Health,
- Food Additives,

- The Wonder of Trees,
- Air Pollution,
- Animals and Their Importance,
- Nature and Its Network,
- Psychoactive Substances: The Risks of Life.

**Workbooks:**

- Polluted Air,
- Water Usage,
- Electricity Saving,
- Hygienic Eating Habits,
- Cleanliness,
- The Importance of Trees,
- Loudness of Noise.

The Pranakorn Teachers' College has developed the following environmental education publications (UNESCO, 1990):

**Elementary level:**

- Trip for Study Environment,
- Trip to the Public Park,
- Trip to the Rocky Shore,
- Trip to the National Park,
- Our School Ground,
- Trip to the Zoo,
- Trip to the Botanical Garden,
- Integrated Activities on the Zoo,
- Urban Study,
- Historical Site.

**Secondary level:**

- Around the School Area,
- Trip to the National Park,
- Trip to the Botanical Garden,
- Trip to the Zoo,
- Trip to the Rocky Shore,
- Field Study of Mangrove,
- Trip to the Forest,
- Urban Study,
- Historical Site.

**Adult education activities:**

The Adult Education Division of the Ministry of Education is developing and expanding several programs for adults, especially for those living in rural areas. Many of the activities include environmental topics, e.g., "Interest group programs" (5 - 30 hours study), which provide training on topics like how to choose fertilizers, how to manage a farm, how to grow mushrooms, or "Mobile vocational training programs", which give short vocational skills training, i.e., in agriculture or food preservation (Puranajoti, 1982).

The Department of Non-formal Education is involved in the production of books and materials, and in teaching by using local experts to help the farmers. Topics on the proper use, misuse and chemical effects of pesticides have been included in the Functional Literacy Program and newspapers. The department also teaches farmers to make natural compost (Choomnoon, 1985).

The Department of Agriculture Extension is disseminating information on topics like the selection of high yield varieties, plant diseases, insect control, biogas production, soil analysis and fertilizers to farmers (Puranajoti, 1982).

The Sanitation Division, Department of Health, is involved in research, experimental production and promotion of biogas and human waste fertilizers, showing people how animal and human waste can be converted into natural cooking gas and fertilizer (Puranajoti, 1982).

Environmental problems concerning nutrition, health, sanitation and the conservation of natural resources are included in the Functional Literacy Programs (UNEP, 1986).

**Mass media:**

The Radio Station of the Environmental Research Institute in Chulalongkorn University broadcasts a weekly half-hour program "Environmental Review" in non-technical language to the general public (UNEP, 1986).

The Education Broadcast Station, organized by Center for Educational Technology, provides programming about both basic and applied science, such as chemistry, biology, physics, nutrition, health and agriculture (Puranajoti, 1982).

The educational television programs comprise about 14 percent of the total. Among them, there is a program, "Life and Nature" (Puranajoti, 1982).

A number of Thai language newspapers play an important educational role. Most well-known newspapers have permanent columns on science and technology, and occasionally present environmental topics like "Beautiful animals", "Knowing little-by-little each day around the house", "Wonderful life of wild animals", etc.

**Governmental and non-governmental organizations:**

Many Clubs and societies are active in promoting environmental education, e.g.:

- The Institute for the Promotion of Teaching Science and Technology,
- Wildlife Fund Thailand,
- Bird Watching Club,
- Division of National Parks,
- TV Channel 9,
- National Board of Environment.

They arrange environmental camps, provide in-service training on certain aspects of the environment, and produce supplementary books (Soerjani, 1989).

The Population and Community Development Association (PDA) is the largest of the private registered non-profit organizations engaged in the training and support of indigenous people for family planning, parasite control, general health and community development at the village level. In December 1978, the Community-Based Appropriate Technology and Development Services (CBATDS) was established, which provides non-formal training, technical assistance, low interest credit and loans to active family planning acceptors for adoption of appropriate technologies for feed, fuel and fertilizer production,

better marketing and environmental sanitation. CBATDS also conducts field study tours for local children to observe the activities of the center and learn the process of methane gas generation and fertilizer production through anaerobic digestion of pig manure in the biogas digester (Puranajoti, 1982).

The Thailand Wild Life Fund campaigns for the protection of wildlife and forest land areas (Choomnoon, 1985).

### 3. Training of environmental education personnel:

#### Teacher training:

Environmental education is offered as a separate course in the teacher-training colleges (UNESCO, 1990).

In pre-service teacher training programs, elective environmental science courses are offered under general science. Graduate training in environmental studies is provided at universities such as Kasetsart, which has an M.Sc. program in Environmental Science, and Mahidol University, which has two master's degree programs: an M.Sc. in the Technology of Environmental Management, offered by the Faculty of Environment and research Studies, and an M.Ed. in Environmental Education, offered by the Faculty of Science and Humanities (Vorapipetana et al., 1981; UNESCO, 1985).

The Office of the National Environment Board gives in-service training courses for teachers of environmental education in addition to producing posters, tape-slide series and other teaching materials. Mobile educational units have been sent out to schools all over Thailand (at least to one school in each of the 73 provinces) to organize environmental exhibitions and related activities (UNEP, 1986).

The Science Teachers Section of the Science Society of Thailand promotes higher standards of teaching science. The activities include, among many others, summer teacher training in environmental science (Puranajoti, 1982).

The Pranakorn Teacher's College has established a special project, "An Environmental Education Development Project for Elementary and Secondary School Levels", that focusses on pre-service and in-service teacher training, and on the development of student workbooks for field study. Almost one thousand teachers have been trained during workshops on environmental education and methodology of teaching at elementary, secondary and tertiary levels (Soerjani, 1989).

#### Organizers of non-formal education training:

Three-day seminars were organized at the village level for volunteer monks, informing them about the state of the environment in their region, as well as about effective strategies for improving it. About 100 abbots from the Upper North, where deforestation is taking place at an alarming rate, attended the seminar (UNEP, 1986).

#### 4. Major environmental education problems (identified by UNESCO-UNEP, 1976):

At the secondary level: relative lack of specially qualified teachers for environmental education.

At tertiary level: insufficiency of professional personnel (university professors, specialists in the different sub-areas of environment), and to a lesser degree, lack of educational facilities and equipment.

At the out-of-school education for youth level: shortage of leadership personnel qualified in the area of the environment, and to a lesser degree, shortage of adequate out-of-school teaching materials for the youth such as audio-visual aids, games, guides, books and magazines.

#### 5. Some institutions engaged in the environmental education (UNESCO, 1983; UNESCO, 1989; Soerjani, 1989):

- Department of Educational Techniques, Ministry of Education, Bangkok;
- National Environment Board, Environmental Impact Assessment Division, Bangkok;
- Ministry of Science, Technology and Energy, (Office of the National Environment Board),
- National Research Council of Thailand, Bangkok;
- Institute for Promotion of Teaching Science and Technology (IPST), Bangkok;
- Environmental Health Division, Bangkok;
- Sanitary Engineering Department, Bangkok;
- Population Education Unit, National Curriculum and Instruction Development, Bangkok;
- Department of Non-Formal Education, Ministry of Education, Bangkok;
- Division of Technological and Environmental Planning, Bangkok;
- Environmental Coordinating Unit (ECU), Economic and Social Commission for Asia and the Pacific (ESCAP), Bangkok;
- Toxic Substances Research Board, Agriculture Technology Department, Ministry of Agriculture and Co-operatives, Bangkok;
- UNEP Regional Office for Asia and the Pacific, Bangkok;
- Archaeology Division, Fine Arts Department, Bangkok;
- Chulalongkorn University, Bangkok:
  - Department of Marine Sciences,
  - Department of Environmental Engineering,
- Mahidol University, Bangkok:
  - Faculty of Science,
  - Faculty of Social Sciences and Humanities, Department of Education, Environmental Education Division,
  - Faculty of Environment and Resource Studies,
  - Institute of Environmental Research;
- Kasesart University, Bangkok:
  - Faculty of Fisheries,
  - Department of Conservation, Faculty of Forestry,
- Chiang Mai University, Chiang Mai:
  - Department of Environmental Engineering,
  - Department of Soil Science and Conservation;
- Prince of Songkla University, Songkla:

Faculty of Education (Pattani),  
Department of Mining and Engineering,  
Faculty of Medicine,  
Faculty of Natural Resources,  
Graduate School (Hat Yai);

- Khon Kaen University, Faculty of Engineering, Environmental Engineering Department, Khon Kaen;
- Pranakorn Teachers College, Environmental Education Center, Bangkhaen, Bangkok;
- Southeast Asian Regional Center for Tropical Biology, Bogor;
- Division of Environmental Engineering, Asian Institute of Technology (AIT), Bangkok;
- Environmental Social Science Program, Department of Social Sciences, Nakornpathom;

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**Country: VIET NAM****Basic indicators (The World Bank, 1990; UNESCO, 1988):**

Population, mid-1988 (millions): 64.2  
Area (thousands of square kilometers): 330  
Adult illiteracy, 1985 (percent): ?  
Percentage of age group enrolled in education (1987):  
    Primary: 102  
    Secondary: 42  
    Tertiary: ?  
Primary education pupil-teacher ratio (1985): 34

**ENVIRONMENTAL EDUCATION:****1. Formal environmental education:**

**Primary and secondary school level:**  
(No data available.)

**University level:**

Some universities and tertiary level institutes, e.g. Faculty of Environmental Engineering in Hanoi Polytechnic Institute and the Faculty of Public Sanitation in Hanoi Medical Institute, have established environmental courses (UNEP, 1986).

**Extension programs (for government officials, specialized technical training):**

Environment management courses for government officials are conducted four times a year, with emphasis on the socio-economic aspects of the environment. Courses for technical manpower focus on the wise use of natural resources and the environment (UNEP, 1986).

**2. Non-formal environmental education:**

**Out-of-school activities:**  
(No data available.)

**Mass media:**

Mass media play an important role in educating the general public. Radio, television, newspapers and journals regularly publish articles on the environment. Special television programs for children on different aspects of the environment are shown daily. Special events are organized for the public on World Environment Day, National New Year and on Traditional Days (UNEP, 1986).

**Non-government organizations:**

Various non-governmental organizations, e.g. Association of Gardeners Activity, promote environmental protection activities. Youth are also involved in various environmental conservation programs in the country (UNEP, 1986).

## CONCLUSIONS

Environmental education is not unknown in most Asian Countries.

In almost all Asian countries public awareness has been raised, and there are environmental issues in the formal and non-formal education systems.

If the amount of published data on environmental education reflects a measure of environmental education activities, the following Asian countries should be pointed out as outstanding:

India, a country with many environmental problems resulting from poverty and underdevelopment on the one hand, and rapid industrialization on the other, has introduced environmentalism in both, formal and non-formal education sectors. In the formal education system, all nationally-developed curricula include at least some environmental issues. Some interesting environmental education packages and programs were developed. Much effort has been put into non-formal environmental education, especially in forms of out-of-school activities for children, youth, adults and the general public, and mass media programs. Many governmental, private and voluntary organizations sponsor environmental education projects.

Singapore is an example of a highly developed country that places great importance on a clean environment and appears to have solved almost all of its major environmental problems. In the formal education system, provisions for the education and training of adequate manpower in environmental planning and control have been made. Environmental issues have also been included in several programs at the university level. In the non-formal education sector, an interesting approach of national education campaigns has been introduced.

In Thailand, environmental education components have been integrated into school curricula and university syllabi. At the primary school level, a "Life experience program" has been introduced. At the secondary level, environmental contents have been integrated into natural and social science programs. Teacher training colleges offer environmental science courses during the pre-service teacher training. Environmental awareness has also been introduced through non-formal education system. Some interesting adult education programs have been developed especially for rural people.

In Malaysia, the interdisciplinary subject "Man and his environment" has been introduced at the primary school level. It uses environmental resources and themes to teach science, health, geography and history. The new secondary school curriculum includes many environmental aspects, especially in science courses. The non-formal environmental education sector seems to be very strong. In addition to various out-of-school

activities and mass media programs, numerous organizations are involved in all kinds of environmental activities.

In China, the process of integrating environmental education into the formal education system moved from the top of the education pyramid downwards. Special in-service and pre-service programs were developed for managers, technical personnel and government officials. Many colleges and universities now offer environmental programs and courses at both graduate and post-graduate levels. Research institutes and university departments with environmental science and engineering programs form a significant part of the research area in China. On the other hand, environmental teacher training is still at a very initial stage. Recently, China focusses on the secondary school level. According to the 1990 revision of middle school teaching program by the Basic Education Department of the State Education Commission, each middle school is entitled to establish environmental education as an elective course at the senior secondary level. Revisions for the basic education school level are still forthcoming.

In Japan, environmental education components have been integrated in the formal school system. Japanese colleges and universities offer scientific and technical courses related to environment. An important role in Japanese environmental education is played by non-governmental and voluntary organizations and movements, that are actively involved in non-formal environmental education programs and also in environmental decision making.

The Philippines incorporated environmental education topics in the school curricula at all levels. Some interesting examples of primary and secondary level environmental activities were found. Environmental science was taught as an elective subject in many public and private schools. Unfortunately, in 1989 electives were removed from the secondary curriculum. At the university level, even non-science students are required to take one environmental science related subject.

Hong Kong, Indonesia, the Republic of Korea and Sri Lanka also have introduced environmental education in their formal and non-formal education systems.

In Afghanistan, Bangladesh, Brunei-Darussalam, Fiji, Nepal, Pakistan, Papua New Guinea and Viet Nam, environmental education systems are not developed in an organized way yet, but public awareness of environmental issues has been raised to at least some extent. There are some data available that show the rudiments of environmental education in the formal or non-formal education systems of these countries.

There are no data available for Bhutan, Kampuchea, Korea DPR, Lao, the Maldives, and Myanmar (Burma). These countries may have some environmental education programs, but probably they are not very active in the field, since they did not participate in any of the environmental education conferences, nor did they publish their results in international journals and other publications.

In implementing environmental education, Asian countries confront many problems. The following appear most frequently in the literature:

- lack of funds,
- shortage of qualified teachers and leaders for non-formal environmental education activities,
- shortages of instructional materials, especially specialized books, magazines, guides and audio-visual aids,
- lack of environmental awareness and participation among community groups,
- lack of coordination and systematic efforts at the country, sub-regional and Asia regional levels.

The weakest point in environmental education in most Asian countries seems to be the training of teachers and non-formal environmental education personnel. Some countries have quite well-developed in-service teacher training programs, but a comprehensive pre-service environmental teacher training program is not described in the available sources of information.

Another problem facing many Asian countries is the sustainability of projects introduced with the financial support of foreign countries or international institutions. Many pilot projects have developed useful teaching materials, that were never transferred into the regular education systems because of lack of funds. Therefore, future efforts should be focused not so much on isolated short-term projects, but on promotion and transference of already developed concepts and materials into regular school systems.

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