Man & His Environment

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NATIONAL SCIENCE COUNCIL OF SRI LANKA

REPORT

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A Seminar Discussion on

Man & His Environment

Guest Participant : Dr. Hansjorg Oeltzschner

Chairman : Prof. B. A. Abeywickrema

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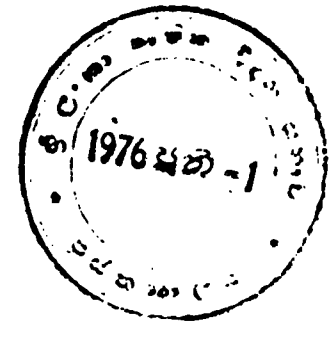

Co-sponsors : National Science Council of Sri Lanka
German Cultural Institute

The Seminar was inaugurated by **Dr. Osmund Jayaratne,** Chairman, National Science Council of Sri Lanka and held at the Sri Lanka Foundation Institute, Colombo, on the 9th March 1976.

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ORGANISER'S NOTE

At a time when we are becoming conscious of the dangers resulting from environmental pollution and the need for the protection of man's environment, the visit to Sri Lanka of Dr. Hansjorg Oeltzschner, Official of the Bavarian State Authority on Environmental Protection, Federal Republic of Germany, was opportune.

The National Science Council took this opportunity to organize a Seminar on "Man and His Environment" with the intention of initiating a stimulating discussion among the participants. I would like to mention here that it was heartening to realise that the participants had taken time off from their busy schedules to be present at the Seminar and I express my thanks to all of them and specially to Professor B.A. Abeywickrema who chaired the Seminar.

I also wish to express my sincere thanks to the Director Dr. G. Greiner, and to Mr. T. Figge of the German Cultural Institute for all the assistance given in connection with the Seminar and to Dr. V. Pasupathy of the CISIR for informing us in advance regarding Dr. Oeltzschner's visit to Sri Lanka. Thanks are also due to the staff of the Sri Lanka Foundation Institute and to the members of the staff of the National Science Council. Special thanks to Miss Seetha Fernando of the National Science Council for all secretarial and other assistance.

Mrs. Swarna Prelis

Organiser

INAUGURAL REMARKS

Dr. Osmund Jayaratne
Chairman, National Science Council of Sri Lanka

It is with great pleasure that I welcome our guest speaker Dr. Hansjorg Oeltzschner from the Federal Republic of Germany to speak to us on various aspects of "Man and His Environment". This Seminar has been organised by the National Science Council with the collaboration of the German Cultural Institute. On behalf of the Council I must thank the Goethe Institute and the German Cultural Institute on behalf of the scientific community of Sri Lanka.

This Seminar is on environmental pollution. Today we hope to discuss various aspects of environmental management ranging from pollution problems to land development and land use. Scientists became conscious of environmental problems about two decades ago. They realised that the effect of man's activities on earth, if unchecked would lead to disaster.

Besides the scientific aspects of environmental pollution to which attention is being given, there are social and political aspects, such as the nuclear arms race and nuclear testing. We can see the tragic results of new forms of warfare such as chemical and biological methods. Vietnam is a tragic symbol of man's pollution of his own planet.

Factories and other industrial units, too, run counter to man's natural environment. Their activities result in pollution of water, soil and air. Most of these, if unchecked become disastrous to man and other living beings. Urban pollution too needs immediate attention today.

Thus our topic today is one of paramount importance to everyone. I am very happy that Dr. Oelzschner is here today to discuss with us the consequences and control of environmental problems.

I must once again thank the Goethe Institute, Munich and the German Cultural Institute for sponsoring this Seminar.

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INTRODUCTION

Chairman : Prof. B.A. Abeywickrema

Man's welfare is inextricably linked with that of his whole environment. Human personality and behaviour is largely determined by the environment. All living organisms evolve together and form a complex system with the non-living environment. Man first came on the scene one million years ago, after other organisms had made the environment suitable for him. The environment then formed a steady state system. There was an inter-relationship between the activities of various organisms. Plants build energy-rich organic matter which provides food for all living organisms. The waste products of living organisms are converted by micro-organisms. The end products of one set of organisms are the metabolic requirements of another. Mineral matter is thus continuously re-cycled. The continuity of life is made possible because of this re-cycling. Life and death are continuing processes. Thus there is an equilibrium between the building up and breaking down processes.

Early man could make only relatively small changes. Palestine which was called the land of milk and honey, due to over exploitation then, is now converted to more or less desert area. Elsewhere, where the rain-fall conditions were more favourable, marshes were converted into paddy fields. Land use systems evolved to prevent deterioration. These systems are in equilibrium with the environment.

During the last two hundred years, science and technology have raised the standards of living. The advance in science and technology have resulted in an increase in material comforts. This is not an unmixed blessing. Enormous industrial development is causing depletion of material resources and pollution of air and water. Urbanisation has led to associated social problems. Death control without birth control has resulted in a population explosion. The population problem is

assuming global proportions and is resulting in land use and housing problems. Land use problems have led to deforestation.

The answer to these problems is a basic change in attitude. Man and his environment form a closed global system. Man has to learn to live in partnership with nature. He has to evolve a system which leads to a balance between himself and his environment on a continuing basis.

I shall now request Dr. Oeltzschner to speak on the problems of our environment.

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SESSION I

Man's Impact on the Ecosystem

Dr. Hansjorg Oeltzschner

I must thank the Goethe Institute, Munich, the National Science Council of Sri Lanka and the local German Cultural Institute for arranging this Seminar. I have to thank you particularly for your interest. Environmental pollution should be a topic of public interest.

Travelling in India I saw a lot of pollution. I have seen only a part of your beautiful country, but Sri Lanka seems almost unpolluted to me. I have not come to show you your mistakes but to discuss and exchange ideas.

The history of mankind has been a struggle to survive and to enjoy a more comfortable life. This struggle resulted in changes in his environment. The artificial environment thus created began to lose qualities essential for life. The equilibrium which was a vital part of Nature is lost. The anthropogenic environment may collapse and turn against man. Man needs protection from his own reckless action.

The statement 'man's biggest enemy is man' holds true. Man has to protect water, air and soil against pollution. This requires close co-operation between engineers, physicists, biologists, etc. They have to study the consequences of existing pollution and to identify and classify and act accordingly. Pollutants endanger man, flora and fauna. The better use of landscape and environment is essential. Ecological thinking is required. This information should reach the general public and this has to be a pre-requisite for policy making.

Real environmental protection began with the Industrial Revolution, when civil engineers started probing sewage and water pollution problems. Their activities were confined to the areas of public health and sanitation.

Global pollution of the environment began late. Now man has realised that all life on earth depends on his activities. By the

production of industrial and radioactive waste, the increase of carbon dioxide, dust and thermal energy, the pollution of the environment is increasing exponentially everyday.

The progressive rise of the carbon dioxide level and dust content of the air causes changes of temperature and climate. At the altitude of 10,000 feet, stationary dust clouds shroud almost the whole east coast of the USA and nearly every huge "modern" city in the world. In Washington DC, since 1900 to 1964 there has been an increase of smog of 57%, at Davos/Swiss Alps of 80% and at Hawaii of 30%. Since the beginning of industrialization in the USSR the dust level has increased 19 times. Now there are about 2.5 to 5 million dust particles (600 to 800 per sq. mile) in the air. At the content of 50 million, the mean temperature will sink down to 4°C. Air pollution by aeroplanes causes 5 to 10% increase of cloudiness.

The growing reduction of the heat radiation of the earth by human influence as effects of urbanization has destroyed woodland. Oil-films on water are reducing the heat storage of sea water and the growth of phytoplankton. There are also dangers by radioactive rainfalls. Increasing fluride contents in the atmosphere are going to destroy the shielding curtain of atmosphere against UV-rays.

Huge concentrations of a black highly poisonous sludge, full of pathogenic agents on the sea floor 50 km. east of New York City, a consequence of permanent uncontrolled discharge of municipal sewage and other liquid wastes from ships and pipelines are moving slowly to the coast. Such sewage discharges may cause cholera and other epidemics. This is a particular point for your environment. At least, bathing should be prohibited on certain beaches as in Italy.

In 1972, one million cans of tuna fish were confiscated in the USA because of the mercury content in the tuna fish. This was the first major incident of mercury poisoning. Irreversible brain damage and death has been caused by mercury poisoning. The presence of mercury in fish, pigs and birds has also been recognised in the United Kingdom and in Canada. 'Minamata' disease in Japan was a result of mercury poisoning due to discharge of sewage from a plastic plant. 'Itai-itai' disease results from cadmium poisoning. In Germany, when pollution exceeds certain limits, industries have had to close down.

Some of the more striking examples of air pollution episodes were 4000 deaths in December 1952 in London, 1000 deaths in January 1956 also in London and 300 deaths in 1960 in New York. In December 1952, the deaths were caused by temperature inversion which lasted 4 days and was particularly severe in London. The majority of the deaths were among the elderly people and cardiovascular patients, and were due to pneumonia. The same thing happened in Puerto Rico. All those examples of pollution have one factor in common. Man is losing control of the environment. Instead of being able to control the four elements fire, water, soil and air, mankind is losing control over them which is leading to his own downfall.

Mankind is destroying himself by exceeding the limits of growth and world dynamics. Forrester's computer analysis has predicted an environmental catastrophe in the years between 2020 and 2060, as a threatening result of the combined factors of over-population, uncontrolled technical development and uncoordinated planning, growing scarcity of natural resources, rising of industrialization and the consequently rising of world-wide environmental pollution.

The Massachusetts Institute of Technology has attempted to find possible solutions :

1) Limitation of the rate of use of natural resources by 75%
2) Reduction of pollution by 50%
   Reduction of production of capital by 40%
   Reduction of production of food by 20%
   Reduction of birth rate by 30%
3) Optimal balance of world population : slightly below the standard of 1970 - not to go over 6 billions.

The required basis is a complete change of values.

DISCUSSION

Abeywickrema : Dr. Oeltzschner mentioned that industries have to close down in the Federal Republic of Germany if pollution exceeds certain limits. What control does the government have over industry ?

Oeltzschner : There is legislation to protect against pollution. The owner of a plant is requested to have monitoring systems to record the emission of pollutants. Certain official levels are given and these limits cannot be exceeded. If the maximum level is reached, production is closed down. If maximum level of hazardous limits is reached in the atmosphere, even motor traffic can be stopped. Co-operation between scientists and legislators is necessary for maintaining this control.

Silva : Has this resulted in the closing down of the smaller industries?

Oeltzschner : No. Smaller industries are given a great deal of help from the government. Some industries could not maintain instruments for environmental protection without state aid. The sewage problem is not very acute as sewage treating plants were given by the government. Air pollution by emissions were also immediately stopped.

Fernando : The problem of environmental pollution comes as a result of industrialization. In Ratmalana, an asbestos cement factory and a battery factory have been started and the atmosphere is polluted by asbestos and lead. The people in the neighbourhood complained of the difficulty in breathing. What are we going to do about such a problem ? As a developing country, we need industry, but we cannot industrialize at any costs.

Oeltzschner : Asbestos is very dangerous and there have been many cases of death due to lead poisoning. But we need industry. There is an almost unpolluted landscape in Sri Lanka now, but there will be problems in the near future unless environmental control is practised. Firstly, good co-operation between scientists and government is necessary to have a monitoring system. Secondly, the possibilities of pollution and its hazards must be demonstrated to the politicians. Thirdly, legislation must be framed by the government.

Abeywickrema : Should not industries be sited away from residential areas ?

Oeltzschner : For future planning, it is very important to site industries away from residential areas. It is vital that the views of scientists be heard by the government. When planning the industrial sites, the direction of wind and other meteorological conditions should be borne in mind.

Costa : As a water pollution biologist, I have observed that our fresh waters are highly polluted with sewage. Most of our lakes, rivers, tanks, etc. are polluted due to 1) excess fertilizer and 2) sewage.

In most villages, the houses are sited near a river or stream and all the sewage is washed down into the river. Research on Boira lake showed that there are 2 million bacteria per millilitre, due to faecal pollution. There are insufficient sewage facilities in Sri Lanka. Our water is highly polluted by sewage and microbes, but not so much by industry.

Oeltzschner : The most severe problem is water pollution by sewage. I have seen children bathing in front of sewage disposal areas. This is very unhygienic and must be stopped. I would suggest firstly, the use of simple technology such as the employment of a sewage treatment plant and secondly, education concerning personal hygiene about the hazards of bathing in front of sewage.

For the state of Bavaria, a big sewage treatment plant is quite ideal, but it is not practicable for Sri Lanka. In Bavaria, each sewage treatment plant is sited centrally with respect to several villages.

I would propose that in Colombo, the main outlet of sewage should be about 1000 metres away from the coast. Also the rural public should be informed about the use of public toilets and special pits should be made for night soil.

Ambalavanar : In the overall context of today's discussions, we are handicapped by the lack of facility, cost and adequate guidance. Shouldn't there be some kind of governmental or state authority for controlling and also for informing the public ?

Oeltzschner : You already have the authority namely, Dr. Pinnagoda, but there is one major problem. Europeans telling you about their sophisticated technology does not help because of the lack of funds. Solutions that are not very costly should be sought. An advisory service and a monitoring system to test and check industries is required.

Ratnayake : As Prof. Costa said, we have pre-industrial pollution here now. In the future we will have to industrialize further. Once our technology is improved, we will have the same problems as the developed countries. Then we will need sophisticated methods to combat the pollution. But this will take time and we will therefore be always lagging behind more developed countries.

Oeltzschner : I agree partly with you. But legislation should be made immediately, to the effect that industries should enforce these legislations in a short specified time. If this is not done early, the damages may be so severe afterwards that they cannot be rectified. You need the industry, but there should be some minimum restrictions. It is a difficult problem and it is political.

Ponnambalam : There is no co-ordination between industries. It is basically wrong not to take action until after the damage is done. There should be a central authority to advise the government about possible pollution problems and their control.

Pinnagoda : You mentioned the London fog of 1952 in which the sulphur dioxide concentration of 0.3% in the atmosphere resulted in several deaths. The sulphur dioxide concentration in the air in the Pettah and Ratmalana areas is 0.03%. Would this have long-term effects and should we consider this as an alarm signal ?

Oeltzschner : It is not fatal, but should be regarded as a warning signal and should not be allowed to rise above this level. I am happy that you have begun monitoring. The building up of a good monitoring system and the demonstration to the public of its importance is essential. The demand for monitoring systems should come from the industries to the agencies that give help.

Noise will be a factor to solve here. Too much noise leads to occupational hazards. The effectiveness of workers is reduced by noise. A permanent level of over 90 decibles will lead to permanent

loss of hearing. Traffic limits must be planned keeping noise in mind. If cars go at 70 m.p.h. the resulting noise level is about 70 decibles, which is very disturbing. Therefore, I would suggest within the city the speed limits should be about 25 m.p.h. The lead emissions along the highways by traffic is also important. 75% of all lead emitted by cars goes into the air and the rest to the soil resulting in a heavy accumulation of lead in 40 to 60 mm of the top soil. This affects farming and is also accumulated in the liver and kidney of cattle. Cattle grazing near the autobahns and those grazing in Switzerland were compared and the concentration of lead was higher in the meat of cattle grazing near the motorways. Hedges should be grown on the sides of the motorways to act as shields to protect vegetation.

Abeywickrema : There is very little co-ordination between the various bodies at present. I would suggest the forming of a Department of Environmental Protection. About 5 to 10% of the funds should be kept apart for monitoring.

Aponso : We have to formulate some concrete steps and these should be put upto the policy makers. A scheme whereby certain co-ordinating bodies are consulted before any plans are approved, should be drawn up.

Abeywickrema : What are Dr. Pinnagoda's views ?

Pinnagoda : A memorandum was drawn and submitted to the Planning Ministry by Dr. G.C.N. Jayasuriya in 1973. At present, environmental planning is done by the Planning Ministry.

Abeywickrema : The Planning Ministry has too much work at the moment.

Gunasekera : There is no legislation in Sri Lanka for environmental protection. We have amended the Factories Act. There is no draft act against general pollution. We must get the government to implement the 1973 report.

Joachim : We are waiting for action on the NSC report submitted three years ago.

Abeywickrema : We have to have a Department of Environmental Protection or a similiar body to implement this report.

Costa : The SLAAS conducted several seminars and suggested the appointment of a committee for environmental protection.

Abeywickrema : We should, today, submit a memorandum to the Government to act on this matter. The National Science Council and the SLAAS could do this jointly and Mr. Samarasekera, General President of the SLAAS will be able to help us by giving the necessary information.

SESSION II

Regional Planning and Technology of Waste Disposal

Dr. Hansjorg Oeltzschner

Increased living standards and greater demands concerning hygiene have put the waste problem in the foreground amongst environmental questions. It is assumed that household and industrial waste will increase by almost double the amount of waste per capita per year within the next twenty years. In the Federal Republic of Germany, the quantity of household waste at the moment lies between 150 kg (in rural districts) and 250 kg per person per year. To provide adequate refuse removal, the cities and villages have to improve their already existing collection and transport systems. New central waste disposal sites have to be found.

This requires an inter-country or regional planning, a continuous exchange of information, documentation and discussion between the local authorities and the planning institutions.

The first step of such a planning is the so called target analysis or target conception. As a general principle the planning should give priority to the interests of water and nature protection. The technical, regional and political aspects of traffic should also be taken into account. The so-called negative areas which are not suitable for the establishment of waste treatment facilities have to be registered. These are the nature reserves and natural parks, which are ecologically important areas, the settlement or development areas, drinking water-protection areas, drinking water catchment areas and areas endangered by floods. The above mentioned are topographically, geohydrologically and geotechnically unsuitable areas.

The present demographic data such as density of population, socio-economic structures etc. have to be analysed, prognostics have to be elaborated and optimations have to be found. e.g.

- the improvement of the waste collection system
- improvement of waste transport, such as so-called primary transport, e.g. in little containers to intermediate

storage stations, from there in large capacity containers, if possible with compaction to a central waste disposal site (so-called secondary transport).

- the establishment of so-called collection provinces with a maximum diameter of no more than 5 km in cities and 15 to 25 km in rural districts, depending on waste density in order to minimize transport distance and costs.
- new types of waste treatment besides sanitary landfill, such as composting or incineration (the latter is not relevant for tropical countries like Sri Lanka), or mechanical re-cycling methods to regain waste paper glass and scrap iron. (In West Germany about 35 to 45% of waste paper is regained.)
- open dumpings should be reconverted (sports fields, special agricultural use, recreation areas). The usual planning period in West Germany for such a planning will be 15 to 20 years.

The costs are totally borne by the citizen. For a regulated service (collection from house to house once a week) they have to be paid about Rs 10 to Rs 35 per household per month. The costs for controlled tipping are about Rs 10 to Rs 50 per ton. The costs for composting are about Rs 120 to Rs 180 per ton, but they may regain about half of this amount by selling the humus-like compost, which is a very good soil fertilizer. It is true that at the moment in a developing country, there are quite a lot of other very urgent problems. But with a fast growing industrialization and urbanization these countries too may face similar problems. They should not commit the same mistakes which have been made in our highly industrialized country, but should learn from our mistakes in order to save a lot of money.

DISCUSSION

Samarasekera : In Sri Lanka, the ~~urban~~ rural balance is changing. This is due to the development of the river valley areas. In the urban areas, the economy has gone down. This provides a good opportunity to relate physical planning principles to economic development and to develop model villages. The model villages would thus have safeguards against pollution.

Oeltzschner : The idea of a model village is very fine. This has been done in India. In a model village, a five-foot area has to be kept unused around wells to prevent water pollution. Even in Sri Lanka a collection system can operate in villages. Waste can be collected in better dust bins and removed by district vans.

Abeywickrema : In our traditional village all refuse is recycled. Pit latrines are used and all organic waste is recycled. This system could be made more hygienic by using the flush system.

Fernando : The introduction of bio-gas generators would solve most of the problems. We have been experimenting with bio-gas generators and if the method is successful, it will be used on a large scale as in India and China.

Oeltzschner : Large amounts of useful material is being thrown away resulting in more pollution. You should have settlement tanks in Colombo for collecting sewage.

Samarasekera : Do plastics deteriorate at all ?

Oeltzschner : No. In Germany, the pollution caused by plastics is 4% by weight. In the West today, we have a 'throwaway' society. Glass, for instance, should not be thrown away.

Samarasekera : What is the contribution per capita to pollution in the various countries ?

Oeltzschner : I have no figures, but the more developed a country is, the greater the pollution per capita. The kind of pollution varies in different countries, but chemical pollution is greater in the West.

SESSION III

Land Development and Land Use

Dr. Hansjorg Oeltzschner

The necessary overall act of environmental protection demands new categories of thinking and new methods. It cannot be mastered by technology alone. In various countries, different standards and different methods have to be applied but all the standards should be based on one common unit.

In the Federal Republic of Germany, legal norms have been enacted based on scientific planning to protect the environment. Environmental conditions after the war have changed due to increasing industrialization and urbanization. Migratory movements have occured. At present about 60% of the population are living in metropolitan areas. The rest live in agricultural areas where industrial jobs are lacking and poor supply conditions prevail. A weak infrastructure existed, mostly agricultural, until measures were taken by the government. The exodus of service enterprises to urban areas could not be prevented resulting in unfavourable housing conditions, increase in traffic, air pollution, industrial waste and lack of playgrounds and recreational areas.

Young people are not attracted by farming, but to making more money in industrial areas. An adjustment of settlement structure in rural areas is being made, including the keeping of preservation areas. This has resulted in better quality residential zones, improvement of pedestrian circulation, better shopping centres, protection against noise from traffic and trams, etc., separation of industrial zones and the development of urban fringe areas. The Land Development Programme of February 1970 was an elaboration of the land development movement. As a second step in April 1973, Bavaria was zoned into officially defined planning areas with their own planning institutions which co-operate with their headquarters in Munich.

These areas are known as Nature Protection Areas. Four levels (defined in September 1973) are re-organized in the regional policy. These are :

1) Smallest Unit
2) Sub-centres
3) Intermediate Centres
4) Highest Centres (normally big cities)

The government approved of this programme as a basis for further work. This could be compared to a master plan which provided guidelines for agglomeration-areas. The Land Development Programme defines priorities and forms the development axis. The development of population growth and capacity are set forth. There are severely protected areas where no buildings can be erected and other protected areas where buildings may be built under certain restrictions. Every settlement area is defined for residential purposes, playgrounds, sports facilities, shopping centres, industries, agricultural use, etc. Every village has to make a plan which has to be given to the authority for approval. The distance between houses is regulated. For this planning, industry, agriculture and forestry have to be studied.

This Programme stipulates guide-lines to give equal living chances for every citizen, no matter where he is living. One of the main aims of the Programme is to give new impetus for areas which are below average requirements. The further growth of population in the agglomeration areas is to be reduced. The birth rate is going down and will almost be equal to the death rate.

In the Land Development Programme, we have to keep in mind that the migration to the cities is very high, although the birth rate has gone down. At the same time, in the interest of a well balanced programme, all the centres must cover job requirements. The higher centres satisfy requirements for special categories of jobs. The Land Development Programme gives a catalogue for facilities at all levels. The concentration of traffic in special areas will improve local conditions in rural areas.

The Bavarian government produced a plan that consolidated all these protective measures. Future orientated environmental protection measures are very costly. To be effective, environmental protection should have solid political support.

DISCUSSION

Samarasekera : We spoke of man's impact on environment, land development and use. My interest is in physical planning, particularly with regard to Sri Lanka. We are now in a state of under development. The earlier we take to physical planning, the better it would be. We have gone into fragmentation of land without planning, resulting in virtual slums. What happened in Mutwal and Kotahena is now occuring in Cinnamon Gardens. The same thing could happen to the whole country if unplanned fragmention continues.

Ribbon development occured in Colombo in the past, but we must now concentrate on new areas. Preventive measures will cost very little. We should make a deeper study for a comprehensive report for a broad-based environmental authority and think of implementing it in a rational way.

SESSION IV

Environmental Education

Dr. Hansjorg Oeltzschner

I have had the opportunity of presenting to you a review on problems of environmental protection. I should like to conclude my report with some remarks on the need for environmental education. Since the beginning of the last century, when Alexander von Humboldt invented the term 'Nature Monument', in Germany it has been pleaded for the protection of vanishing natural features of the countryside. In 1838 and 1858 in Bohemia, two virgin forests and in France in 1853 the forest of Fontainebleau have been put under strict protection.

Nowadays governmental organizations, a lot of scientists, civil engineers and thousands of citizens are helping to fight for a better, a healthy and pleasant human environment, in which the life-supporting nature plays a role of vital importance.

But this fight can never be successful, unless proper, active and constructive environmental attitudes become an integral ingredient in both thinking and pragmatical acting among the majority of the human population.

To achieve this represents the basic objective of enviromental education. This education cannot be only a matter of science. It is - according to a widely accepted definition of the International Union of Conservation of Nature - "The process of recognising values and clarifying concepts in order to develop skills, and attitudes necessary to understand and appreciate the inter-relatedness among man, [illegible] and their biophysical surroundings.

To use the words of Dr. Cerovsky from the IUCN headquarters in Switzerland : "Environmental education, coincidentally with the modern conservation of nature, natural resources, landscape planning and management, including not only scientific, but also broader cultural, economical, hygienical, aesthetical and ethical aspects, is an essential part of general civic, moral and liberal education. In order to be effective, it has to be carried out, as a united education system,

including children, youth, as well as adults; formal education at all levels (pre-school, primary and secondary schools, high schools, colleges and universities), out-of-school-education, etc. and it has to be well integrated in the general educational systems".

There are some items, which deserve the highest priority. Teachers and other educators should be given primarily further education in the role of ecology. There should be a special university training (as it is already done in the Federal Republic of Germany) of technologists, sociologists, economists and technicians.

Comprehensive environmental education programmes should be based on scientific knowledge and they should also be pursued in and between any disciplines.

There are three main lines of environmental education :

1) the teaching from the enviroment
2) the teaching about the environment
3) the teaching for the environment

The first may be seen as a process of basic acquaintance, the second should be a more detailed topic and area orientated study of the environment, its components, inter-relations and functions, comparable to that short survey I have given to you. The third one is a challenge. What to do constructively for the environment.

At the Ruschlikon First European Working Conference on Environmental Conservation in December 1971, the following activities were suggested :

" * appropriate education and instruction in school courses at all levels;
* education and training in environmental matters in institutes of higher education of all kinds;
* out-of-school involvement of young people and adults in practical environmental conservation activities;
* in-service education and training of teachers and others concerned with general and out-of-school education, such as youth leaders;
* the training of professional people concerned with environmental affairs, such as statesmen and administrators, as well as planners, architects, engineers and technologists;
* the education of the public at large by the use of mass information media and other methods."

There seems to be one big problem which is mentioned by Dr. Doraiswami : "The textbooks followed are written by foreign authors; they are not related to the local environment".

Without any doubt, at the moment the universities first of all will have the challenge to educate teachers, engineers and scientists, who then will be able to give all the new won aspects of environmental knowledge to a broader public and to use it for the benefit of our environment.

In the past, environmental protection problems, have been solved by chemical engineers, chemical technologists and civil engineers. But, problems of the future demand a specially trained engineer. This is first of all due to the fact that quantity problems turn into dangerous quality problems. There has to be established a new profession with a coherent body of environmental knowledge.

Environmental Engineering implies utilisation, protection and control of the environment on one hand, and planning and creation of environments on the other hand. Until now, the natural environment played only an exogenous role, supervised and controlled more by scientists and conservationists. In the future, the environmental engineer has to integrate the constructed and the social environments (until now a resort of civil engineering, architecture, urban or regional planning) into his work.

Besides a fundamental knowledge of the basic dynamics of the natural environment, the environmental engineer has to understand the interactions between the natural and social environments. There is need to define the ingredients of well-being as it is perceived by man, and to understand human reactions to environmental stress. There is need to understand the role of social values, legal doctrines, economic pressures and management methods in the cause and control of pollution. Considering the interactions between the natural and the constructed environment, the environmental engineer has to learn to introduce wastes into the environment in a way which will minimize local pollution and how to extract minerals from the earth and to modify natural land use in ways which cause acceptable environmental stress.

The need for a special educational programme is obvious. On the basis of the breadth and complexity of this profession there should be made the following premises :

- there is need not only for technical specialists, but also

- for those with a sound technical background who are equipped by temperament, interest and education to work effectively at the interface between technical and policy decisions;
- all environmental engineers should be well grounded in the relevant earth sciences;
- the normal educational pattern has to include at least the Master's degree (for in-depth specialization in an environmental sub-field). Graduate education should provide further specialization leading to the doctorate, or broadening into other technical areas or into the relevant social and management sciences leading to the professional degree "Environmental Engineer". There is quite a large spectrum of tasks for this career.

It is obvious, that there is an urgent need for specialised professional educational on the problems of achieving a balance between utilization and protection of the natural environment. This education should not be a local challenge. As the world populations are pressing against the limits of support by their local environments, natural hazards gain global disaster potential. To protect ourselves from such impacts and to re-establish the natural equilibrium, we need all over the world besides the improvement of a general understanding of the environmental systems, the special environmental education of people, particularly teachers and engineers, who then will be capable of solving our pollution problems and who can give a profound environmental knowledge to future generations.

DISCUSSION

Abeywickrema : In Sri Lanka, environmental education will be given a prominent place at school level. A plan to introduce environmental education at the tenth grade has been approved by the government. A one-year common course in biology with an ecological approach will be introduced for the physical science and biological science students. The textbooks we have may not be very satisfactory to start with. More books will have to be written in the near future. There is still a big gap in the education of the general public.

Ratnayake : The SLAAS has approved a committee to deal with environmental education.

Oeltzschner : Have textbooks been written on environment by local people ?

Abeywickrema : Books are being written but more data has to be collected, and more research done.

Oeltzschner : Students could be allowed to do research on various aspects and to write theses on them.

Samarasekera : People understand these problems to varying degrees. We need to prepare a comprehensive statement of areas in which action is most urgent and we should also build up public awareness. We should have a concerted programme through the newspapers and the radio to educate the adult public. I would suggest the building up of public opinion to have political impact.

Oeltzschner : This happened in Germany. At the instigation of the citizens, a nuclear plant was not started.

Samaraskera : We must create an atmosphere where environment becomes fashionable.

Ratnayake : Another ingredient necessary for action is to instil fear into the general public of the hazards of environmental pollution such as radioactive wastes, new lethal chemicals, etc.

Abeywickrema : We do not have a course on environmental education in the University as yet. May be in a year or so, we will be able to start one.

Oeltzschner : We must nor produce environmental engineers without having sufficient work for them.

Growing tourism may bring more money to Sri Lanka specially to the private sector (e.g. from hotels) and this private capital may induce more pollution by discharging sewage and other wastes from the hotels directly into the sea. We have seen very bad effects on the Meditteranean sea by the growing tourist industry.

Pinnagoda : Politicians are not ignorant or unaware of the problems. It is a question of priorities. Scientists should make the general public aware of these problems.

SESSION V

Proposals for the Local Scene - Discussion

Abeywickrema : I call upon Dr. Samarasekera to lead a discussion on the recommendations we can make to the government concerning environmental control.

Samarasekera : Scientists should provide the leadership. I would suggest that initiative be taken by the NSC and the SLAAS, (now in its 32nd year and representing scientists and technologists of all disciplines) to make a united effort. We should submit to the government a memorandum with wide coverage which could and should represent all the disciplines connected with this issue. As subjects for discussion I would suggest the following :

1) conservation
2) prevention of pollution
3) correction of environmental decay or pollution. The method of doing this could be by planning and education.

De Costa : The vast strides in Germany are due to tax relief. The government should be asked to give relief to aid such work. How much should we ask from the government ?

Oeltzschner : All these projects need finance. The amount varies depending on the work involved.

Abeywickrema : (Read out the following proposals for future action from the Report of Environmental Management of Sri Lanka, 1973.)

" A representative Central Authority for Environmental Management be established in Sri Lanka under the Ministry of Planning and Economic Affairs.

The main functions of this Central Authority should be broadly as follows :

a) Co-ordination of activities with respect to the environment.
b) Evaluation of new development projects in terms of environmental hazards and conservation of natural resources
c) Responsibility for formulation and implementation of legislation through appropriate agencies.

d) Responsibility for monitoring environmental pollution and determining standards for pollutants in collaboration with the various departments and institutions concerned.

e) Initiation, sponsorship and support of studies pertaining to the environment.

f) Dissemination of information pertaining to the environment.

g) Collaboration with international organizations interested in the environment.

Samarasekera : We could use this report as a base and update it.

Fernando : If the recommendations are made, the government can set up an authority to put them into action.

Pinnagoda : (Read out from the UNDP 2nd Country Programme submitted in 1975 for implementation in 1977-1981).

a) Development of a National Occupational Hazard Evaluation Programme for promoting the health of gainfully employed.

b) Development of a National Industrial Effluent and Air Pollution Quantification and Continuous Monitoring Programme for establishment of national standards in effluent discharges, stream sanitation and air quality.

c) Development of a Documentation and Information Retrieval Service and mass communication media in occupational and environmental health.

d) Development of a Central Registry in Occupational Health Surveillance Programme.

e) Organising Education and Training Programmes at undergraduate and post-graduate levels in Occupational Health and Environmental Pollution.

f) Develop national and international collaborative research programmes in Occupational and Environmental Health in specific problem- riented areas.

g) Development of national standards in Occupational Health and Hygiene to assist Labour Administration

This programme requires funds.

Abeywickrema : Setting up standards such as maximum permissible limits and the levels of pollution are necessary. Have these been defined ?

Boachim : The Bureau of Standards have values for water. I am not aware of others.

Pinnagoda : We have standards from other countries like Japan.

Oeltzschner : I could provide you with air pollution limits for aluminium fluoride, carbon monoxide, hydrogen sulphide, chlorine, etc. and limits for drinking water, formulated for Germany.

TABLE I. Air Pollution Limits

(max. emission rates) (mg/m^3)

	TA - Air new reg.	½ hr. aver.	24 hrs. aver.	aver./yr.
Fluoride of Aluminium	-	0.5	0.3	0.1
Ammonium	-	2.0	1.0	0.5
Pb	-	-	0.003	0.0015
Cd	-	-	0.00005	-
Fly dust	0.1	0.3	0.2	0.1
Particle matter	0.2	0.45	0.3	0.15
Chlorine	0.1	-	-	-
HCl	0.1	-	-	-
HF	0.002	0.2	0.1	0.05
O_3	-	0.15	0.05	0.05
SO_2	0.14	1.0	0.3	0.1
H_2SO_3	-	0.2	0.7	-
H_2S	0.005	0.01	-	-
CO_2	0.1	0.2	0.1	-
CO	0.2	1.0	0.5	-
Zn Comb.	-	-	0.1	0.05

Ratnayake : There are areas in which research could be initiated in Sri Lanka. In the case of agrochemicals and pesticides less lethal alternatives can be used. Harmful preservatives are insidiously absorbed into the body. The use of drugs must be checked. Such activities need finance which we lack. Developed countries should give financial help as outright grants to the developing countries. The request should go from the developing couhtries.

TABLE II. Quality of Surfacewater, being used for drinking

(before treatment)

Chemical	mg/l
NO_3	50 - 100
F	7.5
Fe	0.7
Mn	0.05
Cu	0.05
Zn	2.5
V	0.005
As	0.05
Cd	0.005
Cr	0.05
Pb	0.05
Se	0.01
Hg	0.001
Ba	1.0
Cu	0.05
SO_4	250.0
Cl	200 - 600
P_2O_3	0.3
C_6H_5OH	0.0002
NH_4	0.05

pH - 6.5 to 8.5

Suspended matter - 25 mg/l

Temperature - 25° C

Bacterial Count

Total coli (37°) < 100 L

Coli faec. < 100 L

Streptococcus faec. < 100 L

Oeltzschner : When the grants come as industrial aid, they should come as clean industries (referring to machinery and their maintenance).

Ponnambalam : Very often the safety and hygienic devices are left out.

Abeywickrema : Dr. Bibile is working on drugs and Dr. Pethiyagoda on the effect of agrochemicals. Sooner or later, biological methods of fertilising will have to be used.

Wijesekera : Taking into consideration everything we have discussed at this Seminar, let us now outline the features of action. Mr. Samarasekera suggested a joint communique to the Prime Minister and I endorse it.

Abeywickrema : I would suggest certain recommendations to the Government (see page 31). Legislation has to be drawn up taking into consideration environmental standards laid down in India and other countries. The committee could also look into those aspects of research which could be done by students.

Oeltzschner : Are there any periodicals on environment ? People could be invited to publish their findings.

Abeywickrema : We must not start a journal rightaway. To start with, we can publish in the NSC Journal and when we have enough articles, we could produce a separate one.

Wijesekera : Pure science articles could be published in the Journal. Maybe once a year, an issue of the NSC Bulletin could be devoted to environmental sciences.

Ratnayake : We should ask for international aid such as UNDP.

Abeywickrema : We can submit proposals to the Environmental Committee recommending the fostering of local environmental research.

Fernando : The public has to be educated on environment.

Abeywickrema : Environmental education can be carried out through the Popularisation of Science Committee. If we could foster a research project on a river valley area and ask for government support, in a 25 to 50 year period we could develop the area. Such a pilot study would be feasible if we get geographers and others to work on it.

The general outline of such a project has been made, but it is not possible for the NSC or SLAAS to put it into action. Even to take a

small area and make a detailed study would take several years. It would be useful if geography and geology students and the Town and Country Planning Department could work together on such a scheme.

Samarasekera : Architects, lawyers and others jointly drew up a programme for the Department of Planning.

Oeltzschner : A pilot micro-project would be fine. In Germany, we had the same problems at the beginning.

Abeywickrema : We should immediately initiate a pilot project and this could be formulated by the MAB Programme.

Pinnagoda : Such a project would involve a team of scientists. Even to collect preliminary data might mean a thousand visits.

Oeltzschner : You could study a marginal section of Colombo.

Abeywickrema : It would be difficult in Colombo as it is a built up area. Collection of data would be easier in a rural district. If the plan is put into operation in the Mahaweli, implementation would be easy.

It will have to be a multidisciplinary project.

Fernando : Minimum damage should be caused to the area under investigation.

Abeywickrema : This is one aim - to cause the least amount of damage to the environment. Recycling of material should be practised.

Fernando : We have already selected a village not far from Tangalle which would be a model for Asia. I cannot provide any more details.

A vote of thanks to the Guest Participant, Dr. Oeltzschner was made by Professor B.A. Abeywickrema.

Proposals for the Local Scene - Recommendations

It was decided to adopt two sets of recommendations to promote environmental protection :

(a) Recommendations to the Government

(b) Recommendations to the National Science Council

(a) Seminar Recommendations to the Government :

The Seminar recognising that

- man's welfare is closely linked with and is largely dependent on the quality of his environment, and
- to provide an adequate standard of living for all inhabitants of the island it is necessary to utilise and develop its natural resources to the fullest extent, and
- such development would require the application of modern technologies on a large scale, and

noting that - industrial and technological developments in the past have often resulted in major problems of deterioration of terrestrial as well as aquatic environments, acute pollution and serious disturbance in the water balance in nature, and that

- it is therefore necessary to plan all development projects carefully so as to maximize benefits whilst avoiding the deleterious effects produced in the past,

recommends to the Government -

(i) the creation of a broad-based statutory Environmental Authority representing all disciplines connected with this subject. The main functions of this Authority should be as follows :

a) Co-ordination of activities with respect to the environment.

b) Evaluation of new development projects in terms of environmental hazards and conservation of natural resources.

c) Responsibility for formulation and implementation of legislation through appropriate agencies.

d) Responsibility for monitoring environmental pollution and determining standards for pollutants in collaboration with the various departments and institutions concerned.

e) Initiation, sponsorship and support of studies pertaining to the environment.

f) Dissemination of information pertaining to the environment.

g) Collaboration with international organizations interested in the environment.

(2) the granting of incentives and tax reliefs to industry for Environmental Protection activities,

(3) that before approval is given to any new major development project, it should ensure that adequate provision of funds (including necessary foreign exchange) is made for enviromental protection, and

(4) that early steps should be taken to enact the necessary legislation for environmental protection,

(5) the Environmental Health Research Project (under UNDP - 2nd Country Programme. See page 26)

b) The Seminar recommends to the National Science Council :

(1) Environmental Education of the general public through the SLAAS - Popularization of Science Committee and other agencies,

(2) the funding of local Environmental Research

(3) the sponsoring of a Pilot Project on Environmental Planning in a selected area,

(4) the preparation of a) Environmental standards for Sri Lanka

b) Draft legislation on environmental protection.

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